ENGINEERING EVALUATION/COST ANALYSIS AMENDMENT

MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

U.S. ENVIRONMENTAL PROTECTION AGENCY – NEW ENGLAND
REGION 1

JULY 2018

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATION AND ACRONYM LIST

%	Percent
<	Less Than
>	Greater Than
>/=	Greater Than or Equal To
µg/kg	micrograms per kilogram
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface, or below sediment surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cfs	cubic feet per second
CFR	Code of Federal Regulations
COC	Chemical of Potential Concern
CWA	Clean Water Act
cy	Cubic Yard
EE/CA	Engineering Evaluation/Cost Analysis
FS	Feasibility Study
HI/HIs	Hazard Index/Hazard Indices
HQ	Hazard Quotient
ICs	Institutional Controls
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NHDES	New Hampshire Department of Environmental Services
NPL	National Priorities List
NTCRA	Non-Time-Critical Response Action
OU	Operable Unit
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
ppb	parts per billion

ppm	parts per million
PRG	Preliminary Removal Goal
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
sf	square feet
SVOCs	Semi Volatile Organic Compounds
TBCs	To Be Considered Criteria
TEQ	Dioxin Toxic Equivalent
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

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1.0 INTRODUCTION

1.1 Purpose and Scope

This report presents the Engineering Evaluation/Cost Analysis (EE/CA) for implementing a non-time critical removal action (NTCRA) to address sludge waste and contaminated soils in the Mohawk Tannery Site (the Site) in Nashua, New Hampshire (NH), waste generated from the Site currently stored in a landfill (Fimbel Door Landfill) on adjacent property, and Asbestos Containing Material (ACM) within the Site and currently stored in another landfill at a City owned property adjacent to the Fimbel Door Landfill property. The purpose and scope of this EE/CA is to supplement a 2002 EE/CA with current costs and additional alternatives to conduct a NTCRA that was put on hold at the time. This EE/CA will identify the objectives and goals of this sludge waste, soils, and ACM removal action, and will analyze the effectiveness, implementability, and costs of appropriate removal action alternatives that satisfy these objectives and goals.

The United States Environmental Protection Agency (USEPA) issued a July 12, 2000 Approval Memorandum (Memorandum) to initiate the EE/CA process for the Site. This Memorandum documents that the conditions at the Site meet the National Contingency Plan (NCP) criteria for initiating a removal action and that the proposed action is non-time critical. A copy of this Memorandum is provided as Appendix A.

1.2 Removal Action Process

The USEPA publishes a Notice of Availability and a fact sheet describing the proposed removal action, which solicits public comment on the EE/CA. In accordance with Title 40 Code of Federal Regulations (CFR) 300.415(n), this notice will announce the period during which the public has an opportunity to review and comment on the EE/CA and the recommended removal action. This EE/CA, along with other documents/information which form the basis for the removal action, will be part of the USEPA Administrative Record File. As detailed in the NCP 40 CFR 300.820(a) and 300.825 the Administrative Record File is available for public inspection when the EE/CA is made available for public comment. USEPA will provide a written response (Responsiveness Summary) to each relevant comment received during the public comment period. A summary of the results of the EE/CA, USEPA's response decision, as well as the Responsiveness Summary, will be provided in an Action Memorandum that will be approved at the end of this process. The removal action can be initiated after the Action Memorandum is approved.

2.0 SITE CHARACTERIZATION

2.1 General

This Section presents the site characterization information that supports the removal action recommendation. This Section consists of: Site background and description; past response actions; source, nature and extent of contamination; analytical data; and risk evaluation. Additional information can be found in the *Engineering Evaluation/Cost Analysis for the Mohawk Tannery Site* (Tetra Tech NUS, 2002), the *Draft Final Remedial Investigation Report, Operable Unit 1* (Sanborn Head, 2005), the *Final Report Solidification / Stabilization Bench-Scale Treatability Study for the Mohawk Tannery Site*, *Nashua, New Hampshire* (Shaw Environmental, 2009), the

Technical Memorandum titled *Screening level human health and ecological risk assessment of the Southern Parcel at the Mohawk Tannery Superfund Site, Nashua, NH* (EPA, 2013), and the *Remedial Action Plan DRAFT 1.0* (GeoInsight, 2016).

The Site was officially proposed to the National Priorities List (NPL) by the USEPA, with the concurrence of the Governor of New Hampshire on May 11, 2000, because of USEPA and the New Hampshire Department of Environmental Services (NHDES) investigations that documented a release of hazardous substances to the environment. At the time of the Draft Final Remedial Investigation, the Site was understood as comprised by two Operable Units (OUs), OU-1 and OU-2, two contiguous parcels, approximately 15 acres each. However, no such formal designation was ever made, thus this document will refer to those parcels as the northern and southern parcels. The "northern parcel" contains the former manufacturing and waste management areas; and the "southern parcel" contains primarily undeveloped property. Both parcels border the Nashua River to the west and south. The Site is bordered by the Fimbel Door Corporation to the north, and residential parcels to the east and southeast.

In July 2000, USEPA completed an Approval Memorandum documenting the decision to proceed with a NTCRA in the "northern parcel" of the Site. Then, in July 2002 EPA completed an EE/CA for this parcel, and an Action Memorandum was issued on October 2002. At the request of the City of Nashua, EPA did not move forward with the removal action, allowing time for a viable cleanup and re-development project to be developed. In the interim, EPA conducted several limited investigations to assess the nature and extent of contaminants in both parcels as well as the human and ecological risk posed by those.

2.2 Site Background and Description

The former Mohawk Tannery, also known as Granite State Leathers, is located at 11 Warsaw Avenue on approximately 30 acres in Hillsborough County, Nashua, New Hampshire (See Figure 1). The currently inactive facility produced tanned hides for leather between 1924 and 1984. Of the two contiguous, approximately 15-acre parcels of land, the northern parcel was historically used for tannery and waste disposal operations, while the southern parcel remains undeveloped and does not appear to have been used by the tannery. The Chester Realty Trust is the Site's current owner and both parcels are under a purchase and sale agreement with a local private developer. The Site was proposed to the National Priorities List (NPL) in May 2000; however, at the request of the City of Nashua, EPA did not move forward with the listing on the NPL nor a removal action that was subsequently proposed, allowing time for a viable cleanup and re-development project to be developed. During its 60 years of operation, the tannery produced sludge and acidic residues from the tanning process, much of which was disposed of on site. Site contaminants consist of: metals in ground water, soil, and in sediments within the Nashua River; asbestos in soil; and metals, pentachlorophenol, 4-methylphenol, 2,4,5-trichlorophenol, and dioxins in open sludge lagoons. Approximately 60,389 cubic yards(cy) of contaminated waste (sludge) remains at the site; most of this waste (approximately 54,815 cy) is contained in two Areas (Areas 1 & 2) in the northern parcel adjacent to the Nashua River, with one of these areas (Area 2) partially located within the 100-year flood plain and both areas totally within the 500-year floodplain.

The Tannery Property is bordered to the east and southeast by residential properties, to the north by property currently owned by the Fimbel Door Corporation which includes a closed lined landfill formerly used for disposal of wastewater treatment sludge generated by the Mohawk Tannery, and to the west and south by the Nashua River.

A Locus Map, and the Mohawk Tannery and surrounding properties, are shown on Figures 1 and 2. A Site plan is shown in Figure 3. Current Site features, as well as former Site features identified based on sources of historical information, are shown on Figure 4. Site photographs are included in the 2002 EE/CA found in Appendix B.

After tanning related activities ended at the Site in 1984, several businesses including a landscaper and automotive repair operated at the Site as tenants to the Site owner. Sludge generated from former tannery operations were disposed in six unlined areas (Areas 1 through 6 - which remain in place now) located on the northern parcel, with the bulk of the sludge located in Areas 1 and 2, which were used as lagoons for the treatment of Site wastewater. Hide scraps and other assorted wastes were disposed in Area 7. An approximately 44,000-sf Main Site (Tannery) Building was formerly located in the eastern portion of the Site (Figure 5). A newer (ca. 1980) approximately 11,000-sf 'high bay' cinder block 'Warehouse' formerly occupied the northwest portion of the Main Building, and an approximately 3,000-sf high bay 'Control Building' apparently constructed (ca. 1980) of pre-cast concrete 'slabs' was formerly attached to the southwest portion of the Main Building. A concrete slab/foundation remaining from the former Boiler House is located to the northwest of the Main Building. A wood-frame construction Secondary Clarifier Building was formerly located in the northwestern part of the Site. Several concrete foundations and slabs remaining from various wastewater treatment structures are in the central portion of the Site. The city of Nashua razed all above ground structures in 2014; footings, foundations and concrete slabs remain.

Several underground storage tanks (USTs) and above ground storage tanks (ASTs) appear to have been formerly located at the Site, including: two approximate 10,000-gallon USTs located north/northwest of the Boiler House, both apparently used to store No. 6 fuel oil; an approximate 2,000-gallon UST, located east of the Main Building, used to store fuel oil and/or low-lead gasoline; and a 4,000-gallon fiberglass AST, formerly located immediately east of the Main Building, used to store sodium hydrosulfide (NaHS). All ASTs have been removed. It is unknown if any USTs remain on-site. If they are observed during soil grading/excavation activities, they will be addressed according to applicable Federal and State regulations.

Fencing surrounds the north, east and south sides of the Site; however, the western side of the Site adjacent to the Nashua River is not fenced. The main access gate to the Site is located to the northeast of the slabs of the former Main Building at the end of Fairmount Street.

The Site is currently zoned "RC" for residential multifamily high-rise structures (greater than 6 stories). The Site vicinity is largely residential to the east and southeast, industrial/commercial to the north, and the Nashua River is located to the west and south. Most residents within four miles of the Site are served by municipal water supplies sourced approximately three to four miles from the Site. The nearest known (private) drinking water supply wells are about 2,000 feet southeast of the Site. These wells are not downgradient from the Site. The Nashua River flows from north to south along the west side of the Site. The Mine Falls Park Dam and Jackson Mills Dam are located on the Nashua River approximately two miles upstream and two miles downstream, respectively, from the Site. The nearest municipal water supply intakes are located upstream and downstream of the Site, on the Merrimack River in Merrimack New Hampshire and in Lowell, Massachusetts respectively. The upstream Merrimack intake is approximately 1.8 miles north-northeast from the Site, and the downstream Lowell intake is approximately 14 miles south from the Site. Evidence of recreational swimming in the Nashua River adjacent to the Southern Parcel has been observed during field work. The Nashua and Merrimack Rivers near the Site are regularly fished, and stocked with fish.

The Site's geology consists of glacial and alluvial soil deposits overlying crystalline bedrock, and is illustrated on Figures 8 through 11. Site bedrock is identified as the Berwick Formation, typically described as a quartz-biotite-feldspar granofels or schist; and/or a Devonian-aged two-mica granite that intrudes the Berwick. Depth to bedrock varies considerably across the Site, from about 6 to 9 feet in the northwest, to greater than 80 feet in the southeast portion of the Site near the former Main Building. A bedrock high extends from the northwest portion of the Site to the south-southeast for approximately 500 feet, through much of Lagoon 1, to the eastern part of Lagoon 2. The principal soil types identified within the two lagoons at the Site, generally proceeding from ground surface to depth are: fill, tannery sludge, 'sludge sand', gravelly sand, sand, fine sand, and glacial till.

Site hydrology is primarily influenced by the range and distribution of permeability in soils, bedrock topography, groundwater mounding near Lagoon 1, and the Nashua River at the western Site boundary. The surface water elevations of the Lagoon and Nashua River are approximately 128 feet and 117 feet (NAVD88), respectively. The average flow of the Nashua River in the Site vicinity is approximately 611 cubic feet per second (cfs), and the 7-day/l0-year low flow (7Q10) low flow is estimated at 31 cfs.

Groundwater levels observed at the Site have been typically 7 to 72 feet (ft.) below ground surface (bgs), and at elevations of approximately 117 to 124 ft. (see Figure 12). In general, the depth to groundwater is greatest in the topographically highest (southeast) portion of the Site adjacent to the Main Building, and decreases with topography to the northwest, west and southwest. Groundwater flows in a generally southerly direction in the eastern portion of the Site, and in a generally westerly direction in the western portion of the Site. Groundwater appears to flow generally radially away from Lagoon 1. A northeast-southwest oriented groundwater divide is apparent from the vicinity of the bedrock high and the Lagoon 1 groundwater mound, to the Fimbel Door Landfill.

The average hydraulic conductivities of the principal units are estimated at: sludge-sand (5 to 20 ft./day), sand (50 to 100 ft./day), fine sand (10 to 50 ft./day), till (0.05 to 2 ft./day), and bedrock (4 to 30 ft./day). Horizontal hydraulic gradients range from about 0.002 to 0.005 feet per feet (ft./ft.) near the Fimbel Door Landfill south to the vicinity of the former Main Building, to as steep as 0.1 to 0.3 ft./ft. between the Lagoon and the Nashua River. An average groundwater seepage velocity of approximately 0.8 to 1.7 ft./day is estimated for the apparent principal groundwater flow path at the Site (*i.e.*, from north to south in the central and eastern portions of the Site).

Available data indicate that Site's groundwater discharges to the Nashua River. The limited data on vertical hydraulic gradients near the River indicate an upward gradient. The direction of groundwater flow over much of the Site is to the south to southwest, and not directly to the west toward the River. The apparent cause of this diversion in groundwater flow direction and the groundwater divide, is that the saturated formations over much of the western portion of the Site adjacent to the River consist of relatively low permeability soils (sludge, sludge sand, till) and bedrock (i.e., the bedrock high). On average, Site groundwater discharge is estimated to contribute approximately 0.017 percent of the Nashua River stream flow as it passes the Site, equivalent to a groundwater to surface water dilution factor of approximately 5,800. Assuming the same groundwater discharge and a River flow equal to the 7Q10 low flow of 31 cfs, yields a dilution factor of about 300.

2.3 Past Response Actions

Investigations and Removal Actions

Several environmental investigations and removal/pre-remedial activities have been completed at the Site in association with tannery-related wastes, and soil and groundwater contamination. The following is a summary and the reader is referred to the referenced documents for further description of the activities:

- "Phase I Hydrogeologic Study, Granite State Leathers, Inc. Facility, Nashua, New Hampshire", dated April 1985, prepared by Goldberg, Zoino and Associates, Inc. (GZA) for Fairmount Height Associates (GZA, 1985a). An initial Site characterization was performed to support future Site use after the closure of the tannery. Information on historical tannery operations, waste streams, and treatment facilities was reviewed. Thirty-six test pits, and a test boring/monitoring well were completed.

- "Phase II Hydrogeologic Study and Conceptual Closeout Plan, Granite State Leathers, Inc. Facility, Nashua, New Hampshire", dated October 1985, prepared by GZA for Fairmount Height Associates (GZA, 1985b). This study was performed to further characterize hydrogeologic conditions, the nature and extent of tannery sludge, the nature and extent of groundwater contamination, assess the potential impact to the Nashua River, and provide recommendations for containment of the tannery sludge/waste. Additional test pits and 12 test borings/monitoring wells were performed.

- "Expanded Site Inspection, Mohawk Tannery Site, Nashua, NH", dated December 29, 1993, prepared by NHDES. Bottom sediment samples were collected by NHDES from six transects across the Nashua River, two upstream and four downstream from the former Mohawk Tannery effluent discharge pipe. Three sediment samples were collected from each transect, as well as a soil sample from the immediate proximity of the effluent discharge pipe. Samples were analyzed for total cadmium, chromium and lead, as well as acid extractable semi-volatile organic compounds (SVOCs) (*i.e.*, phenolic compounds).

- "Final Site Inspection Prioritization Report, for Mohawk Tannery, Nashua, New Hampshire", dated November 1996, prepared by NHDES. This report was prepared by NHDES as a preliminary screening to facilitate EPA's assignment of site priorities. This report summarizes the results of previous Site activities, and information from readily available sources.

• "Preliminary Sludge Characterization Investigation, Mohawk Tannery, 11 Warsaw Avenue, Nashua, New Hampshire", dated January 2001, prepared by GeoSyntec Consultants for Environmental Reclamation, Inc. (GeoSyntec, 2001). Sludge samples from Areas 1 and 2, considered representative of sludge characteristics Site-wide, were collected and analyzed. Analytical results indicated that none of the sludge samples exhibited hazardous waste characteristics pursuant to the Resource Conservation and Recovery Act (RCRA). The report concluded that the sludge could be handled, transported and disposed as non-hazardous solid waste at a USEPA- and NHDES-approved landfill.

• USEPA, through contractors, performed a Time Critical Removal Action (TCRA) at the Site between September 2000 and January 2001 (Weston, 1999; Weston, 2001). Removal activities included: abatement of asbestos-containing material from the Main Building; characterizing and disposing of the contents of 42 drums, the 4,000-gallon sodium hydrosulfide AST, approximately 400 gallons of contained sodium hydrosulfide, a large clarifier tank, removing and disposing of approximately 110 empty drums, and 360 laboratory-type containers. In addition, several gates at the Site were repaired and warning signs were posted indicating the dangers of trespassing.

• In February 2001, USEPA requested that TtNUS complete an EE/CA for the Site as part of a Non-Time Critical Removal Action (NTCRA), to focus on evaluating risks and identifying remedial alternatives for the on-Site sludge disposal areas. The EE/CA report was completed by TtNUS in July 2002 (TtNUS, 2002). It included a streamlined Human Health and Ecological Risk Evaluations which indicated that Site contaminants associated with the sludge/waste are likely to pose risk to human and ecological receptors under current and future exposure scenarios.

Three removal action alternatives were considered for addressing the approximately 60,000 cubic yards of sludge identified on-Site:

1) Excavation and off-Site disposal (cost estimate [net present worth - NPW] of approximately $15,000,000 to $23,000,000);

2) Consolidation into on-Site landfill (cost estimate [NPW] of approximately $6,000,000 to $19,000,000); and

3) Excavation, off-Site treatment (incineration), and disposal (cost estimate [NPW] of approximately $50,000,000 to $70,000,000).

Alternative 1 was selected because it was considered the most implementable, it removed the sludge from the Site, and was considerably less expensive than Alternative 3.

• In June 2005, Sanborn Head & Associates completed a Remedial Investigation (RI) (Draft Final Remedial Investigation for OU-1, Sanborn Head & Associates, 2005) that characterized the nature and extent of the Site contamination not addressed by the NTCRA (*i.e.* soils within the northern parcel excluding the Sludge Lagoons and Disposal Areas). The RI completed the definition of the source and extent of contaminants released to soil and shallow groundwater on the northern parcel of the Site; provided information for an assessment of the current and future risks to human health and the environment; and provided information to subsequently evaluate remedial alternatives.

- In 2009 EPA retained Shaw Environmental Inc. to perform a Solidification/Stabilization Bench - Scale Treatability Study. The result of this study identified that binders containing primarily Portland Cement (PC) with lesser quantities of blast-furnace slag and hydrated lime would meet site geotechnical criteria and metals leaching standards; however, post-treatment samples indicated higher phenol concentrations. Shaw recommended the use of absorbent additives to control this leaching.

- In 2012, NHDES via an EPA funded cooperative agreement, retained Sanborn Head & Associates to collect soil, sediment and groundwater data in support of a Screening Level Risk Assessment (SLRA)of the Southern Parcel. EPA completed the SLRA on September 2013. The SLRA evaluated whether all or part of the southern parcel of the Mohawk Tannery Site has acceptable risk to human health and the environment. The data suggested that it may be possible to withdraw a portion of the Southern Parcel from the National Priorities List (NPL), provided that the future use of such portion be limited to recreation. In contrast, other areas of the southern parcel (*i.e.* the wetlands and areas with asbestos debris) presented contamination problems that need to be remediated before considering any form of re-use. Below is a summary of the human health and ecological risk conclusions.

  Human Health Risk Conclusions

  - Only two locations of surface and subsurface soil located near the Area 2 Closed Lagoon pose a potential recreational risk use from dioxin, although the average concentration across the southern parcel (as conservatively represented by the 95% Upper Confidence Limit of the average concentration) does not pose a risk above EPA risk limits.

  - Asbestos has been detected at "trace" to 2% concentrations in surface soils along both sides of the walking path in the northern portion of the southern parcel, which could present a risk to recreational use.

  - There was no apparent recreational risk associated with wetland soil/sediment or riverbank surface soil and river sediment.

  - Groundwater exceeds drinking water standards, and therefore is not suitable for drinking without further treatment. Cancer risk and non-cancer hazard for a future resident were primarily attributable to use of groundwater as tap water and were significantly higher than USEPA and NHDES target risks and HIs. Please see Section 6.2.3 for more information.

Ecological Risk Conclusions

  - There is a possibility of adverse ecological affects to terrestrial receptors in the northern and southern wetlands sediments, associated with cadmium, chromium, and dioxin.

- There is no significant risk to aquatic organisms associated with groundwater discharging to surface water or from river sediments.

- In November 2016, a local private developer (Melton Associates, Inc.) retained GeoInsight Inc. to further the 2009 Shaw Environmental Bench Scale Study. This treatability test evaluated the use of PC with organophilic clays and powdered activated carbon (PAC) absorbents. The 2016 testing recommended the use of 16% by weight PC for Areas 2, 3, 4, 6, and 7 with 3% by weight PAC added to the perimeter of the treatment areas, and a 25% by weight PC for Area 1 with 3% by weight PAC admixed in perimeter treatment areas. Subsequently, GeoInsight, Inc. presented a Draft Remedial Action Plan (RAP) to implement a solidification/stabilization remedial approach for the sludge disposal areas and contaminated soil areas.

2.4 Source, Nature and Extent of Contamination

The principal contaminants detected by TtNUS (2002) in the Site tannery sludge were: metals (*e.g.*, antimony, arsenic and trivalent chromium), dioxins/furans, phenols *(e.g.*, 4-methylphenol, pentachlorophenol), and lighter polycyclic aromatic hydrocarbons (PAHs) (*e.g.*, naphthalene, 2-methylnaphthalene). In general, the results of the RI indicated the presence of similar contaminants in Site soils (and building interior residue samples), with the addition of other metals (e.g., vanadium) and heavier PAHs, and generally less significant concentrations of phenols. Elevated concentrations of metals (*i.e.*, arsenic and manganese), and typically lower concentrations of volatile organic compounds (VOCs) (*e.g.*, chlorobenzene, 1,2-DCB, 1,3-DCB, 1,4-DCB, 1,2-DCA) were detected in groundwater.

<u>Description of Principal Contaminant Source Areas</u>

The principal source areas are indicated on Figure 13. In general, the former tannery operations appear to be the primary source of contamination at the Site. Disposal Areas 1 through 7 contain about 60,000 cy of tannery sludge/waste. The adjacent Fimbel Door Property Landfill contains about 20,000 cy of wastewater sludge from the Tannery. Typically, contaminant concentrations detected in the sludge/waste have been higher than those detected in other Site media, except for residues/soils located within trenches and sumps/pits within the Main/Control Buildings. The concentrations of VOCs and non-PAH SVOCs (*e.g.*, 1,2-DCB, 1,4-DCB, 1,2,4-TCB, phenol, 4-methylphenol, 2,4,5-TCP, PCP), dioxin TEQ, antimony and manganese in the sludges were generally higher than in any of the other media, including the residues/soils from within the Main/Control Buildings.

Other areas of soil contamination and/or residual wastes apparently related to the tannery operations are present at the Site. In general, these areas appear to contain substantially less contaminant mass and appear to be less significant contaminant source areas than the sludge/ waste disposal areas. These other areas include: residues/soils in trenches and sumps/pits within the former Main/Control Buildings concrete slabs; soils contaminated by tannery operations located beneath and/or adjacent to the Main Building slabs; and soils near the various wastewater conveyance and treatment structures. Typically, contaminant concentrations observed in samples from residues/soils located in trenches and sumps/pits within the Main/Control Buildings were relatively elevated, and generally comparable to concentrations observed in sludge samples; whereas, the concentrations of contaminants detected in the other areas were typically significantly lower.

2.5 Analytical Data

This section summarizes the analytical data that is available from several investigations conducted from 1985 through 2013.

2.5.1 1985 – 1996 Investigations

From April 1985 through September 1996 EPA and NHDES conducted several pre-remedial investigations (see Section 2.3 above). Samples from sludge waste, soils, groundwater, and river sediment, were collected and analyzed for metals, VOCs, and SVOCs. The maximum concentrations detected in River Sediment samples were chromium (313 mg/kg), lead (163 mg/kg) and cadmium (18.7 mg/kg). Acid extractable SVOCs were not detected (reporting limits were listed as 400 to 5,200 mg/kg). All the results from these activities are summarized and presented in the "Final Site Inspection Prioritization Report, for Mohawk Tannery, Nashua, New Hampshire", dated November 1996, prepared by NHDES.

2.5.2 2000 - 2002- Investigations

Between September 2000 and July 2002, EPA performed several Removal Investigations and a Time Critical Removal Action (TCRA). Samples from sludge, soil, drums, and containers were collected. Sludge and soil samples were analyzed for VOCs, SVOCs, pesticides/polychlorinated biphenyls (PCBs), metals (23 Target Analyte List [TAL] metals), dioxins/furans, hexavalent chromium and total sulfides. Sludge samples were also analyzed for Toxicity Characteristic Leaching Procedure (TCLP) SVOCs, TCLP pesticides, TCLP metals, corrosivity, and reactivity. Sludge samples from Areas 3 through 7 were also analyzed for TCLP VOCs and ignitability.

The sludge samples exhibited concentrations of carbon disulfide, benzo(a)pyrene, 2-methylnaphthalene, 4-methylphenol, pentachlorophenol, dioxins/furans, antimony, arsenic and trivalent chromium above USEPA and/or NHDES screening level criteria. However, hexavalent chromium was not detected at concentrations above screening level criteria. Analytical results indicated that none of the sludge samples exhibited hazardous waste characteristics pursuant to the Resource Conservation and Recovery Act (RCRA). Two separate investigations conducted by different contractors (GeoSyntec in 2001, and TtNUS in 2002) concluded that the sludge could be handled, transported and disposed as non-hazardous solid waste at a USEPA and NHDES-approved landfill.

2.5.3 2005 – 2013 Investigations

The 2005 RI data can be summarized as follows:

<u>Interior Residue (IR) Samples (i.e. pits/sumps within the building slabs)</u>

In general, contaminant concentrations detected in these samples were higher than those detected in other media. Low levels of VOCs (BTEX, other AVOCs, CVOCs, ketones, MTBE and carbon disulfide) and several pesticides were detected in interior residues samples; however, none at concentrations above NHDES S-l Standards, USEPA Preliminary Removal Goal (PRGs) (at the time) or Oak Ridge National Laboratory (ORNL) ecological toxicological criteria (soil criteria). The detected concentrations were typically about one to four orders of magnitude below the soil criteria. One or more of the SVOCs: bis(2-ethylhexyl)phthalate [BEHP] and the PAHs 2-methylnaphthalene and pyrene, were detected in three of the six samples analyzed. The only SVOC detected at a concentration above its soil criterion was BEHP (180,000 mg/kg) in one sample. PCBs were detected at 400 to 4,000 μg/kg in three of the six samples analyzed. The concentrations detected in all three samples exceed the USEPA PRG (at the time), and the concentrations detected in two samples exceed the NHDES S-1/S-2/S-3 Standards. However, reasonable maximum exposure (RME) risks were calculated for the trespasser based on exposure to both accessible Site-wide surface soil and indoor dirt from an unoccupied portion of the Main Building, and the results were 6 x 10-6 ELCR and 0.08 HI. Risks were also calculated for the current/future indoor worker exposed to indoor dirt in the occupied part of the main building. The results were 2 x 10-5 ELCR and a non-cancer HI of 0.07. All of these risks were found to be below EPA's acceptable risk range and they are likely to be biased high because they assumed worker exposure to the maximum detected concentrations from the interior residue samples at the slab trenches and pits/sumps.

Dioxins/furans were detected at concentrations of 17 to 1,300 nanograms per kilogram (ng/kg) TEQ (mammalian), with all sample concentrations above the USEPA PRG (at the time) of 3.9 ng/kg. Now, the NHDES S-l Standard for dioxins/furans in soil is 0.001 mg/Kg (1000.0 ng/Kg) and the USEPA PRG has been calculated as 5.11×10^{-5} mg/Kg (51.1 ng/Kg). All IR samples exhibited concentrations of multiple metals above soil criteria. Metals detected at elevated concentrations included: total chromium, arsenic, lead, zinc and antimony; and to a lesser extent cadmium, copper, mercury, barium, cobalt, manganese and nickel. Hexavalent chromium was not detected in any of the interior residue samples.

Building Subslab Soil Samples

Contaminant concentrations detected in these samples were substantially lower than those detected in the interior residue samples. Low levels of VOCs (TEX, naphthalene, 1,2-DCB, ketones, trichlorofluoromethane), and pesticides (alpha- and gamma-chlordane) were detected in subslab soil samples; however, none at concentrations above soil criteria. Generally, concentrations are about two to four orders of magnitude below soil criteria. One or two among the SVOCs: BEHP, fluoranthene and phenanthrene, were detected in only three of the sixteen samples analyzed; none at concentrations above soil criteria. PCBs were detected in one of the four samples analyzed at a concentration of 210 μg/kg, which exceeded the USEPA PRG at the time, however the risks posed by this and all other concentrations combined were found to be below the EPA acceptable risk level. The dioxin/furan concentrations ranged from 0.36 to 24 ng/kg TEQ (mammalian), with two of the four samples analyzed having concentrations above the USEPA PRG of 3.9 ng/kg TEQ. The only metal detected at concentrations exceeding NHDES S-l Standards was arsenic in three of the sixteen samples analyzed. Chromium was also detected at relatively elevated concentrations. Cobalt, lead, mercury and zinc were detected in one or two samples at relatively elevated concentrations. Hexavalent chromium was not detected in any of the sub-slab soil samples.

Exterior Soil Samples

Average contaminant concentrations detected in these samples were intermediate between those of interior residue and sub-slab soil samples. Low levels of VOCs (ethylbenzene, toluene. CVOCs, ketones and carbon disulfide) and several pesticides were detected in about half the samples analyzed, however, none at concentrations above soil criteria. Detected concentrations were typically about one to four orders of magnitude below soil criteria. PCBs were not detected in any of the ten exterior soil samples analyzed. One or more of the SVOCs: PCP, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, 2-methylnaphthalene, phenanthrene and pyrene, were detected in seven of 45 samples analyzed. The only SVOCs detected at concentrations above soil criteria were: benzo(a)pyrene at 190 μg/kg in one sample; and PCP at 4,000 μg/kg at another sample. PCP was not detected in any other soil samples. The highest concentration of total detected PAHs (75,000 μg/kg), consisting of 2-methylnaphthalene and phenanthrene, was detected in one sample located near the fuel oil UST and former coal pile (Boiler House area). This and several other samples from this area were described as black, oil-saturated and/or with slag/debris, and had elevated SVOC/PAH reporting limits (2,600 to 18,000 μg/kg). Dioxins/furans ranged in concentration from 0.90 to 1,100 ng/kg TEQ (mammalian). All but one of the 13 samples analyzed had concentrations above the USEPA PRG of 3.9 ng/kg. Exceedances of NHDES S-l Standards were largely limited to chromium and arsenic. The highest chromium concentrations were detected in soil samples from the vicinity of the former chrome tanning solution fill up port, the former area of leather shavings piles east of the Main Building, and the vicinity of former wastewater conveyance/treatment structures to the west of the Main Building. Low concentrations (approximately 1 to 4 mg/kg) of hexavalent chromium were detected in five of the twelve samples analyzed; well below the NHDES S-l Standard and the USEPA PRG. Arsenic was detected at concentrations above NHDES S-1/S-2/S-3 Standards (11 mg/kg) in 15 exterior soil samples. The distribution of elevated arsenic concentrations is relatively similar to chromium. Elevated arsenic concentrations were also detected in samples from north and west of the former Boiler House, and the former gravel pit with the maximum detected concentration of 39 mg/kg. Vanadium (no NHDES S-l Standard) was detected at concentrations up to 6,400 mg/kg; generally, above the ORNL guideline of 2 mg/kg in each sample, and typically above the USEPA PRG of 7.8 mg/kg. Elevated vanadium concentrations were typically detected in samples from north and west of the former Boiler House. Other metals with moderately elevated concentrations (occasionally above soil criteria) included: mercury, nickel, zinc, beryllium, copper, cobalt, lead, manganese and selenium.

Groundwater Samples

The concentrations of organic contaminants (VOCs, SVOCs, dioxins/furans) detected in groundwater were relatively low, except near the Lagoons. There were only five instances where a VOC or SVOC was detected at a concentration above the USEPA Maximum Contaminant Level (MCL)/NHDES Ambient Groundwater Quality Standards (AGQS). Elevated concentrations of arsenic and manganese were detected in groundwater from the Lagoon area, and the southern more downgradient portion of the Site. Chlorobenzene and MTBE were the only VOCs detected in groundwater at concentrations above MCL/AGQS, each in one well. Other VOCs detected in Site groundwater, occasionally at concentrations above USEPA PRGs, included: chloromethane, 1,2-DCB, 1,3-DCB, 1,4-DCB, 1,1-DCA, 1,2-DCA, acetone, tetrahydrofuran and carbon disulfide. In addition, as presented in Woodard & Curran (2004), relatively low concentrations of 1,1-DCA and PCE were detected in groundwater from the Fimbel Door Landfill property. SVOCs, including: BEHP, dimethyl phthalate, and naphthalene, were only detected in groundwater from four of 25 monitoring wells sampled. BEHP was the only SVOC detected in groundwater (from three wells) at concentrations above its MCL/AGQS or USEPA PRG. The maximum dioxin/furan concentration of 28 pg/1 TEQ was detected in one sample. The remaining samples analyzed had concentrations of less than 1 pg/1 TEQ, or not detected. None of the detected concentrations exceed the MCL/AGQS of 30 pg/1 TEQ, and four out of six of the detected concentrations exceed the USEPA PRG of 0.45 pg/1 TEQ. Only arsenic and manganese (maximum concentrations of 1.3 and 8.3 mg/1, respectively) were detected at concentrations above AGQS/MCL. Typically, the more elevated concentrations were observed in the generally more downgradient, western (Lagoon area) and southern portions of the Site. At the Fimbel Door Landfill, generally only arsenic has been detected above AGQSs/MCLs or USEPA PRGs.

The 2013 SLRA data can be summarized as follows:

<u>Groundwater Samples</u>
Groundwater samples were collected from six existing monitoring wells, five mini-piezometers in two wetlands, and ten mini-piezometers along the river bank. The samples were analyzed for metals, total chromium, hexavalent chromium, SVOCs, VOCs, 1-4-Dioxane. At the monitoring wells arsenic, barium, and manganese, were detected in all six samples. The maximum concentrations of these metals were 88.9 μg/L, 49.8 μg/L, and 2810 μg/L respectively. None of the chemicals detected exceeded the MCL, except arsenic. At the mini-piezometers, only arsenic and lead exceeded the MCLs with 305.3 μg/L and 19.3 μg/L as their respective maximum concentrations.

<u>Surface Soil Samples</u>
Surface soil samples (0-0.5 ft. bgs) were collected from 55 locations and 12 samples from areas with ACM. All fifty-five samples were tested for metals, and total chromium, some were also tested for hexavalent chromium, SVOCs, VOCs, PCBs, dioxin/furans, and asbestos. Exceedances of benchmarks occurred for seven PAHs, bis(2-ethylhexyl) phthalate, pentachlorophenol, seven metals, PCBs, and dioxins/furans. Pentachlorophenol was detected in one sample at a concentration of 0.38 mg/kg, and bis(2-ethylhexyl)phthalate was detected in five of 20 samples at a maximum concentration of 1.5 mg/kg.

<u>Sub-surface Soil Samples</u>
Sub-surface soil samples (1-2 ft. bgs) were collected from 5 locations and all were tested for the same parameters as surface soil samples except asbestos. All 10 samples showed detections of the following chemicals (maximum concentration in parenthesis): arsenic (14.9 mg/kg), barium (365 mg/kg), total chromium (13,000 mg/kg), lead (167.00 mg/kg), manganese (403.00 mg/kg), total PCBs (1.53 mg/kg), TE PCBs (8.210E-07 mg/kg), and TE dioxin/furans (1.180E-03 mg/kg).

<u>Surface Water Samples</u>
Surface water samples were collected from two on-site wetlands and they were tested for metals, total chromium, hexavalent chromium, SVOCs, and VOCs. Exceedances of benchmarks occurred for the following chemicals (maximum concentration in parenthesis): benzyl alcohol (160 μg/L), phenol (5.3 μg/L), arsenic (40.9 μg/L), barium (161 μg/L), cadmium (3 μg/L), lead (35.4 μg/L), and manganese (3,190 μg/L).

Sediment Samples

Sediment samples were collected from 10 locations along the river bank, 5 locations in the wetlands, and one location upstream and across the Nashua River. Exceedances of no-effect benchmarks occurred for the following chemicals (maximum concentration in parenthesis): chlorobenzene (0.1084 mg/kg), bis (2-ethylhexyl) phthalate (0.27 mg/kg), anthracene(0.12 mg/kg), benzo (a) anthracene (0.36 mg/kg), benzo (a) pyrene (0.32 mg/kg), benzo (b) fluoranthene (0.41 mg/kg), benzo (k) fluoranthene (0.15 mg/kg), chrysene (0.37 mg/kg), fluoranthene (0.82 mg/kg), indeno (1, 2, 3-cd) pyrene (0.16 mg/kg), phenanthrene (0.61 mg/kg), pyrene (0.67 mg/kg), cadmium (3.02 mg/kg), chromium (99 mg/kg), lead (45.5 mg/kg), manganese (136 mg/kg), TE PCBs (5.300E-07 mg/kg), and TE dioxins/furans (1.680E-05 mg/kg).

2.6 Risk Evaluation

The 2002 EE/CA included a streamlined human health and ecological risk evaluations that focused on the seven sludge waste disposal areas of the Site. Then on 2005 the RI included a Human Health Risk Assessment (HHRA) and a Screening Level Ecological Risk Assessment (SLERA) for the soils, indoor dirt (inside existing buildings at the time), and groundwater within the northern parcel. Finally, on 2013, EPA's Screening Level Risk Assessment evaluated the human health and ecological risk posed by soils, sediments, surface water and groundwater within the southern parcel. The following are summaries of the risk evaluation findings for each investigation.

2.6.1 2002 EE/CA Human Health Risk Summary

The streamlined human health risk evaluation was performed to identify the risk to humans from soil and sludge at the site. The evaluation was conducted using standard quantitative risk assessment methods, except that it focused only on media of concern for the NTCRA at the time. Other media (groundwater, surface water, air) were not evaluated.

The human health risk evaluation identified potential human health risks above EPA's target non-cancer hazard index (H1) of 1.0 and/or cancer risk level (CR) of 1.0 x 10^{-4} for the following receptors and exposure scenarios:

- Current or future adolescent trespasser exposed to wet sludge in Area 1: HI of 42.5, CR of 1.86x10^{-3}
- Future lifetime resident exposed to surface soil in Areas 2 through 7: HI of 13.1, CR of 9.54 x10^{-5}
- Future lifetime resident exposed to surface and subsurface soil/sludge in Areas 1 through 7: HI of 72.4, CR of 1.87 x 10^{-4}

The major contributors to excess non-cancer risks were 4-methylphenol, arsenic, antimony, cadmium, and manganese. The major contributors to excess cancer risks were dioxins, pentachlorophenol, arsenic, and benzo(a)pyrene. Benzo(a)pyrene was detected only in a very localized area of the site, in one sample from Area 7 and it does not appear to be a site-wide concern.

2.6.2 2002 EE/CA Ecological Risk Summary

The streamlined ecological risk evaluation was a screening-level evaluation that used conservative screening values to identify all contaminants that may pose an ecological risk. Contaminant concentrations were compared against screening values to identify contaminants of potential concern (COPCs). COPCs do not necessarily pose a risk to ecological receptors, but rather indicate a potential risk that may warrant further investigation. The degree of potential risk posed by each contaminant was evaluated using hazard quotients (HQs). The HQ is the ratio of the contaminant concentration at the exposure point to its screening value. An HQ of greater than 1.0 indicates that adverse impacts are possible.

The ecological risk evaluation identified potential risks to ecological receptors from exposure to wet sludge (considered sediment in the ecological evaluation) and surface water in Area 1 and surface soil in Areas 2 through 7 in the northern parcel. The evaluation identified numerous contaminants of potential concern (COPCs) in each media. COPCs for sediment and surface soil included multiple contaminants from each of the following contaminant classes: VOCs, SVOCs, pesticides, dioxins, and metals. COPCs for surface water included only one VOC, two SVOCs, and three metals.

The maximum HQs identified for the Area 1 sediment were 35,000 (4-methyphenol), 30,400 (chromium), and 2,293 (carbon disulfide). The highest HQs for Area 2 through 7 surface soil were 8,823 (mercury), 1741 (aluminum) 528 (chromium), 298 (1,2,3,4,6,7,8-HpCDD dioxin), 200 (iron), and 179 (antimony). The highest HQ for surface water was 42 (manganese) followed by 5.4 (carbon disulfide). Although the ecological HQs were calculated using conservative screening values, the magnitude of the HQs calculated for sediment and surface soil in the sludge areas in the northern parcel of the site indicates that contaminants at the site pose a real concern for ecological receptors.

2.6.3 2005 RI Human Health Risk Summary

The HHRA quantified current and possible future risk to people exposed to contamination in soil, indoor dirt, and groundwater throughout the Site, except for seven disposal areas, including two lagoons, associated with the former tannery that were evaluated previously (TtNUS, 2002). At the time the Site was being used by several businesses occupying the warehouse portion of the main building on a part-time basis, with some evidence of trespassers. Cancer risks and non-cancer hazards were evaluated for the following scenarios:

- Current adolescent trespasser exposed to site-wide surface soil,
- Current adolescent trespasser exposed to indoor dirt (*i.e.*, building interior chemical residues as represented by the IR samples) in the unoccupied part of buildings,
- Current/Future indoor worker exposed to indoor dirt in the occupied part of the main building (warehouse), and
- Future resident (child and adult) exposed to soil (at four different exposure points [Sitewide surface soil {0-1' bgs}, Site-wide subsurface soil {0 - 10' bgs}, Boiler House area surface soil {0-1' bgs}, Boiler House area subsurface soil {0 - 10' bgs}]); and tap water.

These calculated risks were compared to USEPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}

excess lifetime cancer risk (ELCR), and the NHDES target risk of 1 x 10^{-5} ELCR. Non-cancer effects were compared to a maximum organ-specific target HI (HI) of 1. Reasonable maximum exposure (RME) risks calculated for the current trespasser based on exposure to both accessible Site-wide surface soil and indoor dirt from the unoccupied portion of the Main Building were 6 x 10^{-6} ELCR and 0.08 HI. Dioxin/furan TEQ and arsenic were the primary contributors to cancer risk; and PCBs, antimony and arsenic were the primary contributors to non-cancer hazard.

The screening-level risk calculation for the current/future indoor worker exposed to indoor dirt in the occupied part of the main building indicated that the cancer risk (2 x 10^{-5}) was within USEPA's cancer risk range and exceeded the NHDES target risk. The calculated non-cancer HI was 0.07, below the NHDES and USEPA target. Dioxin/furan TEQ and arsenic were the primary contributors to cancer risk, and PCBs were the primary contributors to the non-cancer hazard. These risk estimates are likely to be biased high because they assumed worker exposure to the maximum detected concentrations from the interior residue samples from trenches and pits/sumps. The results for this exposure scenario suggested that no further evaluation was warranted for current and future full-time commercial use of the building.

Cancer risk and non-cancer hazard for a future resident were primarily attributable to use of groundwater as tap water and were significantly higher than USEPA and NHDES target risks and HIs. Risks from groundwater exposure were: central tendency exposure (CTE) (ELCR = 6 x 10^{-4}, HI = 20) and reasonable maximum exposure (RME) (ELCR = 4 x 10^{-2}, HI = 400) cases. Arsenic, BEHP, dioxin/furan TEQ and 1,4-DCB were the main sources of cancer risk. Arsenic, manganese, BEHP and chlorobenzene were the main sources of non-cancer hazard.

RME cancer risks from soil exposure for the adult and child resident combined exceed 1 x 10^{-5}, but are less than or equal to 1 x 10^{-4}, at all exposure points. These cancer risks were largely due to dioxin/furan TEQ and arsenic. RME soil HIs exceed one (HI = 3) only at the subsurface soil boiler house area exposure point, primarily due to vanadium. HIs for the other three soil exposure points (Site-wide surface soil, Site-wide subsurface soil, Boiler House area surface soil) were between 0.2 and 1, and were largely due to arsenic and vanadium.

2.6.4 2005 RI Ecological Risk Summary

The 2005 RI SLERA quantified risk to plants, soil invertebrates, and terrestrial wildlife (birds and small mammals) exposed to contamination in soil in at the four principal habitats at the Site (red oak-white pine forest, oak-hickory forest, early successional forest/cultural grasslands, and red maple floodplain), and risk to terrestrial wildlife (birds and small mammals) exposed to contamination in sludge (and overlying soil) at six disposal areas associated with the former tannery (Areas 2 through 7). The aquatic environment of Disposal Area 1 (the open lagoon) was not included.
The assessment endpoints and measures of effect for the SLERA included:

- Assessment endpoint 1: Maintenance of upland plant communities and soil invertebrates exposed to chemicals in surface soil through direct uptake.
- Measure of Effect: Available eco-toxicity values (concentrations) for the protection of plants and soil invertebrates.
- Assessment endpoint 2: Sustainability (survival, growth and reproduction) of bird and

small mammal populations exposed to chemicals in surface soil and sludge through direct ingestion of soil or sludge, and consumption of soil invertebrates.

- Measure of Effect: Available eco-toxicity values (body weight-specific doses) protective of exposure to chemicals in soil and sludge through direct ingestion and the food chain.

More chemicals were detected in the early successional forest/cultural grasslands habitat than in the other three habitats, and most of the maximum surface soil concentrations occurred in this habitat (except for acetone, aluminum, beryllium, cadmium, cobalt, lead, and zinc). This habitat occupies a large portion of the Site, and is a disturbed area where most activities related to the tannery operation occurred. The concentrations of several metals (aluminum, total chromium, hexavalent chromium, copper, lead, manganese, mercury, nickel, vanadium and zinc) have the potential to cause adverse effects to ecological receptors in this habitat. Outside of this habitat, the list of chemicals that might cause adverse effects is shorter, and includes aluminum, total chromium, lead, vanadium and zinc.

For sludge, the list of chemicals that have the potential to cause adverse ecological effects includes some of the same constituents as the soil: aluminum, total chromium, lead, mercury and zinc; as well as antimony, BEHP, cadmium and dioxins/furans. There was uncertainty associated with the conclusions for aluminum, total chromium, lead, mercury, vanadium, and zinc because the available eco-toxicity values (soil concentrations) were below the background soil concentrations established by the NHDES.

2.6.5 2013 EPA SLRA Human Health Risk Summary

A screening level human health risk assessment was conducted by comparing human health risk-based concentrations with the maximum or upper 95% confidence limit concentrations of detected contaminants at groundwater, surface water, soils and sediment samples within the Site's southern parcel. Human health risk-based concentrations were based on EPA's maximum risk limits for Superfund sites, a cancer risk of 1-in-10,000 (*i.e.* 1×10^{-4}) for carcinogenic chemicals and a hazard quotient of one or less for non-carcinogenic chemicals. Contaminants in groundwater from monitoring wells and mini-piezometer wells exceeded risk-based concentrations for residents.

The risk of chemicals in surface soil and subsurface soil was higher than the risk limit for residential receptors, but not for recreational receptors. Asbestos was detected in a limited area containing debris near the northern parcel and may have a risk to recreational receptors. Surface soils in two small wetlands did not have risk above EPA risk limits for recreational receptors. River bank surface soils and river sediments did not have risk above risk limits for recreational receptors, even when the risks of both media were combined.

2.6.6 2013 EPA SLRA Ecological Risk Summary

A screening level ecological risk assessment was conducted by comparing concentrations with the maximum or upper 95% confidence limit concentrations of detected contaminants at groundwater, surface water, soils and sediment samples within the Site's southern parcel.

Surface water in two small wetlands may have an adverse effect on aquatic organisms due to elevated manganese. However, since surface water is not always present at these wetlands, aquatic organisms will probably not be present for a significant portion of their life cycle. Thus, it was concluded that the potential ecological effects are not significant because of the limited populations of aquatic organisms that can be present and that their exposure would not be long enough to be considered chronic.

Groundwater from mini-piezometer wells along the river bank would not exceed ecological benchmarks in river surface water after it is diluted as it emerges into the river.

Adverse ecological effects in surface soil to terrestrial receptors are possible due to chromium and dioxin because the 95% UCL concentrations were higher than their respective benchmarks.

Adverse ecological effects in surface soil in one of the wetlands (northernmost wetland) were deemed possible due to the presence of chromium and dioxin at levels that exceeded their respective benchmarks. Adverse effects in surface soil at the other wetland (southernmost wetland) were deemed possible due to the presence of cadmium, chromium and dioxin, at levels that exceeded their respective benchmarks.

Site-related contaminants in river sediment did not exceed ecological benchmarks for aquatic organisms, and surface water in the Nashua River was not analyzed because previous studies had shown that site-related chemicals were not elevated.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

3.1 General

This section presents the removal action objectives for developing the removal action alternatives to address the sludge waste and contaminated soils generated by the Site. The preliminary removal goals, areas targeted for removal, and regulatory requirements are also presented.

3.2 Development of Removal Action Objectives

The development of removal action alternatives begins with the establishment of Removal Action Objectives (RAOs). RAOs address the contaminants and media of interest and the exposure pathways that result in an unacceptable risk. RAOs are medium specific or unit specific goals for protecting human health and the environment.

The 2002 EE/CA (EPA, 2002), the 2005 RI (Sanborn Head & Associates, 2005), and the 2013 SLRA (EPA, 2013) presented the findings of baseline human health and ecological risk assessment for the sludge waste disposal areas at the Site's northern parcel, the remaining soils and groundwater at the northern parcel, and several media within the southern parcel. Using analytical results from these investigations and the results of the human health risk and ecological evaluations, contaminants of concern (COCs) that pose threats to human health and the environment were identified.

Preliminary Removal Goals (PRGs) were established for these COCs using risk-based values calculated from exposure scenarios identified in the streamlined human health risk evaluations; available guidance for addressing dioxin contamination; and the NHDES Soil remediation standards (SRS) concentrations. For all COCs except dioxins, the proposed PRG was selected from the lower of the risk-based PRGs corresponding to a cancer risk level of 1.0×10^{-6} and a hazard index of 1.0, unless this risk-based value was higher than the NHDES SRSs concentrations of metals in soil, in which case the SRS concentration was selected as the proposed PRG. For dioxin, the proposed PRG was selected based on regional screening levels based on non-cancer risk.

Because the scope of the proposed NTCRA is limited to source control for contaminated soils, sludges, and wastes, PRGs were not developed for groundwater, surface water or river sediments. Also, the PRGS were based strictly on human health risk levels because the potential ecological effects are not significant, except for limited areas of soil contamination and sediment contamination adjacent and within the two wetlands within the southern parcel, as concluded by the 2013 SLRA.

The following is a table showing all the COCs and their respective proposed PRGs.

Table 1.0 Preliminary Remedial Goals (PRGs)

Contaminant of Concern	EE/CA Amendment PRG (mg/kg)	NHDES SRS (mg/kg)
Benzo(a)pyrene	0.7	0.7
Pentachlorophenol	3.0	3.0
4-Methylphenol (p-cresol)	0.7	0.7
Dioxin - TCDD (expressed as toxicity equivalency [TEQ])	5.11E-05*	0.001
Antimony	9.0	9.0
Arsenic	11.0**	11.0
Barium	1,000.0	1,000.0
Cadmium	33.0	33.0
Chromium total	1,000.0	1,000.0
Lead	200.0***	400.0
Manganese	1,000.0	1,000.0
Vanadium	393.0*	NA

Notes:
SRS = Soil Remediation Standards. SRSs are derived from New Hampshire Code of Administrative Rules Chapter Env-Or-606.19, Table 600-2 Soil Remediation Standards as-of 2017

EE/CA - Engineering Evaluation/Cost Analysis
NHDES - New Hampshire Department of Environmental Services

mg/kg- milligrams per kilogram
* The PRG for Dioxin, and Vanadium is based on an EPA Regional Screening Level (RSL) assuming a Hazard Quotient (HQ) = 1, expressed as mg/kg.
** Arsenic PRG may be modified to background, if determined during pre-design soil studies that Arsenic is attributable to background and background levels are higher than the current PRG of 11 mg/kg.

*** The current EPA Region 1 approach for lead in soils is based on the Lead Technical Review Workgroup's current support for using a target Blood Lead Level (BLL) of 5 µg/dL and updated default parameters in the Integrated Exposure Uptake Biokinetic Model (IEUBK) and Adult Lead Methodology (ALM). Using these updated parameters, the model results in screening levels which round to 200 mg/kg for residential and 1000 mg/kg for commercial/industrial land uses. A target BLL of 5 µg/dL reflects current scientific literature on lead toxicology and epidemiology that provides evidence that the adverse health effects of lead exposure do not have a threshold.

NA = Not Available

The following RAOs were developed to address these unacceptable risks:

- Prevent, to the extent practicable, direct contact with, and ingestion of, contaminants in tannery sludge/waste and associated soil at concentrations exceeding PRGs;
- Prevent, to the extent practicable, direct contact with, ingestion, and inhalation of asbestos fibers present in ACM within the Site;
- Prevent, to the extent practicable, a release of contaminants to the Nashua River from a flooding event;
- Prevent ingestion of on-site groundwater that exceeds NHDES Ambient Groundwater Quality Standards (AGQSs);
- Limit, to the extent practicable, further migration of contaminants from tannery sludge/waste and associated soil to site groundwater; and
- Prevent, to the extent practicable, ecological receptor exposure to tannery sludge/waste which could potentially cause adverse effects.

3.3 Removal Action Volume Estimates

3.3.1 Sludge Waste Disposal Areas

Sample analytical results were compared with the proposed PRGs to estimate the volume of sludge/waste and soil to be addressed under the NTCRA. The following table provides a summary of the estimated volumes of sludge/waste and overlying soils in each disposal area that contain COCs at concentrations exceeding PRGs. No evidence of sludge/waste was observed in Area 5 during field investigation activities performed prior to the 2002 EE/CA, and samples collected from Area 5, at that time, did not exceed any of the proposed PRGs. As a result, no sludge/waste volume has been estimated for this area. Overlying soils on top of the sludge disposal areas contain COCs at concentrations exceeding PRGs. Soils outside of the disposal areas in the northern parcel will be addressed in Section 3.3.2.

Table 2.0 Estimated sludge waste and overlying soil volumes[1]

Disposal Area	Estimated Volume of Sludge/Waste (cy)	Estimated Volume of Overlying Soil (cy)
Area 1	29,630	0
Area 2	29,630	8,889
Area 3	556	222
Area 4	800	400
Area 6	1,111	667
Area 7	4,459	2,230

TOTAL SLUDGE/WASTE and OVERLYING SOIL VOLUME: 78,594

3.3.2 Contaminated Soil Areas in the Northern Parcel

The 2005 RI documents several areas within the northern parcel outside of the disposal cells, that were tested and revealed concentrations above the PRGs. Based on that data and the current PRGs the following are estimates of the volumes to be removed:

Table 3.0 Estimated soil volumes[2]

Soil Area	Estimated Volume of Contaminated Soils* (cy)
Former Main/Control Buildings sumps/pits	6
Former Chrome Fill up (TP-01 sample area)	15
Former Wastewater (TP-08 and 09 sample areas + TP 15 sample area + TP21 and 22 sample area)	1020
Former Boiler House (TP-02 sample area)	100
Main Building Subslab Soil (TP-34 sample area)	10

*These volumes assume that arsenic is attributable to natural conditions, and that the 95% Upper Confidence Limit[3] of arsenic site-wide is below the PRG of 11 mg/kg. If necessary, a naturally-occurring arsenic concentration may be determined via a future background study. These volumetric estimates may increase if it is determined that arsenic is not attributable to background.

TOTAL SOIL VOLUME: 1,151

[1] Source: KGSNE JV, LLC. Mohawk Tannery Site - Removal Alternatives Update Technical Memorandum, April 2018.

[2] These volume estimates are derived from the table at page 114 of the Sanborn Head & Associates, *Draft Final Remedial Investigation OU-1, Former Mohawk Tannery Site, Nashua NH*, June 2005

[3] *The Upper Confidence Limit (UCL) is the upper boundary (or limit) of a confidence interval of a parameter of interest such as the population mean. From a risk point of view, a 95% UCL of mean represents a number that is health protective when used to compute risk and health hazards*. USEPA Pro UCL Version 5.0.00 Technical Guide, September 2013.

3.3.3 Contaminated Soil Areas in Southern Parcel

The 2013 EPA SLRA of the Southern Parcel documents the existence of areas with ACM and soil contamination exceeding PRG values. Based on that data and the PRGs, the following are estimates of the volumes to be removed:

Table 4.0 Estimated volumes of soil contaminated with asbestos and other COCs.[4]

Soil Area	Estimated Volume of Contaminated Soils (cy)
Area with scattered asbestos debris	625
Area with abundant asbestos debris	625
Dirt bike area	1250

TOTAL SOIL VOLUME: 2,500

3.4 Applicable or Relevant and Appropriate Requirements

3.4.1 Definition of ARARs and TBCs

In accordance with Section 300.415(j) of the NCP, on-site removal actions conducted under CERCLA are required to attain Applicable or Relevant and Appropriate Requirements (also referred to as "ARARs") to the extent practicable. In determining whether compliance with ARARs is practicable, the lead agency may consider appropriate factors, including the urgency of the situation and the scope of the removal action to be conducted.

While ARARs under CERCLA pertain only to on-site activities, off-site activities relating to hazardous waste disposal are required to meet all applicable laws including, but not limited to: Department of Transportation regulations governing the marking and labeling of hazardous materials shipments (49 CFR 192), shipping requirements (49CFR173), and transport of hazardous materials by motor vehicles (49 CFR 173 and 49 CFR 177); and RCRA regulations governing transporter activities and treatment, storage, and disposal facilities (40 CFR 261-264), land disposal restrictions (40 CFR 268), and off-site response actions (40 CFR 300.440); and CERCLA 121(d)(3). Other non-ARAR off-site requirements include state labeling, shipping, and transport requirements for state-designated hazardous wastes and CERCLA Section 121 (d)(3) requirements for the off-site transfer of CERCLA wastes.

The Occupational Safety and Health Administration (OSHA) regulations are not ARARs, but apply to both on- and off-site activities. These include regulations governing performance of activities at hazardous waste sites (29 CFR 1910.120), general construction guidelines (29 CFR 1926), and occupational exposure to asbestos (29 CFR 1910.1001).

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[4] These estimates are based on the areal extent as depicted in Figure 2 (Proposed Sampling Location Plan) of the USEPA, *Screening Level Human Health and Ecological Risk Assessment of the Southern Parcel at the Mohawk Tannery Superfund Site, Nashua, NH*, September 2013. They are rough estimates using the figure scale and assume a depth of 1 foot.

ARARs are subdivided into chemical-specific ARARs (that apply to establishing chemical cleanup standards), location-specific ARARs (that apply to certain locations, like rivers and wetlands), and action-specific ARARs (that apply to certain activities, like dredging and filling). The following sections summarize the key ARARs considered in developing removal alternatives.

3.4.2 Chemical-Specific ARARs and TBCs

Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the determination of numerical values that establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. In general, chemical-specific requirements are set for a single chemical or a closely-related group of chemicals. These requirements do not consider the mixture of chemicals. Several chemical-specific ARARs and TBCs were identified.

The EPA Region IX Preliminary Remediation Goals, the EPA oral non-cancer toxicity value, or reference dose (RfD), for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) at the Integrated Risk Information System (IRIS), February 2012, and the NHDES Soil Remediation Standards are identified ARARs that were used in the data evaluations and human health risk evaluations to identify potential contaminants of concern and develop PRGs. A summary of potential chemical-specific ARARs and TBCs for each removal action alternative is presented with the detailed analysis of each alternative (Section 5.0).

3.4.3 Location-Specific ARARs and TBCs

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances, or the conduct of activities solely because they are performed in specific areas. The general types of location-specific ARARs that may be applied to the site are briefly described below.

Several federal and state ARARs regulate activities that may be conducted in wetlands and floodplains. These regulations and requirements may apply because portions of the site are either occupied by wetlands or are situated in the 100-year floodplain and/or 500-year floodplain. The Wetlands Executive Order (E.O. 11990) and the Floodplains Executive Order (E.O. 11988), incorporated into 40 CFR Part 6, Appendix A, require that wetlands and floodplains be protected and preserved, and that adverse impacts be minimized. Section 404 of the Clean Water Act and state wetland protection regulations restrict activities that adversely affect wetlands and waterways.

Additional location-specific ARARs include the Fish and Wildlife Coordination Act, which requires that any federal agency proposing to modify a wetland or body of water must consult with the U.S. Fish and Wildlife Service. A summary of potential location-specific ARARs and TBCs for each removal action alternative is presented with the detailed analysis of each alternative (Section 5.0).

3.4.4 Action-Specific ARARs and TBCs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are generally focused on actions taken to remediate, handle, treat, transport, or dispose of hazardous wastes. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be implemented. The general types of action-specific ARARs that may be applied to removal actions at the site are briefly described below.

Most action-specific ARARs fall into three primary categories: federal and state regulations pertaining to the Clean Water Act (CWA), Clean Air Act (CAA), and RCRA. CWA ARARs generally regulate the discharge of treated groundwater. CAA requirements typically pertain to air emissions from hazardous waste treatment operations and from dust generated from removal activities (including asbestos). RCRA ARARs typically establish design, operating, and monitoring requirements for hazardous waste treatment facilities. A summary of potential action-specific ARARs and TBCs for each removal action alternative is presented with the detailed analysis of each alternative (Section 5.0).

For the purposes of identifying ARARs for removal alternatives in the EE/CA, it is assumed that sludge/waste retained on-site would not be classified as a hazardous waste. However, any waste taken off-site would be tested to confirm it does not meet hazardous waste standards. Any contaminated materials disposed on on-site will be capped on-site with caps that meet relevant and appropriate hazardous waste standards (therefore are protective for any type of waste that may be consolidated under the lagoon caps).

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

4.1 General Response Actions

The general response actions identified to attain the RAOs presented above include:

- No Action,
- Excavation with Off-Site Disposal,
- On-Site Treatment (Solidification/Stabilization),
- Waste Encapsulation and Impermeable Capping.

The No Action general response action would not address the existing risk to human health and the environment identified in Section 2.6 above. However, the No Action response action is included in this EE/CA because it is required by the NCP [40 CFR 300.430(e) (6)] as a baseline for evaluating all other removal alternatives under consideration.

4.2 Other Actions

North of the Site, lies the Fimbel Door property which contains a landfill that holds sludge waste from the former Mohawk Tannery operations and areas of soil contaminated with ACM. Further north from the Fimbel Door property, lies a City-owned property that contains ACM that was removed during the recent construction of the Broad Street Parkway (See Figure 2). This ACM is properly capped. These two properties are not considered part of the Mohawk Tannery Site, however, for a redevelopment proposal that is currently being reviewed by EPA and NHDES, access to these two properties is needed.

Furthermore, the contaminated media within these two properties, some of which is Site-related, needs to be removed and disposed at some other location. The alternatives laid out in this EE/CA Amendment assume access to both properties and include the removal and disposal of the sludge waste from the Fimbel Door Landfill and the ACM from the City -owned property. Specifically, all the sludge waste from the Fimbel Door Landfill (estimated at 20,000 cy) would be excavated and either treated or moved to existing below-ground sludge waste Areas 1 & 2, and encapsulated with an above-ground vertical containment structure along with sludge waste and contaminated soils to be excavated from other areas of the Site. In addition, ACM from the City-owned property (estimated at 17,000 cy) and ACM contaminated soils (estimated at 5,000 cy) at the Fimbel Door property would be excavated and deposited into a capped cell adjacent to the eastern edge/wall of either the containment structure that would be built or the solidification monolith that would be created after treatment of the tannery waste.

Table 5.0 Estimated volumes of sludge and contaminated soils at other properties

Soil or Sludge Area	Estimated Volume of Contaminated Soils (cy)
Fimbel Door Landfill (sludge waste)	20,000
City Parkway Asbestos Disposal Cell	17,000[5]
Fimbel Property Asbestos	5,000[6]

TOTAL SLUDGE AND SOIL VOLUME: 42,000

4.3 Identification and Screening of Applicable Technologies

Potentially applicable technology types for the sludge waste and contaminated soils at the Site are identified in this section. The potentially applicable technology types were derived from experience with similar types of contaminants, the 2002 EE/CA for the Site, and a Technical Memo prepared by KGSNE on April 2018, that updates the 2002 EE/CA options with current cost figures and additional alternatives.

As defined in the USEPA Remedial Investigation/Feasibility Study (RI/FS) guidance document (USEPA, 1988), the term "technology type" refers to the general categories of technologies, such as biological treatment, physical treatment, capping, and excavation. This EE/CA focuses on the development of removal action alternatives that can address sludge waste and contaminated soils associated with the Site that are within the two parcels comprising the Site, sludge waste deposited at the adjacent Fimbel Door Landfill by the tannery operation; ACM within the Site, the adjacent Fimbel Door property and an adjacent property owned by Right of Way (ROW) by the City of Nashua, which are consistent with the proposed re-development at the Site.

[5] Estimate from available documentation for asbestos disposal cell construction at the City/Parkway Right of Way on file with NHDES.

[6] Preliminary value based primarily on a visual indication of asbestos in surface soil to the north of the Fimbel Landfill and a limited number of test pits advanced through the asbestos waste by GeoInsight.

The identification of remedial technologies for the sludge waste and contaminated soils was derived from the previously mentioned sources, considering the future use of the Site and the surrounding communities. Several screening steps were conducted prior to selecting the most promising technologies to be assembled into removal alternatives. An initial screening of technologies was conducted by preparing a draft technical memorandum updating and supplementing those alternatives that were identified in 2002. During the initial screening step, technology types were evaluated based on technical implementability. Those and other technology types that could not be implemented effectively were eliminated from further consideration. Site-specific information, were appropriate, was used to screen out technology types and that could not be effectively implemented.

4.4 Development of Removal Action Alternatives

Removal action alternatives were developed for the sludge waste and contaminated soils using various combinations of technologies that were retained in the screening evaluation and discussed above. Often, a combined approach is necessary to achieve the RAOs. The development of alternatives has considered the distribution of contaminants in the soils, an in the sludge waste areas and the suitability of the various technologies to the conditions of the Site and the potential re-use that has been identified.

EPA guidance and the NCP require that a No Action alternative be developed as a baseline to which other alternatives can be compared. USEPA guidance and the NCP state that a containment option involving little or no treatment, be developed, as well as treatment alternatives that, to the degree possible, eliminate the need for long-term management (including monitoring) at a site, and other alternatives that treat the principal threats posed by hazardous substances at a site but that vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed. The following NCP remedy expectations and their potential application to contaminated sludge waste and soils, summarized below, were considered in the development of removal alternatives for the Site.

- **Use treatment to address principal threats wherever practicable**. One of the alternatives (Alternative 4) uses in-situ treatment of the wastes. However, none of the source material is considered highly toxic (*i.e.*, greater than 10^{-3} risk), therefore, principal threat wastes are not present at the site. Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The way principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material.

- **Use engineering controls such as containment for waste that poses a relatively low long-term threat or where treatment is impractical.** Capping and vertical containment is incorporated into some of the removal alternatives to address sludge waste and contaminated surface and subsurface soils that pose a low, long-term threat or where treatment is impractical.

- **Use a combination of methods, as appropriate, to achieve protection of human health and the environment.** Some of the removal alternatives include various combinations of vertical and horizontal containment methods plus institutional controls, which might include measures such as a deed notice, activity and use restriction (AUR), or City Ordinance, to achieve protection of human health and the environment.

- **Use institutional controls as needed to supplement engineering controls to prevent or limit exposure.** Long-term institutional controls will be established as mentioned above to prevent exposures to contaminants left in place subject to engineering controls.

- **Consider using innovative technologies when they offer the potential for superior treatment performance or implementability.** Innovative technologies were evaluated during the screening of technologies. Innovative use of materials or measures, such as *in-situ* solidification/stabilization and the use of secant walls, are being considered.

- **Prevent further migration of groundwater plumes and exposure to contaminants in groundwater**. While groundwater is not directly addressed by the removal action, there is no current exposure to groundwater in the Site due to the existence of public water service in the area. Activities to determine the Site's impact of groundwater to the Nashua River have been conducted in the past and the data does not indicate an unacceptable risk from contaminants in surface waters. The removal alternatives (except no action) will prevent and/or minimize the migration soil/waste contamination to groundwater as part of the source control component of the alternatives.

4.4.1 Additional Screening Evaluation

The retained technology types were evaluated based on effectiveness, implementability, and cost. Site-specific conditions, Site history, the river and its surroundings (including the 100- and 500-year floodplains) were considered during this evaluation, including significant limitations on open areas near the river that are large enough to stage construction equipment, and/or treatment. Land near Areas 1 & 2 in the northern parcel and near the adjacent Fimbel Door Landfill was assumed to be available for use, for the purposes of this EE/CA Amendment.

The overall goal of the secondary screening was to develop a list of the most promising alternatives to be combined into a set of removal action alternatives for detailed evaluation. When detailed or site-specific information was unknown, assumptions were applied to allow for an engineering evaluation and cost analysis.

4.4.2 Technologies Retained for Additional Analysis

A wide range of technologies have been evaluated for their applicability to remediating the sludge waste and contaminated soils at the Site. The technologies retained through the screening process are presented below.

The technologies that will be retained for further analysis are presented below and are further addressed in more detail and compared to other retained alternatives in Sections 5 and 6 of this report:

- No Action;
- Excavation with Off-Site Disposal,
- On-Site Treatment (Solidification/Stabilization), and
- Waste Encapsulation and Capping.

Figures 16,17 and 18 show conceptual layouts for each alternative.

4.4.3 No Action

In accordance with the NCP and USEPA guidance, a No action alternative is required to be developed as a baseline that other alternatives can be compared to. Under No Action, no cleanup activities, including removal or containment of sludge, contaminated soils, monitoring, engineering controls, or institutional controls, are to be implemented.

4.4.4 Alternative 1: Excavation with Off-Site Disposal

The 2002 EE/CA recommended selection of the excavation and off-site disposal alternative (Alternative 1) for the NTCRA. The Subsequent NTCRA Action Memorandum proposed this removal action. The 2002 EE/CA called for the excavation of approximately 60,000 cy of sludge waste and contaminated soil. The amended Alternative 1 calls for excavating approximately 52,587 cy, which includes 20,000 cy from the Fimble Door Landfill and additional asbestos-contaminated material.

Definable Features of Work (DFOWs) & Costing Assumptions:

<u>Site Access Road & Construction</u>: Access road construction would initiate at the Broad Street Parkway entrance, through the City of Nashua Parkway Right-of-Way, through the Fimbel Door Corporation property, and would extend across a known asbestos disposal site (ADS) and connect to an existing gravel/dirt road that accesses the Mohawk Tannery property northwest of Areas 1 and 2.

<u>Building/Foundation Demolition</u>: The structures formerly present on the Mohawk Tannery site have been razed and removed. The sole remaining remnants of these buildings are the concrete floor slabs and foundations. The concrete slabs around Area 6 will require removal and disposal. Based on available data, it does not appear that Area 6 sub-slab sample collection or concrete sample collection has been conducted to determine whether the concrete has been impacted by contamination. Testing may be required to determine this. Samples of residue within portions of the main building and associated out-building slabs have identified the presence of contaminants which exceed PRGs. Sub-slab soil samples collected from this area have also identified similar contaminants. However, no concrete samples have been collected to determine if the contaminants detected in the residue and/or sub-slab soil are present in the concrete slabs as well, which may require waste management.

Haul Road Construction: Existing Site roads would be improved to allow unimpeded construction-related traffic. Improvements assumed include modifications to grading, placement and grading of gravel surfaces, and increased widths in some areas.

Stockpile/Staging Area Preparation: Stockpile areas established and maintained in Areas 5 and 6. Stockpiles would be underlain by a 12-inch thick layer of gravel over a 40-mil high density polyethylene (HDPE) liner and 6-inches of gravel. Gravel and liner would be graded to promote drainage to the perimeter of the stockpile, and bermed to prevent run-off or run-on during precipitation events. Any stockpiling in the 500-year floodplain would need to be protected from flooding (put on a raise pad or bermed).

Dewatering: Excavation dewatering would be required in Areas 1, 2, and 3 via three pumps discharging to a fractionation tank. A transfer pump would discharge settled water from the first fractionation tank to a second tank for additional settling prior to potential treatment, and discharge to the publicly-owned treatment works (POTW) via a connection to the existing sewage pipeline that is on-site. Routine discharge samples would be collected during the dewatering effort. An estimated 250,000 gallons of total dewatering volume is assumed.

Sludge Waste/Soil Excavation: Excavate and stage overlying soil using a track-mounted excavator with a two-cubic-yard bucket and transport soil via two off-road dump trucks. Soil will be staged for later reuse. Excavation of waste/sludge material is assumed at a reduced rate of production due to moisture content and odor management considerations (see below). Sludge transported to stockpile staging area for moisture and odor management (mechanical mixing of agricultural lime). The PRG-exceeding contaminated soil (1,200 cy) would be removed from all areas within the northern parcel. Approximately 2,500 cy of material from the southern parcel will also be excavated and transported for off-site disposal, plus 42,000 cy of contaminated material from other adjacent properties.

Asbestos Excavation: Soils containing ACM from the adjacent Fimbel Door Landfill, the City-owned property, and the southern parcel of the Site, will be handled separately from other soil excavations. The material will be kept wet always to minimize the release of asbestos fibers to the ambient air during the soil excavation, transportation, and disposal off-site. Air samples will be collected and analyzed to monitor the levels of asbestos fibers in the work area and the worker's exposure.

Dust and Odor Suppression: Routine water-bar spraying of access and haul roads. Foam odor/dust suppression of work areas plus agricultural lime additive mixing to stockpiles at 10% by weight. Excavation perimeter surrounded by misting nozzles spraying odor reduction solutions. Solution mixed on-site in storage tank and delivered via diesel pumps.

Air Monitoring: Perimeter air monitoring would be required daily at two locations (up and downwind) for the duration of the excavation. Air samples analyzed for the presence of sulfide and dioxin.

Excavation confirmatory samples: Confirmation soil samples collected at a rate of one per 500 square feet of exposed excavation for laboratory analysis of dioxin, semi-volatile organic compounds (SVOCs), and metals. Waste characterization samples collected at a rate of one per 500 tons of sludge/waste for disposal. Sample analyses for volatile organic compounds (VOCs), SVOCs, and metals via the Toxicity Characteristic Leaching Procedure (TCLP), flashpoint, corrosivity, reactivity, and free-liquids.

Transportation and Disposal: Assumed 20 trucks loaded per day. The 2002 EE/CA stated that a RCRA Subtitle D landfill facility located in New Hampshire would accept non-hazardous wastes. The 2002 EE/CA assumed that a RCRA Subtitle C landfill located in upstate New York would accept the hazardous waste stream. However, as of September 2017, this landfill is no longer accepting wastes for land disposal. Therefore, trucking to a facility in the upper Midwest is assumed. If it is necessary to dispose of hazardous waste stream at a RCRA Subtitle C landfill, costs are expected to increase by approximately 40%.

Site Restoration: Excavations will be backfilled with the overlying soil previously excavated and staged, supplemented with off-site borrow material. Backfill will be placed in 6-inch lifts and compacted to original Site grades. A 4-inch layer of topsoil will be placed on impacted areas, and will be hydro-seeded and mulched. No excavation is expected at the wetlands within the southern parcel of the Site. However, some restoration of wetland and floodplain habitats with native vegetation may be required if disturbance or excavation of wetlands are necessary due to adjacent soil excavations.

Monitoring wells will be abandoned following ARAR standards for well abandonment

Site Staffing/Labor: Site management staff will require travel expenses; however, site labor and operators will be local.

Post-Removal Site Control (PRSC): These controls would include quarterly inspection and maintenance of the new vegetation, and erosion/sedimentation control features (as needed). They would be required for two years.

Figure 4 (Figure 4-1 from TtNUS) provides a conceptual layout of Alternative 1.

4.4.5 Alternative 4: On-Site Treatment (Solidification/Stabilization)

During the 2002 EE/CA, alternative 2 (Excavation and Consolidation into On-Site Landfill) and alternative 3 (Excavation, Off-Site Treatment and Disposal) were screened out. To be consistent with that document, this EE/CA amendment is keeping the sequence of the alternatives numbering, thus this documents only looks at the No Action Alternative, Alternative 1(Excavation with Off-Site Disposal), Alternative 4 (On-Site Treatment (Solidification/Stabilization)), and Alternative 5(Waste Encapsulation and Impermeable Capping).

The solidification/stabilization alternative is similar in scope and magnitude to the approach identified in the GeoInsight RAP. Although the solidification/stabilization alternative was not selected in the 2002 Action Memo, stabilization bench testing performed in 2009 and 2016 identified that PC and binders coupled with powdered activated carbon provided a suitably strong, minimally transmissive, stabilized material that did not present a leaching concern for organic constituents in the sludge. Therefore, this alternative is undergoing additional evaluation.

DFOWs & Costing Assumptions:

Building/Foundation Demolition: The structures formerly present on the Mohawk Tannery site have been razed and removed. The sole remaining remnants of these buildings are the concrete floor slabs and foundations. The concrete slabs around Area 6 will require removal and disposal. The remaining slabs will require management in accordance with redevelopment needs.

Pre-Construction Activities: Pre-construction activities would include a pre-design investigation, engineering and removal designs and specifications, establishment of the contractor's performance and payment bonds, and preparation of project-specific plans.

- *Pre-design Investigation*: The investigation would obtain alternative-specific design data including verification of moisture and odor control technology effectiveness, verification that overlying soil is suitable for reuse, and verification through additional bench testing that the selected solidification/stabilization technology remains effective below the groundwater level.

- *Engineering and Removal Designs and Specifications*: The required engineering, designs, and specifications would be completed and approved prior to initiating construction work. At a minimum, this design will establish materials specifications, identify the limits of work, identify project controls locations, identify anticipated application rates, estimate excavation and swell volumes, establish quality assurance/quality control and materials testing requirements, and establish end-goals.

- *Project Bonding*: Due to the estimated size of this project, it is assumed that the Government would require performance and payment bonds (at 1% of construction costs).

- *Project-Specific Planning*: Plans including a Construction Implementation Plan, a Health and Safety Plan, an Erosion and Sedimentation Control Plan, a Storm Water and Water Pollution Prevention Plan, a Construction Quality Assurance Project Plan, and an Analytical Quality Assurance Project Plan would be prepared and approve prior to mobilization.

Project Management and Staffing: A site-superintendent, a health and safety officer, a quality control officer, and an office administrator/cost reporter would be on-site for the duration of the construction (estimated at 12 months).

Mobilization, Site Preparation, and Temporary Facilities:

Mobilization: Heavy equipment including tracked-excavators, wheeled-loader, low ground-pressure bulldozer, off-road dump trucks, mixing equipment, power mixers, tracked pressure feeders, and associated equipment would be mobilized to the Site as needed. Equipment resources will be scheduled and staged to minimize equipment down time.

- *Site Preparation*: Site preparation would include establishment of erosion and sedimentation controls, clearing/grubbing of designated work areas, chipping of above-grade vegetation, disposal of below-grade vegetation, establishment of equipment and personnel decontamination facilities, establishment of construction-access roads (from Broad St. Parkway), improvement of on-site haul roads, establishment of a stable staging and stockpile management area, and relocation/management of the sewer utility located at the southwest corner of Area 2. Monitoring wells located within the treatment zone (Supply Well, GZ-09, GZ-10, SH-16S/D) would be abandoned consistent with state and local requirements. Other monitoring wells in the work area will be preserved to the extent practicable.

The structures formerly present on the Site have been razed and removed. The sole remaining remnants of these buildings are the concrete floor slabs and foundations. The concrete slabs around Area 6 will require removal and disposal. Based on available data, it does not appear that Area 6 sub-slab sample collection or concrete sample collection has been conducted to determine whether the concrete has been impacted by contamination. Testing may be required to determine this. Samples of residue within portions of the main building and associated out-building slabs have identified the presence of contaminants which exceed PRGs. Sub-slab soil samples collected from this area have also identified similar contaminants. However, no concrete samples have been collected to determine if the contaminants detected in the residue and/or sub-slab soil are present in the concrete slabs as well, which may require waste management.

- *Temporary Facilities*: Temporary facilities would include an office trailer (for contractor and government use); water (200 gallons per minute) service from Warsaw Ave, electricity (600 amp. service) from adjacent utility pole, phone and internet from adjacent utility pole, steel storage containers; non-hazardous waste disposal, temporary security/dust control fencing, and temporary water management facilities (dewatering pumps, fractionation tanks for water settlement, a potential water treatment system, water quality verification laboratory analyses, and discharge connection to the publicly-owned treatment works via [on-site or off-site] sewer main).

<u>Project Controls:</u> This DFOW would include purchase and use of health and safety equipment, personal protection equipment, dust control equipment and materials, odor control equipment and materials, perimeter odor controls, establishment of survey controls, and materials/quality assurance/quality control testing.

<u>Excavation and Removal of Overlying Soil</u>: Excavation activities would initiate with the removal of the soil berms surrounding Area 1. This soil would be transported to the stockpile area for later reuse. Excavation activities would progress to the excavation of a 6- to 12-foot-deep/16,000 CY expansion cell located adjacent to the Area 1 sludge lagoon. Excavation spoils would be transported to the stockpile area for stockpile and later reuse. This cell would accommodate sludge/soil swell volume due to the application of solidification/stabilization reagents. From this point, excavation activities would alternate between sludge excavation and consolidation, and overlying soil/PRG-exceeding soil excavation and transfer. In general, the overlying soil from Areas 3, 6, and 7 would be excavated and transported to the stockpile area for later reuse. The Area 2 cap/overlying soil would also be stripped and stockpiled for later reuse. Overlying soil data from Area 4 shows exceedances to the PRGs for Antimony and Trivalent Chromium. Therefore, overlying soils at Area 4 are unsuitable for stockpiling and reuse and shall be excavated and disposed along with the sludge waste located underneath it.

The PRG-exceeding contaminated soil (1,200 CY) would be removed from each of the areas with contaminated soils within the Site. These soils would be transferred to Area 2 (after the overlying cap soil has been removed) for subsequent stabilization/solidification (described below). Approximately 2,500 CY of soil contaminated with asbestos and other substances, would be excavated from the southern parcel and relocated to the Area 2 waste sludge area.

Sludge Consolidation: With the expansion cell excavated, sludge from Areas 3, 4, 6 and 7 as well as PRG-exceeding contaminated soil, and ACM contaminated soils would be placed into the expansion cell along with the anticipated swell volume resulting from the application of stabilization/solidification reagents. Excavations in Areas 3, 6, 7, and the areas from which PRG-exceeding contaminated soil was removed would be backfilled using previously excavated uncontaminated soil material staged in the stockpile area. As noted above, the PRG-exceeding contaminated soil would be consolidated into the Area 2 sludge volume for solidification/stabilization treatment.

Solidification/Stabilization of Soil/Sludge: Two solidification/stabilization technologies would be employed to achieve design criteria: hollow-stem auger/mechanical mixing (for Area 1 and the Expansion Cell); and power-auger/blender with a hood (for Area 2). The rationale for the two techniques is due to the waste thicknesses. Area 1 thicknesses approach 20 feet, and Area 2 approaches 10 feet. The hollow-stem auger method is not depth-limited, while the power-auger method is limited by the reach of conventionally-available heavy equipment. Ten feet is well within the reach of conventional equipment.

To maximize optimal mixing weather, both solidification/stabilization methods would progress concurrently. Each solidification/stabilization method would be demonstrated to be effective at mixing the materials *in-situ* prior to initiating full-scale operation.

Area 1: The Area 1 sludge lagoon would be surveyed and the approximate center of each treatment “cylinder” would be identified and staked. A track-mounted multi-purpose drill would advance between 5- and 10-foot-diameter hollow-stem auger boreholes to the targeted depths at each cell. The solidification mixture will consist of the following materials: 25% by volume sand (from stockpiled reuse), 25% by weight Portland cement and binder material, and 3% by weight powdered activated carbon in perimeter regions. Due to the general lack of stability associated with the *in-situ* materials, weight dispersion equipment will likely be required to access more central portions of the lagoon. Additionally, an odor-controlling shroud would be placed over the borehole during and after mixing.

The solidification media is blended in a grout plant located near the drilling machine to the required slurry density/makeup. While the auger is turning, the slurry is pumped into the hollow-stem auger at sufficient pressure to effectively interact with the subsurface soil. Each treated soil mass “cell” would be overlapped slightly by adjacent treatment “cylinders” to promote effective reagent-soil contact, and minimize untreated areas. This process is repeated until the entirety of the sludge volume has received solidification/stabilization treatment. The surface area of Area 1 is estimated to be 40,000 square feet. Each treatment “cell” would be 10 feet in diameter with an assumed 20% perimeter overlap, which would increase the effective treatment area to 48,000 square feet. Based on this estimate, approximately 600 treatment “cells” would be required to account for the entire Area 1 sludge volume. Stabilization/solidification progression would be tailored to maximize the cement curing time to generate sufficient material strength (10 pounds per square inch) to support the stabilization equipment within three days (with additional matting as needed). Excess swell volume above grade in Area 1 would be removed and placed into the expansion cell. Excess swell volume above grade is not anticipated in the expansion cell.

Area 2 & Expansion Cell: The Area 2 sludge lagoon would be surveyed and the approximate center of each treatment "cell" will be identified and staked. A tracked-excavator-mounted power auger and a 20-foot by 20-foot application hood would be used to provide Area 2 sludge treatment. This method applies dry-mixed cement/binders/powdered carbon (delivered/stored in a bulk tanker) to the application hood via compressed air. The air leaves the hood via ports fitted with particulate filters and odor suppressants, as needed, and deposits a targeted quantity of reagents to the 400-square foot treatment area. The hood is then removed, and initial rough mixing is performed using a standard tracked excavator and bucket. Finer mixing/blending is performed using the excavator-mounted power auger. Water is added to the mixture as needed to assist with *in-situ* material blending. The process is repeated until each 400-square foot cell has been mixed/blended. The surface area of the Expansion Cell is approximately 40,000 square feet. Therefore, approximately 100 treatment cells would be required.

<u>Asbestos Excavation and Disposal</u>: Soils containing ACM from the adjacent Fimbel Door Landfill, the City-owned property, and the southern parcel of the Site, will be handled separately from other soil excavations. The material will be kept wet always to minimize the release of asbestos fibers to the ambient air during the soil excavation, transportation, and disposal on-site. Air samples will be collected and analyzed to monitor the levels of asbestos fibers in the work area and the worker's exposure. The ACM from all these areas will be deposited at a cell adjacent and outside the eastern wall of the containment structure to be built. This cell will be capped with clean soil.

<u>Cap and Vent Construction</u>: The cap will be designed and constructed to prevent any release of contaminants in up to a 500-year storm event. The solidified sludge areas would be covered with 16 inches of compacted well-draining common borrow (re-use material from overlying soil excavations/expansion cell construction) bisected by a 15-mil vapor barrier. The common borrow will be overlain by a 4-inch layer of topsoil and hydro-seeded. The vapor barrier would serve two purposes, to direct precipitation away from the solidified sludge and to promote capture of generated gases by a gas vent system. The system would consist of a series of lateral vent fingers converging on a central vent stack. The vent fingers would be installed in a 12-inch thick layer of 0.75-inch gravel. The stack would be capped by a wind-driven turbine to promote negative pressure within the system. This vent system would be located above the 500-year flood elevation or would be flood-proofed[7]. Additional material (*e.g.* rip-rap) may be required along the edges of the capped area for additional flood protection.

<u>Backfill and Site Restoration</u>: Excavations in Areas 3, 4, 6, 7, and the PRG-exceeding soil areas would be backfilled using re-use materials from previous removal action construction. This

[7] "Flood-proofing" is a defined term in the federal floodplain regulations at 44 CFR Part 9: "*Flood-proofing* means the modification of individual <u>structures</u> and facilities, their sites, and their contents to protect against structural failure, to keep water out, or to reduce effects of water entry."

material would be transported to the fill areas, and dumped in-place. The material would be graded and compacted. The re-use soil would be overlain by approximately four inches of topsoil, which would not be compacted. The entire area, including the excavation and solidification/stabilization areas would be seeded at the same time. Monitoring wells GZ-09, GZ-10, and SH-16S/D would be replaced in kind.

Any lost flood storage volume filled by the remedy below the 100-year flood elevation will be replaced on-site or in the immediate vicinity. Lost flood storage volume between the 100- and 500-year flood elevation is expected to have *de minimus* impact on downstream floodplain resources and will not require replacement.

No excavation is expected at the wetlands within the southern parcel of the Site. However, some restoration of wetland and floodplain habitats with native vegetation may be required if disturbance or excavation of wetlands are necessary due to adjacent soil excavations.

<u>Decontamination, Temp Facility Removal, De-Mobilization</u>: As equipment is demobilized from the Site, it would be thoroughly decontaminated and cleaned. Decontamination (predominantly water) fluids would be captured and transferred to the on-site fractionation tanks for settlement, possible treatment, and disposal via the POTW.

Monitoring wells, not required for the long-term monitoring of the capped waste, will be abandoned following ARAR standards for well abandonment.

After the construction is accepted as complete, the temporary facilities including utilities, trailers, storage containers, erosion controls (if the vegetation has sufficiently taken) would be removed disconnected/removed from the Site. The Site would be left in a clean and tidy state.

<u>PRSC Monitoring</u>: Initial PRSC activities would include quarterly inspection and maintenance of the new vegetation and erosion/sedimentation control features (as needed). These controls would be required for a period of two years.

Groundwater monitoring is expected to be required for as long as the consolidated waste is capped on-site, based on ARAR requirements (for costing purposed the estimated time used is 30 years). It is assumed that a deed notice, AUR, City ordinance or other form of institutional control will be established to maintain the long-term protectiveness of the remedy. For the purpose of this evaluation, the monitoring program outlined in the GeoInsight's 2016 RAP proposes bi-annual groundwater monitoring of up to eight monitoring wells. Sample analyses would include SVOCs and total/dissolved metals.

Annual cap/vent system inspections will be required during the PRSC period (assumed for costing purposes at 30 years). The inspections would focus on the ability of the cap/vent to meet its design goals. Damage, erosion, settlement, or other evidence of cap/vent system failure would be investigated and remediated as-needed. Each inspection would be documented by an inspection report to be submitted to the regulatory agencies.

A conceptual layout of Alternative 4 is included in Figure 5 (Figure 2 of KGSNE).

4.4.6 Alternative 5: Waste Encapsulation and Impermeable Capping

Table 4-2 of the 2002 EE/CA eliminated both vertical and horizontal barriers because they were not considered to be effective technology process options. The vertical barrier was eliminated because it was not considered to be effective at preventing the release of contaminants from unsaturated soil to the environment and because it would have limited effectiveness within a floodplain. The horizontal barrier was eliminated because it was considered to be ineffective at preventing the release of contaminants to the environment due to the presence of contaminants below groundwater, and because the barrier would potentially alter the floodplain.

Considered separately, these process options would not likely be effective for the reasons stated above. However, considered jointly it presents itself as a viable alternative to be considered. The encapsulation alternative involves: consolidating contaminated soil that exceeds PRGS and sludge waste from all areas into Areas 1 and 2; enclosing the waste using vertical barriers; and capping the waste using an impermeable surface. The purpose of this alternative is to prevent direct contact with the waste and to minimize potential groundwater and surface water impacts.

The vertical barriers and capping would be adequately designed with long-term integrity for seasonal conditions, severe storms (up to a 500-year storm event), and freeze/thaw conditions; to satisfy ARAR requirements (*e.g.*, RCRA); and minimize contaminant leaching to groundwater (*i.e.* meet impermeability requirements). Any lost flood storage volume filled by the remedy below the 100-year flood elevation will be replaced on-site or in the immediate vicinity. Lost flood storage volume between the 100- and 500-year flood elevation is expected to have *de minimus* impact on downstream floodplain resources and will not require replacement. See EPA's floodplain assessment in Section 6.1.3.

This alternative also includes long-term monitoring and maintenance of the encapsulated area, as well as Institutional Controls to insure the encapsulated area is maintained; prohibit construction on top or adjacent to it and guard against any tampering with its components.

Impermeable capping will include a synthetic geomembrane installed with bedding and protection layers, and covered with vegetation. Several design options to accomplish vertical encapsulation of the waste are available; this EE/CA Amendment will briefly discuss the three most popular/viable options: steel sheet-pile walls, slurry walls, and secant-pile walls.

DFOWs & Costing Assumptions:

Aside from the noted examples below, the pre-construction activities, project management and staffing, excavation and removal of overlying soil, sludge consolidation, backfill & site restoration, and decontamination/temporary facilities removal/de-mobilization tasks are essentially the same as Alternative 4, with differences due to scale and duration. The vertical encapsulation and impermeable cap construction tasks are unique to this alternative and are described further below.

<u>Excavation and Removal of Overlying Soil</u>: The soil excavation volumes identified in Alternative 4 remain for Alternative 5, except for the expansion cell. Under Alternative 5, no expansion cell would be necessary as no swelling is anticipated. However, it is expected that a small cell adjacent to the containment structure would be necessary to accommodate the ACM from the City-owned

property, the Fimbel Door property, and the Site's southern parcel to minimize the dimensions of the containment structure and the possible impacts to flood-storage capacity. Additionally, spoils from the vertical containment structure construction (due to the construction of structural piles/piers) may either be placed in the ACM cell or the containment structure, depending on its composition.

Sludge Consolidation: The sludge volumes and deposition locations for Areas 3, 4, 6, 7, and the PRG-exceeding soil remain the same as described in Alternative 4.

Below-Ground Vertical Encapsulation Options:

Sheet-Piling
Under this option, the *in-situ* and consolidated waste would be encapsulated within a perimeter of steel sheet-piles to contain the sludge and prevent groundwater contamination from moving laterally to the adjacent Nashua River or other areas. To accomplish this, a track-mounted excavator equipped with a sheet-pile hammer and hydraulic power pack would advance up to 22-foot long steel sheet-piles along the perimeter of Areas 1, 2, and an expansion area (to manage soil/sludge volumes needed to comply with floodplain criteria, and resulting from estimated cap installation-related excavation spoils). The sheeting will be securely installed into dense till material located above the bedrock surface. This sheet-pile length was assumed for cost estimating purposes. The knuckle joints of each sheet-pile would be flushed clean of debris and pressure-sealed using a compatible sealant.

Slurry Wall
For this evaluation, a soldier-pile tremie concrete slurry wall is evaluated. Wall construction would begin with the installation of a guide-wall to approximately four feet below grade along the proposed wall alignment. Adjustments may be made at this time. Steel H-piles would be driven to the bedrock surface on 8-foot centers. Soil would be excavated along the wall alignment and placed within the expansion cell. Slurry would be placed into the excavation and allowed to cure. The slurry would be allowed to dewater into a temporary holding lagoon. The resulting sludge would be excavated and transported to the expansion cell to be incorporated into the sludge materials.

Secant Wall
Secant wall construction would begin with the establishment of the wall's alignment. Adjustments may be made at that time. Several options for secant wall construction are available; however, final selection of the technical implementation methods and materials' details would be made after the remedial design has been performed. However, for this evaluation, the following assumptions apply:

- A single secant-pile drilling rig would perform the work;
- Each 22-inch secant-pile will be installed by advancing a steel casing securely into till followed by auger excavation of the annulus;
- Assumed average soil thickness is 22 feet, and no bedrock embedment is needed;
- Excavation spoils will be placed beneath the cap and used to establish the subgrade;
- A low-strength cement-bentonite slurry (assumed to be 100 pounds-per square-inch strength) will be pumped into the annular space;

- Steel H-piles may be placed in the secant pile prior to curing approximately every eight feet, to accept a retaining wall system approximately six feet high along the western edge of Lagoons 1 &2 and approximately 11 feet high along the easterly edge of same; and
- Adjacent secant-piles will be advanced such that they intersect the prior pile by approximately 20% thus forming a continuous wall.

Significant design investigations including at a minimum floodway, scour, seepage, and stability analyses, would be required to design the slurry composition, admixtures, pile lengths, till embedment, H-pile installation frequency, and other similar components.

Each encapsulation method would be designed and constructed to withstand flood-related challenges such as scouring and erosion/wall exposure that are anticipated and outlined in the basis of design.

As a demonstration of the concept and quality analysis, a section of a slurry or secant wall may be constructed to allow for evaluation of quality-control conformance.

Impermeable Cap Construction: The impermeable cap would include a geo-synthetic cap and associated drainage, and protection layers. The cap may include features such as: a geogrid to stabilize the cap system over the in-situ waste; a textured high-density geomembrane; a bi-planar geo-composite material placed over the geomembrane to direct percolated precipitation from the geomembrane; a 12-inch layer of screened re-use soil over the geo-composite; and topsoil/hydro-seeding at the surface. However, alternate impermeable cap designs will be evaluated and determined during the design phase.

Depending on storm water modeling results, surface drainage swales and underdrains may be required to collect and direct storm water. These swales would discharge to a detention system to be constructed on the Site. Detained storm water would either be discharged to the Nashua River, or allowed to percolate into the groundwater.

The entire cap/cover system will be installed within the 500-year floodplain. Therefore, additional resilience features may be needed to the cover system within the floodplain. These features may include placement of large-diameter armoring stone placed on a cushion of more finely graded aggregate materials. Additionally, seaming and anchoring of the HDPE geomembrane may be implemented to take advantage of the natural features such as the likely flood-flow direction and scouring potential.

Removal Action Estimated Durations

The following conceptual construction sequence and durations are approximations. The estimates are to plan and design the removal action, perform the removal action work, perform quality control verifications, comply with federal acquisition regulations, and evaluate performance.

Table 6.0 Comparison of durations for vertical containment

Definable Feature	Duration – Sheet-Pile Wall (Weeks)	Duration – Slurry Wall (Weeks)	Duration – Secant Wall (Weeks)
Engineering & Removal Design	25	30	30
Subcontracting and Procurement	8	8	8
Mobilization	1	1	1
Site Preparation	3	3	3
Excavation and Consolidation	7	7	7
Wall Installation	11	33	50
Impermeable Cap & Vent Construction	6	6	6
Backfilling and Site Restoration	5	5	5
Demobilization	1	1	1
Total Pre-Construction Estimated Duration	33	38	38
Estimated Construction Duration	34	56	73

Figure 6 includes a conceptual layout of Alternative 5.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents an evaluation of the three removal action alternatives developed in Section 4.0 against three broad CERCLA criteria for removal actions: effectiveness, implementability and cost. These three criteria are first discussed below.

The effectiveness of the alternative is evaluated using the following criteria:

- Overall protection of public health and the environment;
- Compliance with ARARs and Other Criteria, Advisories, and Guidance;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment; and
- Short-term effectiveness.

The alternative's implementability of the alternative is evaluated using the following criteria:

- Technical feasibility;
- Administrative feasibility;

- Availability of Services and Materials;
- State Acceptance; and
- Community Acceptance.

The cost of each alternative is evaluated based on the present worth of the following cost elements:

- Direct capital costs;
- Indirect capital costs; and
- Annual PRSC costs.

The following sections provide an evaluation of each alternative using these criteria.

No Action Alternative

The No Action Alternative serves as a baseline by which all other alternatives are compared. This alternative consists of no remedial activities (including no monitoring), and it represents the minimum proposed removal action to address risk posed from exposure to contaminated sludge waste and soils at the Site. No action would not address or facilitate change to the Site's present situation, specifically with respect to possibility of re-use, and current risks to human health or the environment would continue to be present, and would likely increase.

Human health and ecological risks from exposure to sludge waste and soils would continue. In addition, dry summer seasons would continue to allow for exposure to contaminated soils with asbestos fibers among other contaminants through recreational use by trespassers. Contaminated sludge waste and soils within the Site would also act as a continuing source of contamination to the groundwater and eventually the Nashua River habitat. There would not be any monitoring or data collected to evaluate changes in groundwater quality or risks to human health and the environment.

Institutional controls, such as a GMP or a City Ordinance to prevent exposure to contaminated groundwater would not be implemented as part of this alternative.

The alternative will not meet the RAOs. A cost estimate was not prepared as there is no cost associated with the No Action Alternative.

<u>Alternative 1 – Excavation with Off-Site Disposal</u>

Effectiveness

The 2002 EE/CA concluded that this alternative met the removal action objectives by preventing direct contact with and ingestion of contaminated sludge/waste, preventing ecological exposure to contaminants, preventing the migration of contaminants to groundwater and surface water, and restoring the Site to a condition suitable for residential use. The following table summarizes the effectiveness evaluation for Alternative 1 based on the evaluation criteria.

Table 7.0 Effectiveness for Alternative 1

Effectiveness Criteria	Capability of Meeting the Criteria	Comments
Overall protection of human health and the environment	✓	Excavation and off-site disposal removes the contaminants from the Site.
Compliance with ARARs	✓	Alternative would be designed and implemented to comply with ARARs and other criteria. Since unavoidable impacts within the 500-year floodplain would occur, federal ARARs require soliciting public comment concerning the impacts through this EE/CA.
Long-term effectiveness and permanence	✓	Excavation and off-site disposal is a permanent solution.
Reduction of toxicity, mobility, or volume through treatment	•	The 2002 EE/CA assumed that the waste would be classified as non-hazardous, therefore no treatment would be required prior to land disposal. However, if this assumption proves incorrect, then some waste treatment may be required to meet land-disposal restriction treatment requirements, which may partially satisfy this criterion. Some treatment of water generated from dewatering activities may also partially satisfy the criterion.
Short-term effectiveness	✓	Short-term concerns such as air quality/dust/odors, and sedimentation/erosion would be mitigated through engineering controls. Once properly implemented, the removal action goals would be achieved immediately.

Notes:

✓ - Generally meets this criterion

• - Will not fully meet this criterion

• - Will not meet this criterion

Implementability

The 2002 EE/CA concluded that this alternative was implementable, but identified several implementation challenges. The following table summarizes the implementability evaluation for Alternative 1 based on the evaluation criteria.

Table 8.0 Implementability for Alternative 1

Implementability Criteria	Capability of Meeting the Criteria	Comments
Technical feasibility	✓	Excavation, materials management, and waste disposal are well-understood remedial construction techniques. Technical implementation could become more complicated (and costly) should assumptions made regarding the waste classification, hydrogeological conditions, waste locations, and engineering controls prove not to be correct. Excavation de-watering and discharging to a fractionation tanks and possible treatment, prior to discharge to the publicly-owned treatment works (POTW), would be required. Also, routine discharge samples would need to be collected during the dewatering effort.
Administrative feasibility	✓	An exception from the NTCRA statutory limit of $2 million would be required. Federal and Canadian approvals would be required to ship dioxin-contaminated waste to the only disposal facility that will accept it in Canada. Municipal approval would also be required to discharge to the POTW. Licensed personnel would be required to address the ACM.
Availability of Services and Materials	✓	Numerous remedial contractors are available locally to perform waste excavation, materials management, and waste transportation. Should the assumption that the waste is non-hazardous prove correct, several RCRA Subtitle D landfills are located relatively locally to the Site. Facilities are also available for the disposal of ACM. However, should the material be classified as a hazardous waste, then additional pre-land disposal treatment may be necessary (either on-site or at the TSDF) to meet land disposal restriction treatment criteria. Suitable facilities are not local to the Site, and would require many trucks (or a suitable off-site rail staging/loading area) or the

		availability of rail service to transport the waste within a reasonable timeframe. No facilities located within the United States can accept Dioxin-Containing Hazardous Wastes; therefore, export of such waste to Canada would be required. The EE/CA indicated that facilities in Canada are available to manage such wastes. Additionally, given the volume of wastes to be managed, individual facilities may be reluctant to accept 100% of the volume for fear of exceeding permitted capacities, therefore, more than one facility may be required to manage this waste volume.
State/Support Agency Acceptance	N/A	With this EE/CA Amendment EPA is performing a supplemental analysis for the NTCRA. EPA will be seeking feedback from the State during a public comment period.
Community Acceptance	N/A	With this EE/CA Amendment EPA is performing a supplemental analysis for the NTCRA. EPA will be seeking feedback from the public during a public comment period.

Notes:

✓ - Generally meets this criterion

• - May not fully meet this criterion

• - Will not meet this criterion

N/A – Not applicable

Cost

EPA updated the costs for Alternative 1 presented in the 2002 EE/CA using the Engineering News-Record (ENR) Construction Cost Index (CCI) for the Boston Area for August 2017 compared against the 2002 ENR CCI. The updated cost estimate is presented in Appendix D.

The cost update was calculated as follows:

$\% \text{ Change} = [(CCI_{2017} - CCI_{2002}) \div CCI_{2002}] \times 100\%$

Updated Cost = Unit Cost × % Change

where:

CCI_{2002} = Construction cost index for 2002 (7042.39)

CCI_{2017} = Construction cost index for 2017 (13797.06)

$[(13797.06 - 7042.39) \div 7042.39] \times 100\% = 95.91\%$

The total present worth costs Alternative 1 (assuming all waste is disposed of in a domestic RCRA Subtitle D landfill) is approximately $32,600,000. As detailed in Appendix E, at least half of the alternative's cost reside in the transportation and offsite disposal of the excavated sludge/wastes.[8]

Alternative 4 – On-Site Treatment (Solidification/Stabilization)

Effectiveness

The following table summarizes the effectiveness evaluation of Alternative 4 based on the evaluation criteria.

Table 9.0 Effectiveness for Alternative 4

Effectiveness Criteria	Capability of Meeting the Criteria	Comments
Overall protection of human health and the environment	✓	Solidification and stabilization coupled with a soil cover and venting system would mitigate the risk to public health and the environment by consolidating contaminated material and treating it to reduce the ability of receptors to contact the stabilized material. The technology also transforms contaminants into less toxic and/or a less mobile form and decreases the permeability of the treated media, reducing the potential for contaminant release. This approach was successfully applied at the Pownal Tannery Superfund site in Pownal, Vermont.
Compliance with ARARs	✓	The solidification/stabilization alternative would be constructed to comply with ARARs. Capping of the solidification/stabilized waste at the lagoons will meet relevant and appropriate performance standards for capping hazardous waste permanently within surface impoundments. This conservative approach will allow all site wastes to be consolidated and capped on site. The capping will also meet ARAR requirements relating to floodplain impact avoidance and replacement of lost flood storage

[8] At the time these estimates were prepared, ACM disposal was not contemplated. CM disposal would involve additional costs.

		capacity below the 100-year flood elevation. Since unavoidable impacts within the 500-year floodplain would occur, federal ARARs require soliciting public comment concerning the impacts through this EE/CA.
Long-term effectiveness and permanence	✓	Solidification/stabilization technologies are generally permanent, and with maintenance should be effective in the long-term. Previous bench testing using site-specific materials suggests that this alternative would effectively achieve the desired removal goals with some exceptions (leaching of some non-COC substances occurred). Additional pre-design investigations would be needed to assess other aspects of effectiveness such as odor/moisture control technologies and the extent of soil suitable for on-site reuse.
Reduction of toxicity, mobility, or volume through treatment	✓	Although the waste volume would increase by approximately 30%, the solidification and stabilization technology generally reduces the mobility of contaminants, and may also reduce the toxicity of the contaminants. There may also be some treatment of water generated from dewatering, if required prior to discharge to the POTW.
Short-term effectiveness	✓	Outside of risks typical of a construction project, the solidification/stabilization alternative has relatively few short-term risks to the public/site workers. Work would be performed by properly trained and competent personnel. Rigorous work area and perimeter air monitoring coupled with odor and dust suppression and other odor-controlling methods would support the short-term effectiveness of the alternative (particularly regarding ACM). A pre-design investigation would be performed to verify and potentially customize odor control technology effectiveness. Increased use of local roadways may be required to achieve the construction goals; however, the

		route would be carefully selected and traffic control planning would be coordinated with community officials. Erosion and sedimentation concerns would be mitigated by readily available control measures.

Notes:

✓ - Generally meets this criterion

• - May not fully meet this criterion

• - Will not meet this criterion

With careful design, evaluation, and execution, the solidification/stabilization alternative would meet each of the effectiveness criteria.

Implementability

The following table summarizes the implementability evaluation for Alternative 4 based on the evaluation criteria.

Table 10.0 Implementability for Alternative 4

Implementability Criteria	Capability of Meeting the Criteria	Comments
Technical feasibility	✓	Numerous complexities exist for in-situ stabilization/solidification such as establishing and metering the reagent dosage rates; achieving sufficient mixing; demonstrating compliance with design criteria; and water management. These complexities can be overcome during the design or implementation stage. However, if the remedy fails to perform as expected, it would be difficult or impossible to modify remedy without substantial costs. Also, the capped area would need to be designed, constructed, and maintained to prevent any contaminant release in the event of up to a 500-year storm event and lost flood storage volume below the 100-year flood elevation will need to be replaced either on-site or in the vicinity.
Administrative feasibility	✓	An exception from the NTCRA statutory limit of $2

		million would be required. Access to the Broad Street Parkway (a limited access road) would be needed, thus coordination with the Federal Highway Administration (FHA) would likely be required. Municipal approval would also be required to discharge to the POTW. Licensed personnel would be required to address the ACM.
Availability of Services and Materials	✓	Stabilization and solidification equipment is readily available. Some customized media-application equipment fabrication may be required to control odors and solidification media delivery. A similar solidification/stabilization project was completed at the Pownal Tannery Superfund site in Pownal, Vermont.
State/Support Agency Acceptance	N/A	With this EE/CA Amendment EPA is performing a supplemental analysis for the NTCRA. EPA will be seeking feedback from the State during a public comment period
Community Acceptance	N/A	With this EE/CA Amendment EPA is performing a supplemental analysis for the NTCRA. EPA will be seeking feedback from the public during a public comment period.

Notes:

✓ - Generally meets this criterion

• - May not fully meet this criterion

• - Will not meet this criterion

N/A – Capability of this alternative to meet the criteria cannot be determined or is not applicable.

Implementing the solidification/stabilization alternative is technically feasible, and capable contractors and proper equipment are available to complete the work. However, design and execution challenges exist which could impact the duration of implementation, and increase the technical complexity of the removal action. Replacement flood storage of flood volume lost below the 100-foot flood elevation will need to be created on site or in the vicinity. Minimizing community concerns, particularly with construction traffic, would be paramount during design and implementation. One alternative to potentially mitigate this would be accessing the work area from a limited-access road (Broad Street Parkway), where impacts to residential neighborhoods would be minimized. Granting of such access would require coordination with the FHA, and state and local officials.

State and community acceptance has not yet been determined, and cannot be assessed now.

Cost
Based on the previously stated assumptions along with those included in Appendix D, the present worth costs for Alternative 4 are estimated to be approximately $18,700,000. The construction would require approximately one year to execute (at a capital cost of approximately $18,400,000), therefore no present worth adjustment is necessary for the construction costs. Post-construction vegetation and erosion inspections and 30 years of groundwater monitoring and cap O&M (30 years used for cost estimation purposes only) result in a present-value of operations and maintenance (O&M) of approximately $300,000. Pursuant to the June 1993 EPA OSWER directive No. 9355.3-20, a 7% discount rate was used in calculating the present worth of long-term O&M costs. However, with such comparably low PRSC costs, no notable difference in present value was encountered when using a lower discount rate.

<u>Alternative 5 – Waste Encapsulation and Impermeable Capping</u>

Effectiveness
The following table summarizes the effectiveness evaluation of Alternative 5 based on the evaluation criteria.

Table 11.0 Effectiveness for Alternative 5

-Effectiveness Criteria	Capability of Meeting the Criteria	Comments
Overall protection of human health and the environment	✓	Consolidation of all contaminated sludge waste and soil at the capped lagoons will physically isolate the waste from the surrounding environment. The alternative would be consistent with the removal objectives and be protective of human health and the environment. Encapsulation has been successfully implemented at numerous waste disposal sites.
Compliance with ARARs	✓	Capping of the lagoons will meet relevant and appropriate performance standards for capping hazardous waste permanently within surface impoundments. This conservative approach will allow all site wastes to be consolidated and capped on site. The capping will also meet ARAR requirements relating to floodplain impact avoidance and replacement of lost flood storage capacity below the 100-year flood elevation. Since unavoidable impacts within the 500-year floodplain and federal jurisdictional wetlands would occur, federal ARARs require soliciting public comment concerning the

		impacts through this EE/CA. EPA is also soliciting public comment on its determination that Alternative 5 is the "Least Environmentally Damaging Practicable Alternative" for protecting wetland resources as required under Section 404 of the federal Clean Water Act.
Long-term effectiveness and permanence	✓	A well-maintained encapsulation system should function effectively. The containment structure will be flood-proofed so to prevent, to the extent practicable, any release of contaminants in up to a 500-year storm event. See additional Long-Term Effectiveness discussions below.
Reduction of toxicity, mobility, or volume through treatment	•	No treatment of the waste will occur with this alternative. Some treatment of water generated from dewatering activities, if required, prior to discharge to the POTW may also partially satisfy the criterion.
Short-term effectiveness	✓	Outside of risks typical of a construction project, the waste encapsulation and capping alternative has relatively few short-term risks to the public/site workers. Work would be performed by properly trained and competent personnel. Depending on the method selected for vertical encapsulation wall installations, this could be a loud activity. Rigorous work area and perimeter air monitoring coupled with odor and dust suppression and other odor-controlling methods would support the short-term effectiveness of the alternative (particularly regarding handling of ACM). A pre-design investigation would be performed to verify and potentially customize odor control technology effectiveness. Increased use of local roadways may be required to achieve the construction goals; however, the route would be carefully selected and traffic control planning would be coordinated with community officials. Erosion and sedimentation concerns would be mitigated by readily available control measures.

Notes:

✓ - Generally meets this criterion

• - May not fully meet this criterion

• - Will not meet this criterion

The three vertical encapsulation methods evaluated in this memorandum: steel sheet-pile walls, soldier-pile cement tremie slurry walls, and secant walls are each effective at encapsulating wastes to minimize contaminant migration.

Properly installed steel sheet-piles in which the seams have been sealed to the extent practicable coupled with an impermeable horizontal barrier (cap) would serve to minimize groundwater discharge from the containment area. Vertical joints are located approximately every two feet; therefore, there is some potential for leakage. Additionally, the knuckle joints may not remain interlocked along the entirety of the sheet-pile. Un-coated sheets may also degrade under oxidative conditions. The groundwater in and around the waste sludge areas exhibits an acidic pH and relatively oxidative conditions. Although sheet-piles are expected to be effective in the long-term, without a chemically resistant coating, or the use of polyethylene sheets, degradation may be anticipated. Such degradation may result in leakage of groundwater through the barrier. Should this barrier option be selected, materials compatibility analyses should be completed as part of the design process, as well as a design-life determination.

Slurry walls are considered a standard vertical barrier technology. Wall types and installation methods are varied (e.g., single-pass construction, soldier-pile construction, bucket excavation/fill construction). These walls may be constructed using a variety of materials including cement, bentonite, soil, and/or polymers; and with or without steel reinforcement.

Each wall type and material type has disadvantages. For this evaluation, a soldier-pile tremie cement-bentonite slurry wall was evaluated due to its structural stability (when faced with a significant erosion of 10 feet of exposed wall). Faster and less-complicated/costly wall types/installation methods may be equally effective in managing groundwater transference when compared to the soldier-pile tremie wall; however, strength of structure may be lessened. Should this alternative be selected, such evaluations should be included in the design documents.

Soldier-pile tremie cement-bentonite slurry walls exhibit relatively high shear strength, low compressibility, and permeabilities in the 1E-06 centimeters per second range (assuming good bonding to the reinforcing steel). A slurry wall can be expected to effectively minimize transfer of groundwater. However, some limitations to the effectiveness of the method include: difficulty in verifying that the slurry wall is contiguous (panel-to-panel continuity, sluffing of debris/soil into the trench); more permeability through the barrier than anticipated; degradation due to the presence of highly-ionic substances, sulfates, and/or acids/bases, and scaling/cracking of the wall itself. Admixtures can be added to the slurry to improve barrier performance. If this barrier option is selected, the design should evaluate material compatibilities, as well as the potential admixtures which may be beneficial to the barrier.

Like slurry walls, secant-pile walls are also constructed of a slurry with a similar composition to the slurry wall. The primary difference between slurry walls and secant-pile walls is the means of construction. Secant-pile walls have been used as cut-off barriers for dams, deep excavation support/walls, and for the prevention of water intrusion/flow. Soldier-pile tremie slurry walls have fewer seams between panels/joints compared to a secant-pile wall, but must bind/adhere to the steel soldier-piles to minimize groundwater flow. Therefore, the potential for groundwater transfer through the seams is present. However, the controls on construction for each pile is greater than that of the slurry wall because each pile is cased to the target depth. Limitations to the effectiveness of the secant-pile barrier option are like those of the slurry wall option. Additionally, admixtures or amendments may also be added to the slurry to enhance performance. Steel reinforcement may be required to add additional strength to the piles. Such an addition would be based on the potential exposed height of the piles above grade. These considerations should be evaluated as part of the design.

Table 12.0 Implementability for Alternative 5

Implementability Criteria	Capability of Meeting the Criteria	Comments
Technical feasibility	✓	Numerous complexities exist for encapsulation and capping alternative. However, with sufficient data collected during a pre-design investigation and/or pilot/demonstration testing, these complexities can be overcome during the design and/or implementation stage. Also, the capped area would need to be designed, constructed, and maintained to prevent any contaminant release in the event of up to a 500-year storm event and lost flood storage volume below the 100-year flood elevation will need to be replaced either on-site or in the vicinity.
Administrative feasibility	✓	An exception from the NTCRA statutory limit of $2 million will be required. Additionally, this alternative would require the construction/ improvement of a temporary access road through the adjacent Fimbel Door Company property. Access to the Broad Street Parkway (a limited access road) is needed, thus coordination with the FHA would likely be required. Municipal approval will also be required to discharge to the POTW. Licensed personnel would be required to address the ACM.
Availability of Services and Materials	✓	Numerous specialty contractors can install the encapsulation walls and cap

		system. The materials required for this alternative are readily available.
State/Support Agency Acceptance	N/A	With this EE/CA Amendment EPA is performing a supplemental analysis for the NTCRA. EPA will be seeking feedback from the State during a public comment period.
Community Acceptance	N/A	With this EE/CA Amendment EPA is performing a supplemental analysis for the NTCRA. EPA will be seeking feedback from the State during a public comment period.

Notes:

✓ - Generally meets this criterion

• - May not fully meet this criterion

• - Will not meet this criterion

N/A – Capability of this alternative to meet the criteria cannot be determined or is not applicable.

Implementing each of the vertical encapsulation options coupled with an impermeable barrier are technically feasible, and capable contractors and proper equipment are available to complete the work. However, design and execution challenges exist which could impact the duration of implementation and the technical complexity of the removal action. Replacement flood storage of flood volume lost below the 100-foot flood elevation will need to be created on site or in the vicinity. Minimizing community concerns, particularly with construction traffic, would be paramount during design and implementation. One alternative to potentially mitigate this concern would be accessing the work area from a limited-access road (Broad Street Parkway) to minimize impacts to residential neighborhoods near the site. Granting of such access would require coordination with the FHA, and state and local officials.

State and community acceptance has not yet been determined, and cannot be assessed now.

Cost

The following table presents summarized costs for the encapsulation methods. Please refer to Appendix E for more detailed cost estimates.

Table 13.0 Cost comparison for vertical containment

Cost Element	Sheet-Pile Wall	Slurry Wall	Secant Wall
Approx. Estimated Capital Costs – Present Value	$7,600,000	$13,800,000	$13,800,000
Approx. Estimated PRSC Costs – Present Value	$400,000	$400,000	$400,000
Total Costs – Present Value	$8,000,000	$14,200,000	$14,200,000

Post-construction vegetation and erosion inspections and 30 years of groundwater monitoring and cap O&M (30 years used for cost estimation purposes only) result in a present value of O&M of approximately $270,000. Pursuant to the June 1993 EPA OSWER directive No. 9355.3-20, a 7% discount rate was used in calculating the present worth. However, no notable difference in present value was encountered when using a lower discount rate.

6.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This comparative analysis section evaluates the performance of the alternatives from Section 5.0 relative to the three criteria, effectiveness, implementability and cost. The Threshold criteria (*i.e*., overall protectiveness of human health and the environment and compliance with ARARs) serve as the basis for the assessment. The remaining evaluation criteria (long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost) are used to help identify the best alternative that meets the threshold criteria. The purpose of the comparative analysis is to identify the advantages and disadvantages of each of the alternatives relative to one another and to aid in the selection of the removal action alternative(s).

6.1 Effectiveness

6.1.1 Overall Protection of Human Health and the Environment

The No Action Alternative is the least protective alternative since no active remedial action, monitoring, or communication of risk to the public is proposed. Because readily accessible sludge waste and contaminated soils would remain in place, human health exposure through recreational activities would not be reduced. Contaminated media that pose a risk to ecological receptors would also remain in place. USEPA has determined that the No Action Alternative is not protective of human health and the environment.

Alternative 1 (Excavation and Off-Site Disposal) offers the most permanent protectiveness to human health and the environment, as no waste would be left in place and the waste will be disposed of off-site at a licensed disposal facility. However, it is extremely expensive as it will be discussed further below and it may require shipping the dioxin-contaminated waste to Canada.

Alternative 4 (*In situ* Solidification/Stabilization) would be protective since it includes treatment of the wastes to reduce/minimize their toxicity and mobility. However, it has the potential to facilitate the leaching of some contaminants, such as pentachlorophenol, into the groundwater and costly additives to the concrete mix would be necessary to prevent leaching. This alternative would require long-term groundwater monitoring and ICs) to ensure that the removal action remains protective.

Alternative 5 (Encapsulation with impermeable cap), with its different sub-options for the encapsulation methods, offers protection to the human health and the environment, as it creates a barrier between the waste, humans, and the rest of the environment. Thus, preventing human and ecological exposures. However, to ensure this protection remains effective, long-term ICs and maintenance activities, as well as groundwater monitoring, would be required.

Alternatives 1,4, and 5 would meet the RAOs immediately upon completion of the construction because all the contaminated media that exceeds the PRGs would be removed, contained, or treated. Under alternatives 4 and 5, the cap would have to be monitored and maintained indefinitely to ensure stability and continued protectiveness.

6.1.2 Compliance with ARARs

ARARs are discussed in Section 3.4 above and a table showing all of them and TBCs in included in Appendix C. Section 5.0 showed each individual alternative's ability to attain ARARs.

The ARARs at the Site pertain only to on-site activities. There is one chemical-specific ARAR and several TBCs used to develop risk-based PRGs; several location-specific federal and state ARARs that regulate activities that may be conducted in wetlands and floodplains; and several action-specific federal and state regulations pertaining to components of the removal alternatives, including waste characterization, discharge standards, waste handling/management (including for asbestos), and waste capping requirements.

Both excavation and capping of the lagoons will meet relevant and appropriate performance standards for closure of hazardous waste surface impoundments. This will either remove all wastes exceeding PRGs or consolidate and cap contaminated media on-site under a protective cap which will meet all regulatory performance standards. The capping will also meet ARAR requirements relating to floodplain impact avoidance and replacement of lost flood storage capacity below the 100-year flood elevation. Flood storage loss between the 100- and 500-year flood elevation has been determined to be *de minimus* within the downstream watershed, so flood storage volume replacement will not be required. Any waste capped within the 500-year floodplain will need to be able to withstand a 500-year flood event with no release of contamination

Since unavoidable impacts within the 500-year floodplain and federal jurisdictional wetlands would occur, federal ARARs require soliciting public comment concerning the impacts through this EE/CA.

The No Action Alternative would not prevent exposure to site contaminants that exceed chemical-specific ARARs or human health and ecological risk-based standards derived from chemical-specific TBCs. Alternative 1 (Excavation and Off-Site Disposal) would prevent all exposures to soil/waste contaminants. Alternatives 4 and 5 would address human health (contact) and ecological ARARs and risk exceedances derived from chemical-specific TBCs, as they would consolidate all site wastes at the lagoons and establish a barrier between the contaminated wastes/soils and the potential receptors by either treatment or encapsulation; additional long-term compliance would be addressed with ICs and monitoring.

Under federal and State wetland protection standards the capping and excavation work cannot impair wetland and aquatic habitats without mitigation.

Both the No Action Alternatives 0 and Alternative 1 are expected to have the least impacts to floodplains and wetlands because there would be no alteration to the current topography. Under

Alternative 1 (Excavation and Off-Site Disposal) contaminated waste sludge and soils l would be permanently removed and clean native substrate would replace the voids. Native vegetation would be used to restore area of altered floodplain and wetlands, if such alteration cannot be avoided.

Alternative 4 would have some floodplain impacts because it includes the formation of a solid monolith which will involve some volume expansion plus the installation of an impermeable cap on top. Alternative 5 would also have some impact to the floodplains because it would involve the construction of a vertical containment structure which will result in some impact to flood storage capacity. Any lost flood storage from Alternatives 4 and 5 between the 100- and 500-year flood elevations will only have *de minimus* impact on downstream floodplain receptors, however, loss in flood storage capacity below the 100-foot flood elevation will need to be mitigated by excavations in the Southern parcel.

The action-specific ARARs address components of the removal alternatives, including waste characterization, discharge standards, waste handling/management (including for asbestos), and waste capping requirements. Both excavation and capping of the lagoons will meet relevant and appropriate performance standards for closure of hazardous waste surface impoundments. This will either remove all wastes exceeding PRGs or consolidated and cap contaminated media on-site under a protective cap which will meet all regulatory performance standards.

The No Action Alternative would fail to comply with ARARs as waste and contaminated soils would remain readily accessible and uncontrolled. Alternative 1 (Excavation and Off-Site Disposal) would meet all ARARs that pertain to the excavation and off-site disposal of site contaminants. Alternatives 4 and 5 would meet all ARAR requirements pertaining to the consolidation, treatment or encapsulation, and capping of site wastes. Compliance with ARARs would be relatively more complicated for Alternatives 4 and 5, due to the proposed construction of a cap or cover system within a delineated floodplain. Additional engineering and flood storage mitigation may be required for these alternatives, whereas such requirement would not apply to Alternative 1.

6.1.3 Wetlands and Floodplain Analysis per the requirements of Federal Wetland Protection and Floodplain Management regulations and Section 404 of the Federal Clean Water Act

This analysis focuses on adverse impacts to wetlands and floodplains by alternatives evaluated in the EE/CA Amendment for the Mohawk Tannery Site. This analysis includes an evaluation of how well each alternative addresses federal wetlands/floodplain requirements.

A. Federal Wetland Protection and Floodplain Management Requirements

Federal Emergency Management Agency (FEMA) regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands). These executive orders prohibit activities that adversely affect a federally regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use. They require the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain and to avoid development within floodplain wherever there is a practicable alternative. An assessment of impacts to 500-

year floodplain is required for critical actions – which includes siting waste facilities in a floodplain. A public notice is also required when proposing any action in or affecting floodplain or wetlands. The proposed alternative in this EE/CA Amendment constitutes a critical action, thus EPA is performing an assessment of the impacts to the 500-year floodplain with this Wetland and Floodplain Analysis. EPA has made this EE/CA available to the public and has specifically requested comments concerning proposed work within wetlands and floodplain on-site. The comments received will be considered and responded to in a Responsive Summary prior to the finalization of the Amended EE/CA and the Action Memo. The Action Memo, with the attached Responsiveness Summary, will officially authorize and initiate the selected alternative for the NTCRA.

For the purpose of this floodplain assessment, floodplain areas are defined as the area of water and land inundated during the highest point of the base, or 100-year flood and the extent of the 500-year flood, using maps prepared by the Federal Insurance Administration of FEMA (Flood Insurance Rate Maps or Flood Hazard Boundary Maps). See a copy of the Flood Hazard Boundary Map in Appendix E. As part of implementation of the NTCRA the removal action will need to minimize impacts to the floodplain including addressing flood storage impacts consistent with floodplain requirements. At the Site whichever alternative is chosen will not cause a loss of flood storage volume below the 100-year flood elevation. For Alternative 1 this will be accomplished by restoring all excavated areas within the floodplain to grade. For Alternatives 4 and 5 this will be accomplished by creating replacement flood storage to replace lost storage resulting from the consolidation and disposal of site wastes in the lagoon area. After assessing floodplain characteristics in the downstream watershed, EPA has determined that any lost flood storage from Alternatives 4 and 5 between the 100- and 500-year flood elevations will only have *de minimus* impact on downstream floodplain receptors. Therefore, replacement of lost flood storage capacity above the 100-year flood elevation will not be required. However, the lagoon disposal units located within the 500-year floodplain for Alternatives 4 and 5 must be constructed to prevent any release of contamination in up to a 500-year flood event. Floodplain habitat will be restored, to the extent practicable.

Regarding wetland protection requirements under 44 C.F.R. Part 9, if there is no practicable alternative method to work in federal jurisdictional wetlands, then all practicable measures will be taken to minimize and mitigate any adverse impacts. If necessary due to adjacent excavations, sediments within wetlands will be excavated and either disposed of off-site (Alternative 1) or on-site at the solidified and capped sludge waste or the containment structure (Alternatives 4 and 5). The excavation voids within wetlands, if any, will be restored using native plant material, to the extent practicable.

Also, erosion and sedimentation control measures will be adopted during excavation, soil management, and capping activities, to protect federal jurisdictional wetlands

B. <u>Section 404/Wetlands of the Federal Clean Water Act Requirements</u>

Under Section 404 of the federal Clean Water Act, adverse impacts to wetlands must be avoided wherever there is a practicable alternative to address contamination at a site. Wetlands requirements focus on avoiding to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

For purposes of the Site, where contamination is found above PRGs in the floodplain or in wetland areas, EPA has determined that there is no practical alternative to doing work in these areas because contamination is present in these areas and it poses a risk to human health and the environment. In this case, given the possible location of part of the waste being adjacent to the wetlands, there may be no practical alternatives to the alteration of wetland areas. As a result, EPA must evaluate alternatives to select the "Least Environmentally Damaging Practicable Alternative" (LEDPA) consistent with Clean Water Act requirements. At this Site EPA has determined that Alternative 5 is the "LEDPA", because it provides the best balance for protecting and restoring wetlands that could be impaired. Under Alternatives 1, 4, and 5 all contaminated soils (including those that may be adjacent to wetland sediments) exceeding PRGs will be removed, but Alternative 5 presents the most practicable and protective alternative for the permanent disposal of these soils within the containment structure, where any risk of the contaminants migrating back to wetland areas is controlled to the greatest extent practicable.

6.1.4 Long-Term Effectiveness

The No Action Alternative would not be effective in the long term because no contaminated media would be removed and all risks associated with the waste material and contaminated soils would remain. Conversely, alternative 1 would be effective in the long term and would be permanent because all contaminated media exceeding the PRGs would be removed from the Site. No residual risks would remain associated with this waste material.

Alternative 4 would consolidate contaminated material from throughout the Site at the lagoons and convert the sludge and soil wastes into a solidified/stabilized mass that is covered by clean backfill and cover material to prevent flood damage. A combination of the solidified mass and capping system would mitigate the residual direct exposure risks, and would render the contaminants immobile. Bench testing of the solidification methods has demonstrated that this alternative effectively reduces most of leachable substances; however, some solidification formulations continued to leach substances. This condition may be controlled using additives (such as activated carbon). The solidified mass significantly reduced the matrix permeability, preventing significant groundwater flow through the mass. Alternative 4 would be effective in the long term and would be essentially permanent, provided that the solidified mass is not allowed to erode (such as during flooding, up to a 500-year flood event). Long-term monitoring of groundwater would evaluate the long-term effectiveness of the solidification alternative. Erosion of the solidified mass could result in a release via storm water transport or wind action. However, repairing or re-stabilizing the solidified mass would be complicated and difficult as the contaminated mass would be a cemented block.

The consolidation of contaminated material from throughout the Site at the lagoons and the installation of physical barriers and impermeable cap included in Alternative 5 are effective long-term solutions, but they are not as permanent as off-site disposal. Each of the encapsulation options would effectively prevent direct human contact with the contaminants and exposure to ecological receptors. None of the encapsulation/capping options would completely block groundwater flow; however, they all would reduce the flow significantly, thus achieving the limitation of contaminant migration objective. Each encapsulation system would need to be flood-proofed to prevent any release of contamination from a 500-year flood event. Each encapsulation system will require regular maintenance and monitoring (such as vegetation monitoring, groundwater monitoring, *etc*.) to maximize long-term effectiveness. The longevity of Alternative 5 may vary based on the encapsulation option selected. However, encapsulation system repairs are possible should degradation or damage be encountered.

Alternative 1 would be the most effective alternative because it would remove all the contaminated media exceeding PRGs, from the Site. The long-term effectiveness of Alternatives 4 and 5 are similar, each would attain the RAOs to the extent practicable. However, due to the solidified nature of the waste, failures and/or degradation of the Alternative 4 components would be more difficult to address/repair than those of Alternative 5 components, which are more modular.

6.1.5 Reduction of Toxicity, Mobility, or Volume through Treatment

The No Action Alternative would not reduce the toxicity, mobility or volume through treatment as is implies no-action. This element of evaluation may have only limited applicability to Alternatives 1 or 5 as they involve no significant treatment, except for some potential treatment of water generated during dewatering prior to discharge to the POTW. Alternative 4 would include a treatment step that would reduce the toxicity and mobility of contaminants, although with some limitations that would require the use of additives. Also, the volume of contaminated media would increase by approximately 30%, due to bulking/swelling from the treatment process. Some treatment of water from dewatering may also occur under Alternative 4.

6.1.6 Short-Term Effectiveness

The No Action Alternative would not be effective at all since it implies no-action. Alternative 1 proposes to remove all wastes from the Site, which will result in significant odors. Odor suppressants and perimeter air misters may assist in reducing the potential for fugitive odor-related impacts to on-site personnel and the nearby community, but this alternative exhibits the highest potential to result in fugitive odors. Safety standards, including dust suppression, for handling and disposal of ACM will also be required. This alternative results in significant truck and construction-related traffic, which could impact the nearby community with noise, dust, and odors. The quantity of exposed waste/earth associated with Alternative 1 increases the potential for environmental impacts if erosion/sedimentation controls are insufficient. Therefore, of all the alternatives, Alternative 1 exhibits the lowest short-term effectiveness.

Alternative 4 also directly impacts all the waste materials via *in-situ* mixing. As with Alternative 1, the generation of fugitive odors potentially impacting on-site workers and the nearby community is possible as the mixing is conducted and as it cures. Odor suppressants and perimeter air misters may assist in reducing the potential for fugitive odor-related impacts to on-site personnel and the nearby community. As with Alternative 1, safety standards, including dust suppression, for handling and disposal of ACM will also be required. A relatively minor amount of construction-related traffic is expected in association with Alternative 4, as contaminated wastes would not be transported off-site under this alternative, and the active working areas would be relatively limited and controlled such that it is unlikely to result in environmental impacts. With alternatives 1, 4 and 5, efforts would be managed to minimize impacts to the community and to on-site workers. Also, a site-specific health and safety plan and best management practices would be implemented to protect workers during excavation, sludge/soil/ACM management and either off-site disposal or capping activities.

Alternative 5 directly impacts relatively little of the waste materials. Therefore, of the three alternatives, it exhibits the lowest potential for fugitive emission generation. Safety standards, including dust suppression, for handling and disposal of ACM will also be required. As with Alternative 4, this alternative results in a small amount of construction-related traffic, which may impact the nearby community. However, depending on vertical encapsulation option selected, major noise concerns may be present (*e.g.* due to the use of a hydraulic sheet-pile driver). Relatively little earth disturbance is expected as part of Alternative 5, which would reduce the potential for environmental impacts.

All alternatives would achieve the RAOs at the completion of construction, however Alternative 4 will include a delay factor as the solidification matrix cures. Based on the above, Alternative 5 exhibits the greatest amount of short-term effectiveness, whereas Alternative 1 exhibits the least amount.

6.2 Implementability

Technical Feasibility

All three alternatives can be constructed. However, some technical challenges are expected for each. Significant excavation challenges exist for Alternative 1 due to the limited-access excavation of soft sludge materials below the water table that could result in difficult site management conditions and schedule delays. Significant dewatering efforts would likely reduce this risk, but would not eliminate it. Water generated from dewatering for Alternatives 1, 4 and 5 may require additional treatment before it can be discharged to the POTW. Similarly, the implementation schedule for Alternative 4 is predicated upon the sludge (including the sludge below the groundwater) solidifying to a sufficient strength to support the solidification equipment within several days of mixing. Bench testing of several mix formulations suggest that it is possible to achieve sufficient strength; however, the heterogeneity of the *in-situ* materials may be more significant than anticipated.

The constructability of the vertical encapsulation component of Alternative 5, regardless of the encapsulation option selected, has been implemented many times in traditional construction, at a minimum. Typical construction challenges associated with vertical encapsulation include subsurface debris/boulders, subsurface heterogeneity, and challenging alignments/access limitations. Each of these can be addressed without significant delays or costs. The cap system over the wastes may be challenging to construct due to the soft saturated wastes, particularly in Area 1. Methods to mitigate this risk may include the use of low-ground-pressure equipment, weight dispersion matting, and geotechnical fabrics/matting.

Both Alternative 4 and 5 would require constructing replacement flood storage capacity to replace lost flood storage capacity below the 100-year flood elevation resulting from the construction of the containment structure within the floodplain. Also, the Alternative 4 and 5 caps would need to be either located above the 500-year flood level or flood-proofed so that they would prevent any release of contaminants in up to a 500-year storm event.

Each of the Alternatives have been successfully and reliably implemented at CERCLA sites located throughout Region 1.

Additional remediation/repairs are possible and relatively easy to implement for Alternatives 1 and 5; however, such remediation/repairs would be more difficult to conduct on Alternative 4 due to the solid nature of the materials.

Administrative Feasibility

Actual permits would not be required for on-site work if implemented under CERCLA. However, administrative approvals would be required for the off-site transportation and disposal (and potential treatment) of contaminated media under Alternative 1. In particular, Federal and Canadian approvals may be required to if shipment of dioxin-contaminated waste a disposal facility that will accept it in Canada is required. Alternatives 1, 4 and 5 would require municipal approve to discharge water from dewatering into the POTW (with or without pre-treatment). For the three alternatives, licensed personnel would be required to address the ACM. Alternatives 4 and 5 would require coordination with municipal departments and NHDES to satisfy construction requirements.

Availability of Services and Materials

Qualified contractors with trained personnel, equipment, and hazardous waste site experience would be readily available to perform all the on-site services that would be required for all three alternatives (1, 4, and 5). Some specialty equipment would be required to implement Alternatives 4 and 5, so these alternatives would be slightly less implementable than Alternative 1 in this respect. However, the availability and capacity of off-site disposal facilities permitted to receive the volume of wastes contemplated for off-site disposal under Alternative 1 may be limited, which would not be a concern for Alternatives 4 and 5.

State Acceptance

The State of New Hampshire support for any of these removal actions will be determined during the public comment process.

Community Acceptance

The community support for any of these removal actions will be determined during the public comment process.

Based on the above, Alternative 1 is considered the least implementable, and Alternatives 4 and 5 are somewhat equally implementable.

6.3 Cost

A summary of costs for each alternative is presented in the table below. Appendix D includes the detailed cost estimates for each of the alternatives.

Table 14.0 Cost comparison of alternatives

Alternative	Capital Cost	Present Worth of O&M	Present Worth of Alternative
0	0	0	0
1	$32,600,000	<$10,000	$32,600,000
4	$18,400,000	$270,000	$18,700,000
5	$7,600,000 - $13,800,000	$400,000	$8,000,000 - $14,200,000

As shown in the table above, Alternative 1 would be the most expensive of the alternatives evaluated, and is at least approximately $14,000,000 more expensive than Alternatives 4 and 5. The cost for Alternative 1 is driven primarily by the fees associated with transportation and off-site disposal of contaminated media.

Alternative 4 is less expensive than Alternative 1, but more expensive than any of the Alternative 5 encapsulation options. Alternative 5 costs vary by as much as $6,200,000 with the different vertical encapsulation options.

6.4 Comparative Analysis Summary

The No Action Alternative is not protective of human health and the environment while all other alternatives (1, 4, and 5) are protective of human health and the environment by preventing contact with contaminated waste sludge and soils. Alternatives 4 and 5 would require ICs to prevent protect components of the remedies (*e.g.* monitoring wells, caps) and prevent exposure to the treated or encapsulated contaminants.

The No Action Alternative does not meet chemical-specific ARAR and TBC risk-based standards. Alternative 1, 4, and 5 can be engineered to satisfy chemical-specific, location-specific, and action-specific ARARs. However, Alternative 5 has specifically been determined to be the Least Environmentally Damaging Practicable Alternative under Section 404 of the federal Clean Water Act since it provides the best balance of protecting wetland resources on-site in a practicable manner.

The No Action Alternative and Alternatives 1, and 5 do not meet the treatment criterion, except to the limited extent that water generated from dewatering may require treatment before discharge to a POTW. Alternative 4 meets the criterion through the solidification and stabilization of sludge waste and contaminated soils (as well as through any treatment of water from dewatering).

The No Action Alternative provides no long-term effectiveness or permanence. Alternative 1 provides the most long-term effectiveness and permanence as all contaminated waste sludge and soils exceeding PRGs would be removed. Alternative 4 offers more long-term effectiveness and permanence than alternative 5, provided that adequate maintenance/repairs are done. However, these maintenance/repair activities are more difficult to achieve than those that would be required for alternative 5. Both Alternatives 4 and 5 would require the monitoring of groundwater and the monitoring of a protective cap, to ensure the integrity of the treatment or encapsulation, and its continued protectiveness.

In summary, only Alternatives 1, 4, and 5 would be protective, meet ARARs, achieve RAOs, and be effective in the short term and long term. However, only Alternative 5 offers the possibility to meet these requirements, while causing minimal environmental impacts at a reasonable cost. Alternative 4 is the only alternative that provides significant treatment, but the need of additives to the solidification mix makes it cost prohibitive. Also, the complexity / difficulty of future maintenance/repairs put it at a disadvantage when compared to Alternative 5. Short term environmental impacts within the Site are all similar for Alternatives 4 and 5 but more so for Alternative 1 due to the need for transportation off-site.

6.5 Recommended Removal Action Alternative

Based on the comparison of Alternatives 1, 4, and 5, Alternative 5 (Waste Encapsulation and Impermeable Capping) was selected as the recommended removal action alternative.
Each of the alternatives effectively addressed the RAOs. However, the balance between long-term and short-term effectiveness, when coupled with implementability and costs, favored Alternative 5. Alternative 5 is expected to present the fewest and least complicated implementation challenges of the three alternatives.

Alternative 5 effectively achieves the removal goals, is implementable, and appears to be the most cost-effective alternative presented regardless of the encapsulation method selected.

Alternative 5 will achieve ARARS identified in Appendix C and the following specific findings and determinations have been made relative to specific requirements under federal Floodplain Management and Wetland Protection regulations and CWA requirements:

- EPA has determined that because significant levels of contamination exist in sludge waste open lagoons and soils within the Site, and because of it being so close to the Nashua River, there is no practicable alternative to conducting work in these areas of the Site including wetlands, other than consolidating and encapsulating the contaminated media in place. EPA has determined that the Alternative 5 cleanup activities that would impact wetlands are the LEDPA. EPA is also specifically requesting public comment concerning this finding in a Fact Sheet being issued concurrently with this EE/CA Amendment. Wetlands will be restored and/or replicated with native vegetation nearby consistent with the requirements of federal and state wetlands protection standards.

- Alternative 5 also includes activities that result in the occupancy and modification of the 100 and 500-year floodplains. Before selecting a cleanup alternative, federal Floodplain Management regulations at 44 C.F.R. Section 9 require EPA to decide that there is no practicable alternative to the proposed actions within floodplains and to solicit public comment, which is also being done through the Fact Sheet, regarding proposed alterations to floodplain resources. EPA has determined there is no practicable alternative to occupancy and/or modification of portions of the floodplain in the immediate vicinity of the Site, but that loss of flood storage below the 100-foot flood elevation will be restored on-site in in the vicinity. EPA has determined that loss of flood storage between the 100-

and 500-year floodplain will only expect to have *de minimus* impact on downstream floodplain resources and will not require replacement. The cap will be either located at an elevation above the 500-year flood elevation or flood-proofed so that there would be no release of contaminants from the capped lagoons in up to a 500-year flood event. Floodplain and/or wetland habitat altered by the removal action will be restored to the extent practicable. EPA is specifically requesting public comment concerning this finding. Best management practices will be used to minimize adverse impacts on the floodplain resources, including: 1) damage to floodplain areas will be mitigated through erosion control measures and proper re-grading and re-vegetation of the impacted areas with indigenous (native) species; 2) any lost flood storage capacity from the proposed project, resulting from a 100 year flood event, will be compensated for, so that downstream receptors are protected; and 3) flood velocity will not increase as a result of the removal action.

- EPA's Superfund program has determined that the areas with soils contaminated with dioxin and other COCs, will be excavated and replenished with clean soils. In total, approximately 69,847 of COC -contaminated soils and sludge waste with greater than (">") PRG values for the COCs, will be consolidated and encapsulated on-site under the non-time-critical removal action (NTCRA). These target soil cleanup goals were derived based on in-house EPA risk assessment evaluation that concluded the COCs, posed an elevated risk to human health and ecological receptors from the exposure to the sludge waste and COC contaminated soils, at the Site. EPA has made the determination that the method of consolidation and encapsulation of the COC-contaminated sludge and soils as described will not pose an unreasonable risk of injury to health or the environment if the following conditions are met:

  1. Excavated COC-contaminated sludge and soils shall be disposed of at Lagoon #1 and 2 after the selected vertical containment structure and cap has been constructed to meet performance standards for the closure of hazardous waste surface impoundments and in accordance to the approved design and to EPA's satisfaction.

  2. The party performing the COC removal work shall submit a work plan describing the containment, air, and water quality monitoring that will be employed during the removal activities, including but not limited to site control, excavation, handling, storage, and disposal activities (including any specific requirements for addressing ACM). This work plan should also include information on how and where all COC-contaminated sludge wastes and soils will be stored and disposed of; how dewatering (including potential pre-treatment prior to disposal to the POTW) will be implemented, if required; how storm-water controls and runoff will be managed; how dust levels and other air quality standards will be controlled and monitored, if necessary; and how field equipment will be decontaminated and unneeded monitoring wells abandoned. All COC soil handling, storage, and water treatment areas will either be outside of the 500-year floodplain or flood-proofed up to the 500-foot flood elevation.

  3. A confirmatory sampling plan shall be developed and implemented to document that the PRGs for all COCs have been achieved. This confirmatory sampling plan shall

include a Not to Exceed Number ("NTE") which shall be developed and submitted with the confirmatory sampling plan as part of the design phase for the removal action.

4. Monitoring of groundwater will determine if, after implementing the NTCRA, groundwater is not impacted by the consolidated encapsulated/capped sludge waste and contaminated soil.

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USEPA, *Superfund Removal Guidance for Preparing Action Memoranda*, September 2009.

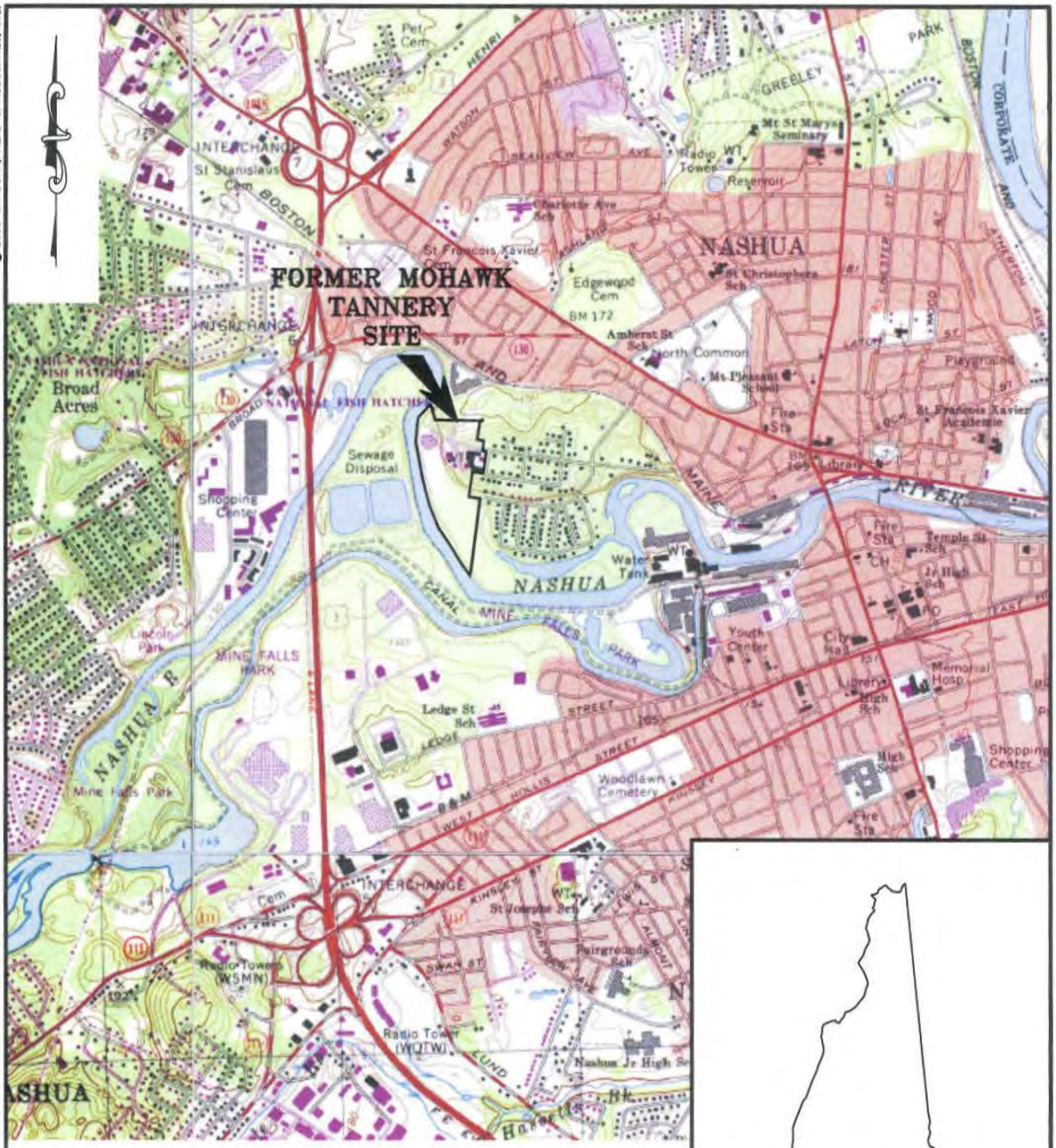
USEPA, Region 1, *Request for Removal Action Mohawk Tannery Site, Nashua, New Hampshire, Action Memorandum- Non-Time-Critical Removal Action.* October 2002.

USEPA, *Settlement Agreement for Site costs under Section 122(h)(1) of CERCLA*, April 2006.

USEPA, *Unilateral Administrative Order to Chester Realty Trust(CRT) ordering the Trust to perform the time-critical removal action for the Site*, August 2000.

USEPA, USDOJ, *State of New Hampshire, Settlement Agreement with CRT and Mr. Kean for Site costs under Section 122(h)(1) of CERCLA*, April 2006.

Figure 1



NOTES:

BASE MAP TAKEN FROM 7.5 MINUTE
USGS QUADRANGLE MAPS:
NASHUA NORTH, NH (1965)(PROVISIONAL 1979)
NASHUA SOUTH, NH (1965)(PROVISIONAL 1979)
PEPPERELL, MA (1965)(PROVISIONAL 1979)
SOUTH MERRIMACK, NH (1968)(PHOTOREVISED 1985)

—DRAFT—

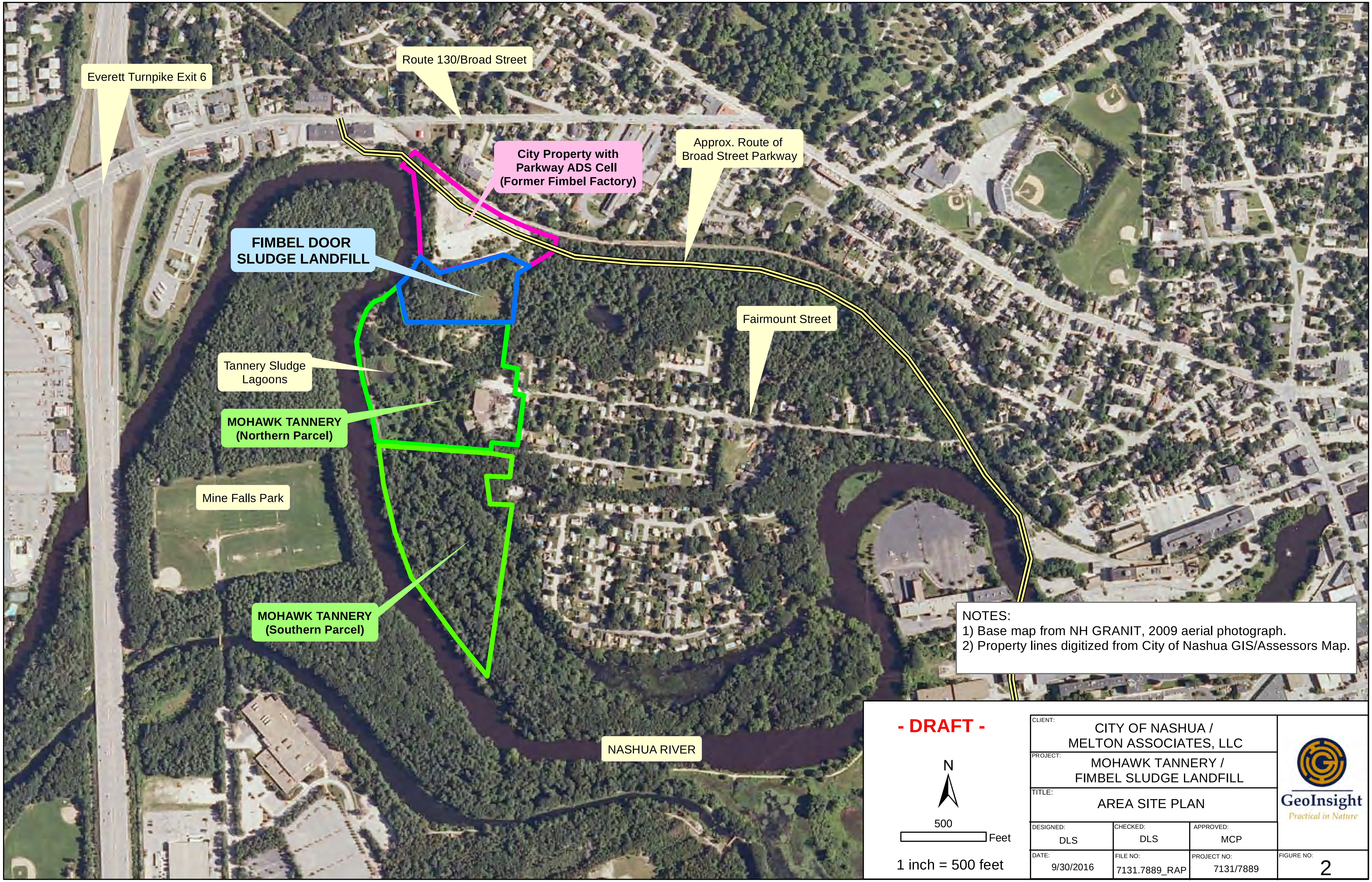
FORMER MOHAWK TANNERY SITE NASHUA, NEW HAMPSHIRE	REMEDIAL INVESTIGATION OPERABLE UNIT 1 LOCUS PLAN		
SHA Sanborn, Head & Associates *Consulting Engineers & Scientists*	SCALE: 1"=2000'	DRAWN BY: PGP	FILE NO. 2158
	DATE: MAR 05	CHECKED BY: CAC	FIGURE NO. 1

IMAGES: Z:\RFPs\01-200\dwg\POWERPOINT\mohawk.jpg
Z:\RFPs\01-200\dwg\POWERPOINT\MOHAWKB.jpg
Z:\RFPs\01-200\dwg\POWERPOINT\MOHAWKC.jpg
Z:\RFPs\01-200\dwg\POWERPOINT\MOHAWKD.jpg
Z:\RFPs\01-200\dwg\POWERPOINT\SITEA.jpg
Z:\RFPs\01-200\dwg\POWERPOINT\tox.jpg

XREFS:

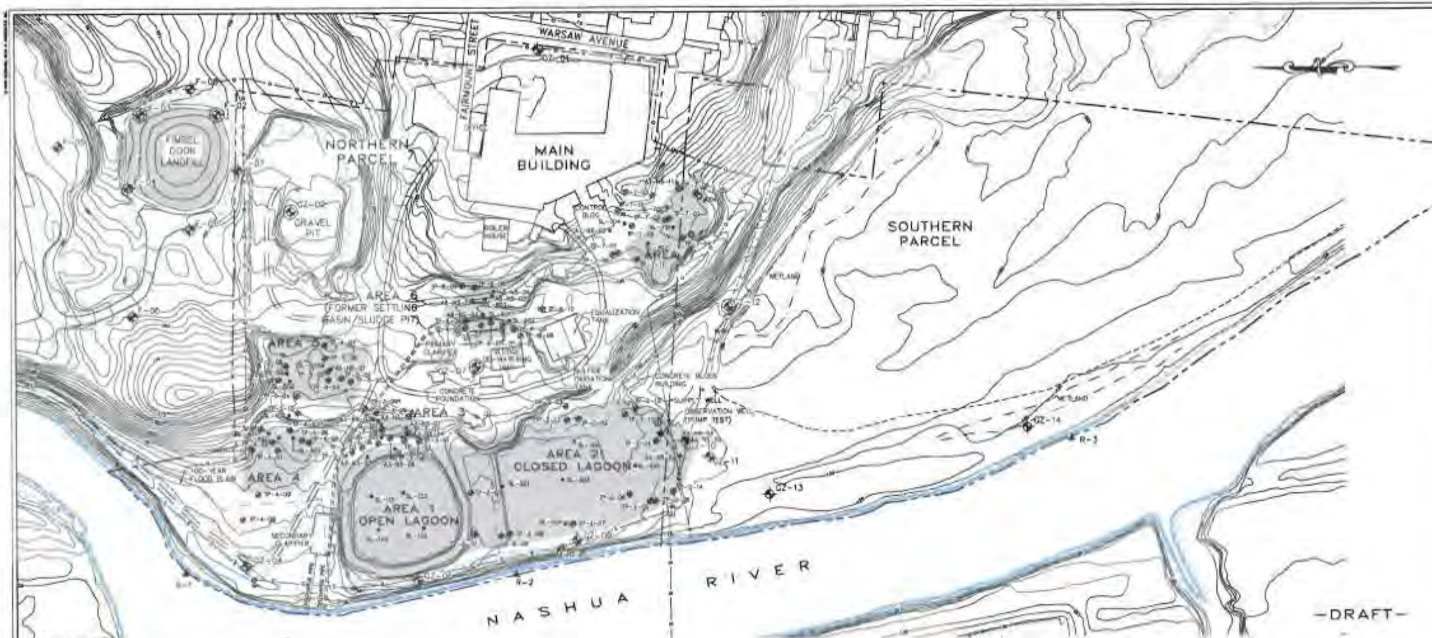
FILE: Q:\CONCORD\2158.01\dwg\2158-locus.dwg
LAYOUT: LOCUS
CTB FILE: SHA STANDARD.CTB
PLOT DATE: 3-16-05

Figure 2



Everett Turnpike Exit 6
Route 130/Broad Street
City Property with Parkway ADS Cell (Former Fimbel Factory)
Approx. Route of Broad Street Parkway
FIMBEL DOOR SLUDGE LANDFILL
Fairmount Street
Tannery Sludge Lagoons
MOHAWK TANNERY (Northern Parcel)
Mine Falls Park
MOHAWK TANNERY (Southern Parcel)
NASHUA RIVER
NOTES:
1) Base map from NH GRANIT, 2009 aerial photograph.
2) Property lines digitized from City of Nashua GIS/Assessors Map.
- DRAFT -
N
500
Feet
1 inch = 500 feet
CLIENT: CITY OF NASHUA / MELTON ASSOCIATES, LLC
PROJECT: MOHAWK TANNERY / FIMBEL SLUDGE LANDFILL
TITLE: AREA SITE PLAN
DESIGNED: DLS
CHECKED: DLS
APPROVED: MCP
DATE: 9/30/2016
FILE NO: 7131.7889_RAP
PROJECT NO: 7131/7889
FIGURE NO: 2
GeoInsight
Practical in Nature

Figure 3



LEGEND:

GZ-13/F-02	MONITORING WELL LOCATION AND DESIGNATION (GZA 1985, WCI 1991)
GZ-02/F-03	INDICATES WELL COULD NOT BE LOCATED/WAS NOT FUNCTIONAL DURING OPERABLE UNIT 1 REMEDIAL INVESTIGATION
TP-2-14	TEST PIT LOCATION AND DESIGNATION (TINUS 2001)
SL-200	OVERLYING SOIL, SLUDGE AND UNDERLYING SOIL SAMPLE LOCATION AND DESIGNATION (TINUS 2001)
A2-NS-01	OBSERVATION BORING (NO SAMPLES [NS] SUBMITTED FOR LABORATORY ANALYSIS) LOCATION AND DESIGNATION (TINUS 2001)
#004	SURFACE SOIL/SLUDGE SAMPLE LOCATION AND DESIGNATION (COLLECTED BY WESTON IN 1989)
R-2	NASHUA RIVER SAMPLE LOCATION AND DESIGNATION (GZA 1985)
	APPROXIMATE LOCATION OF PROPERTY BOUNDARY
	AREA OF SLUDGE/WASTE DISPOSAL
	EXISTING BUILDING
	FOUNDATION/SLAB OF FORMER STRUCTURE
MH	MANHOLE
	APPROXIMATE LOCATION OF FENCE
	APPROXIMATE LOCATION OF SEWER LINE
	APPROXIMATE LOCATION OF TRAIL/FOOTPATH

NOTES:

1. THE BASE MAP WAS DRAWN FROM A PLAN ENTITLED, "SITE PLAN AND SAMPLING LOCATION PLAN, MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE" PREPARED BY TETRA TECH NUS, INC. (TINUS) OF WILMINGTON, MASSACHUSETTS, DATED OCTOBER 17, 2001. ORIGINAL SCALE: 1"=60'

2. THE LOCATION OF THE SITE AND SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE ONLY.

3. BASED ON HISTORICAL DATA PROVIDED IN A REPORT TITLED "PHASE II HYDROGEOLOGIC STUDY AND CONCEPTUAL CLOSEOUT PLAN, GRANITE STATE LEATHERS FACILITY, NASHUA, NEW HAMPSHIRE" PREPARED BY GOLDBERG-ZOINO & ASSOCIATES, INC. (GZA) OF MANCHESTER, NEW HAMPSHIRE IN OCTOBER 1985 (1985 GZA REPORT), AREAS 1 THROUGH 7 ARE DESIGNATED AS AREAS THAT RECEIVED UNTREATED TANNERY WASTE STREAMS (LAGOONS), TANNERY WASTE SLUDGE (BURIED), OR SCRAP ANIMAL HIDES AND RELATED MISCELLANEOUS REFUSE (BURIED) THROUGHOUT THE HISTORY OF OPERATION OF THE SITE.

4. THE GZ-SERIES MONITORING WELLS AND MONITORING WELLS F-01 THROUGH F-04 WERE INSTALLED UNDER THE DIRECTION OF GZA IN NOVEMBER 1984 (GZ-01), AND JUNE 1985 (REMAINING WELLS).

5. MONITORING WELLS F-05 THROUGH F-08 WERE INSTALLED UNDER THE DIRECTION OF WOODARD & CURRAN, INC. IN DECEMBER 1991.

6. TP-SERIES TEST PITS, SL-SERIES SOIL/SLUDGE SAMPLING PROBES, AND A-SERIES OBSERVATION BORINGS (NO SAMPLES (NS) SUBMITTED FOR LABORATORY ANALYSIS) WERE COMPLETED UNDER THE DIRECTION OF TINUS IN AUGUST AND SEPTEMBER 2001.

7. THE LOCATIONS OF THE TEST PITS, SOIL/SLUDGE SAMPLES AND OBSERVATION BORINGS PERFORMED/COLLECTED BY TINUS ARE BASED ON THE OCTOBER 17, 2001 TINUS SITE PLAN.

8. THE LOCATIONS OF MONITORING WELLS F-01, F-04 THROUGH F-08, GZ-01, GZ-04, GZ-06, GZ-09 AND GZ-10 WERE SURVEYED BY CHAS. H. SELLS, INC. OF NASHUA, NEW HAMPSHIRE ON AUGUST 19 AND 20, 2003. THE LOCATIONS OF MONITORING WELLS F-02, F-03, GZ-02, GZ-07, AND GZ-11 THROUGH GZ-14, AND NASHUA RIVER SAMPLING LOCATIONS R-1, R-2, AND R-3 ARE BASED ON FIGURE NO. 4, TITLED "GROUNDWATER ELEVATION CONTOUR PLAN" OF THE 1985 GZA REPORT.

9. REFER TO "SITE FEATURES PLAN DETAIL – NORTHERN PARCEL (SITE)" FOR ADDITIONAL DETAIL REGARDING FEATURES ON THE NORTHERN PARCEL.

GRAPHICAL SCALE: 80' 40' 0 80' 160'

Sanborn, Head & Associates
Consulting Engineers & Scientists

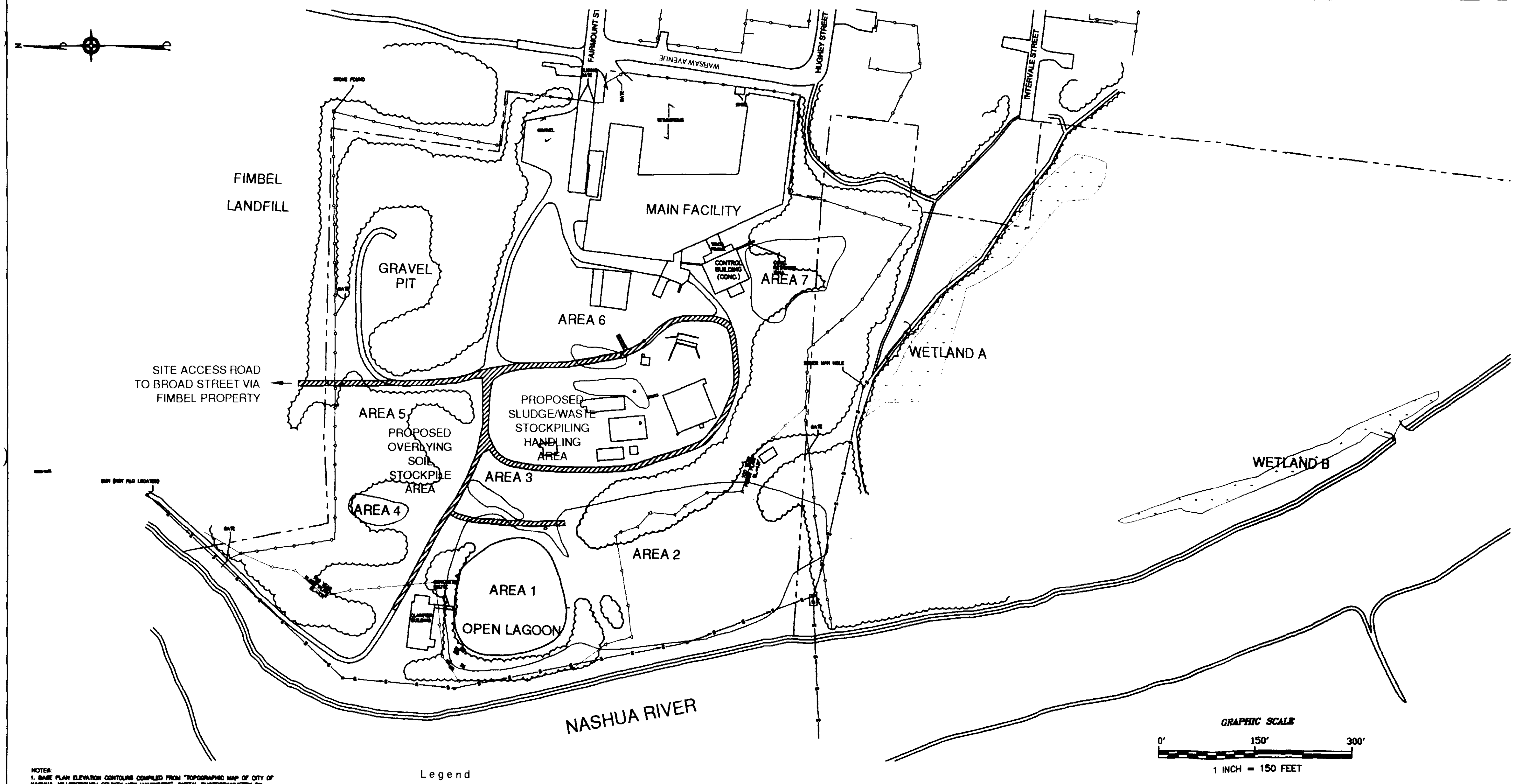
DRAWN BY: NMV
DESIGNED BY: PLR
CHECKED BY: TEH
REVIEWED BY: PMS
PROJECT MGR: PLR
FILE: CAC
DATE: MAR 05

REMEDIAL INVESTIGATION – OPERABLE UNIT I
FORMER MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

SITE FEATURES AND PRE-EXISTING EXPLORATION LOCATION PLAN – NORTHERN AND SOUTHERN PARCELS

PROJECT NUMBER: 2158
SHEET NUMBER: 2

Figure 4



NOTES:

1. BASE PLAN ELEVATION CONTOURS COMPILED FROM "TOPOGRAPHIC MAP OF CITY OF NASHUA, HILLSBOROUGH COUNTY NEW HAMPSHIRE", DIGITAL PHOTOGRAMMETRY BY CHAS. H. SELLS, INC., CHARLTON, MA, AERIAL PHOTOGRAPHY APRIL 13, 1998. SITE FEATURES AND SELECTED TEST PIT AND BORING LOCATIONS COMPILED FROM A PLAN BY GEST ASSOCIATES, INC., LABELED: "MOHAWK TANNERY, FAIRMONT STREET – NASHUA, NEW HAMPSHIRE, EXISTING CONDITIONS PLAN", NOVEMBER 20, 2001. SELECTED TEST PIT AND BORING LOCATIONS BASED ON GLOBAL POSITIONING SYSTEM (GPS) SURVEY BY TTNUS, SEPTEMBER, 2001.

2. COORDINATE / BEARINGS ARE BASED ON NEW HAMPSHIRE GRID COORDINATE SYSTEM (NAD 83). GRID NORTH, ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88), MEAN SEA LEVEL.

3. BASE FLOOD ELEVATION IS BASED ON FLOOD INSURANCE RATE MAP PANEL NUMBER 5 OF 10, COMMUNITY PANEL NUMBER 330097-0005B WITH AN EFFECTIVE DATE OF JUNE 15, 1979. BASE FLOOD ELEVATION DETERMINED TO BE 131.0 FEET (NAVD 88).

4. UTILITIES SHOWN ON PLAN ARE LOCATED APPROXIMATELY. LOCATIONS SHOWN ARE BASED ON PHYSICAL LOCATIONS AND / OR MAPS FROM THE CITY OF NASHUA.

5. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.

6. PLAN NOT TO BE USED FOR DESIGN.

Legend

- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- APPROXIMATE PROPERTY LINE
- WETLAND BOUNDARY
- ESTIMATED LIMITS OF SLUDGE/WASTE
- HAUL ROADS TO BE IMPROVED

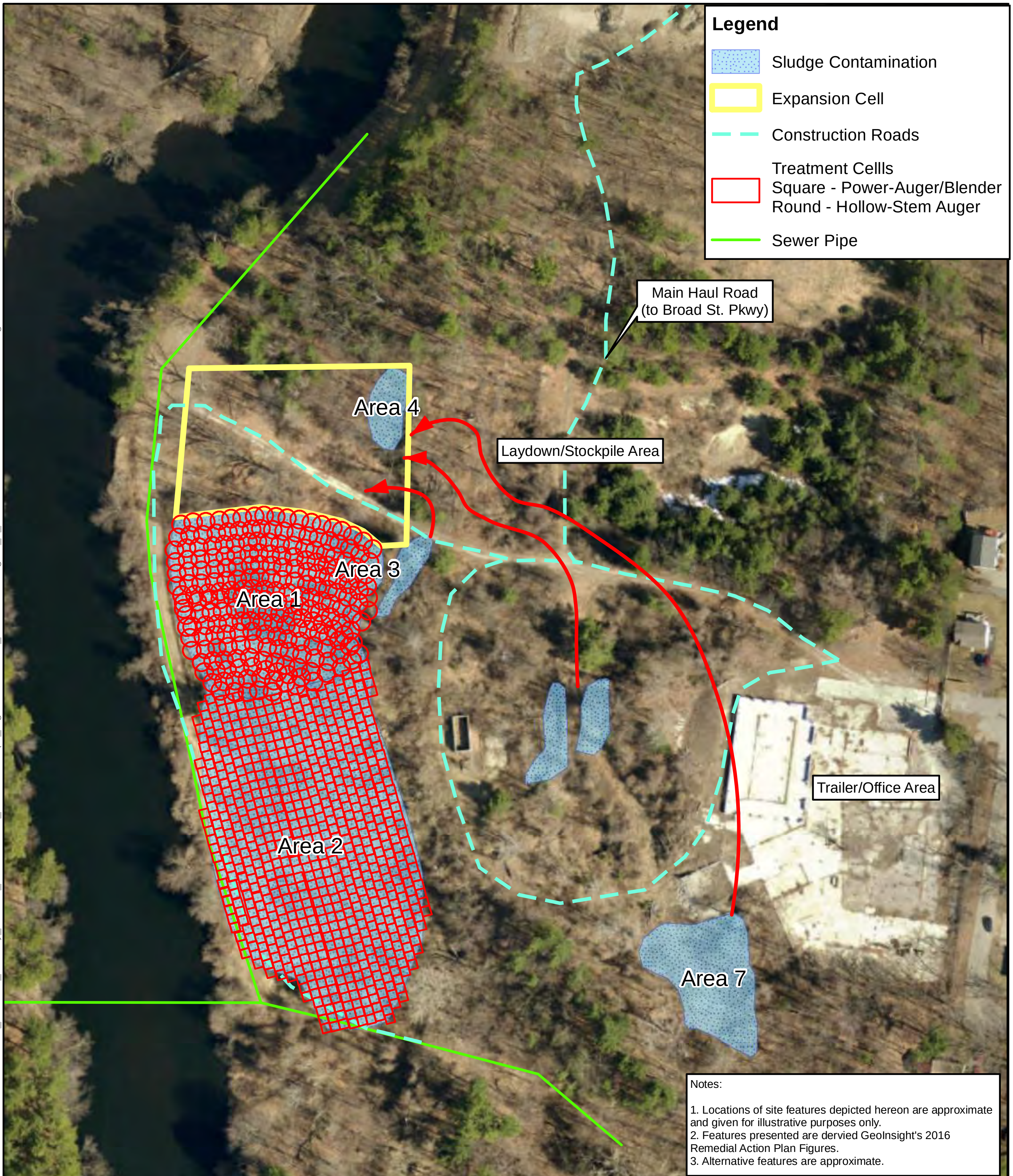
CONCEPTUAL SITE IMPLEMENTATION LAYOUT – ALTERNATIVES 1 & 3			
MOHAWK TANNERY SITE			
NASHUA, NEW HAMPSHIRE			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	S. VETERE	DATE:	APRIL, 2002
SCALE:	1" = 150'	FILE NO.:	\DWG\4111\1010\FIGURE_4-1.DWG

FIGURE 4–1

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887
(978)658-7899

Figure 5



0 75 150 300

Feet

1 inch = 150 feet

N

KGSNE

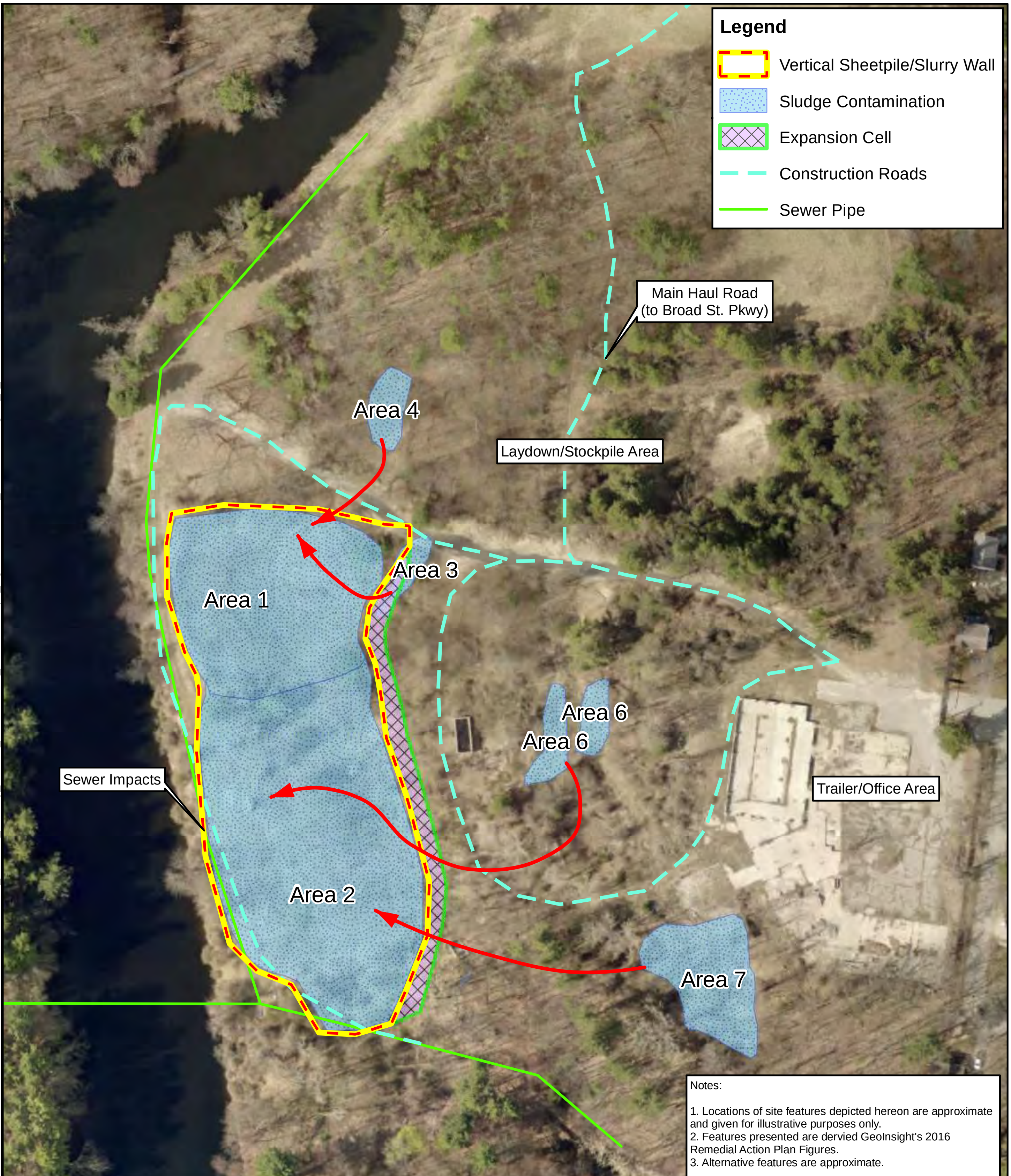
FIGURE 2

ALTERNATIVE 4 FEATURES
STABILIZATION/SOLIDIFICATION
MOHAWK TANNERY SITE
TDD No. SA-01-17-09-0001

PREPARED BY: DFM	REVIEWED BY: SV
PROJECT NO. 93201.03	DATE: OCT 2017

O:\Active\93201.00 - START Contract - Task Order 01\93201.03_Mohawk_Tannery_Nashua_NH\Technical_Data\GIS\Maps_Figures\Technical_Memo\Draft\Figure_2_Alternative 4.mxd 10/30/2017 dmcgrath

Figure 6



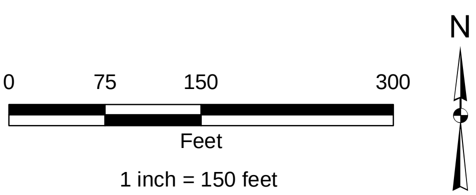


FIGURE 3

ALTERNATIVE 5 ENCAPSULATION FEATURES
MOHAWK TANNERY SITE
TDD No. SA-01-17-09-0001

PREPARED BY: DFM	REVIEWED BY: SV
PROJECT NO. 93201.03	DATE: OCT 2017

Appendix A

United States Environmental Protection Agency
New England Region
Office of Site Remediation and Restoration
One Congress Street, Boston, MA 02114-2023

Enforcement-Sensitive Information Attached

Memorandum

Date: October 29, 2002

Subject: Request for Removal Action Mohawk Tannery Site, Nashua, New Hampshire – **Action Memorandum - Non-Time-Critical Removal Action**

From: Neil Handler, Remedial Project Manager
NH & RI Superfund

Thru: Michael Jasinski, Section Chief
NH & RI Superfund

Larrry Brill, Branch Chief
R & RI

To: Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration

I. Purpose

The purpose of this Action Memorandum is to request and document approval for the proposed Non-Time-Critical Removal Action (NTCRA) and a $2 million exemption request described herein for the Mohawk Tannery Site (the Site) located in the City of Nashua, Hillsborough County, New Hampshire. The Removal Action is necessary to prevent, minimize, and mitigate potential threats to human health and the environment posed by a release of hazardous substances to the environment. The NTCRA would address the threats posed by a release of dioxin and other hazardous substances found at the Site by removing contaminated waste from six unlined disposal areas and transporting the waste off-site to a permitted facility for disposal. The NTCRA is consistent with the long-term remedial strategy for this Site to minimize exposure to and migration of contaminants and to restore the Site to its productive use.

The New Hampshire Department of Environmental Services (NH DES) under a Cooperative Agreement with the U.S. Environmental Protection Agency (EPA) is now in the process of conducting a Remedial Investigation (RI) to evaluate the full nature and extent of the contamination at the Site not already addressed by this NTCRA or by previously completed time-critical removal activities.

II. Site Conditions and Background

CERCLIS Identifier:	NHD981889629
Site Identifier:	017C
Category of Removal:	Non-Time-Critical
Nationally Significant/ Precedent Setting:	No
NPL Status	Proposed on the NPL on May 11, 2000

A. Site Description

1. Background

The Mohawk Tannery Site (a.k.a. Granite State Leathers) is located at the intersection of Fairmount Street and Warsaw Avenue in Nashua, New Hampshire. The Site is the former location of a leather tanning facility that operated at the property from 1924 to 1984. The Site consists of two adjacent properties; they are a developed parcel to the north, and an undeveloped parcel to the south. Each parcel is about 15 acres. The inactive tannery facility, which is the focus of the NTCRA, is situated on the northern parcel. The tannery is bordered by the Nashua River to the west, the Fimbel Door Company to the north, and residential areas to the east and southeast. As of 1990, the total number of people living within one mile of the Site was 1,470.

Several structures used in tannery operations, as well as debris from several demolished structures, still remain at the Site. Remaining structures include: the main facility building; a smaller control building attached to the main building; and portions of the former wastewater treatment system. Although the tannery shut down in 1984, portions of the main building have since been used by the owner and several renters for storage purposes. The formerly industrial property has been re-zoned residential by the City of Nashua. Future development of the Site is very likely, given its close proximity to downtown Nashua (see attached Figure 1).

Little is known about the tannery's effluent treatment practices prior to the 1960's. In general, industry practice prior to that time did not require any treatment of wastewater prior to its discharge into nearby waterways. In the 1960's the facility began providing some treatment of wastewater prior to its discharge into the Nashua River. Two unlined lagoons were constructed along the western side of the tannery property approximately 60 feet from the Nashua River. These lagoons are located predominantly within the 100-year floodplain of the Nashua River.

Initially, treatment within the two lagoons (which are identified as Areas 1 and 2 on Figure 2) consisted of combining acid and alkaline waste streams and allowing the solids to settle out before the liquid fraction was discharged to the river. Periodically, the sludge from the two lagoons was dredged and disposed of in several other disposal areas on the property. During the 1970's, a new treatment facility was constructed at the Site and it was reported that sludge located in the vicinity of the new treatment facility was transferred to Areas 3 through 6 as identified on Figure 2. In1980, materials including hide scraps and other miscellaneous refuse located near the main facility were excavated in preparation for construction of the control building. The excavated materials were moved to the southwest to the area identified as Area 7 on Figure 2.

During the early1980's, dried sludge from the tannery was placed in a PVC-lined landfill on the adjacent Fimbel Door Company property (Fimbel Landfill). The Fimbel Landfill has since been capped with a low permeability cover and closed under New Hampshire State Regulations. The Fimbel Landfill was not evaluated as part of this NTCRA. A majority of the lagoons and disposal areas at the Site have been covered with varying amounts of fill material and allowed to naturally revegetate. The one exception is Area 1, an open lagoon approximately one acre in size, containing approximately 25,000 cubic yards of wet odorous waste material.

While operating, the tannery used numerous hazardous substances in the preparation and tanning of animal hides including chromium, pentachlorophenol, and 4-methylphenol. Dioxin has also been found at the Site and is believed to be a by-product associated with the use of pentachlorophenol and other chlorinated phenolic compounds for the treatment of hides. It appears that the southern undeveloped parcel has not been impacted by contamination associated with past operations and waste disposal practices at the tannery based on earlier investigations completed on behalf of the tannery owner.

EPA investigations concluded that during the time the tannery operated, hazardous substances, such as those mentioned above were discharged directly into the Nashua River and deposited into the lagoons and waste disposal areas at the Site. There are approximately 60,000 cubic yards of waste at the Site. A majority of the waste is located within the 100-year floodplain of the Nashua River. The waste has not been disposed of in a manner which would prevent human exposure nor the washout of materials in the event of a flood.

A Time-Critical Removal Action was completed by EPA at the Site in January of 2001. During this removal action, EPA characterized and shipped off-site for disposal drums and small containers containing hazardous substances, asbestos containing material, caustic wastes, and the contents of a clarifier tank. In addition, a number of gates were repaired and warning signs were posted to help further secure the Site. Additional details concerning the removal action are provided in Section B below.

2. Removal Site Evaluation

An initial characterization of subsurface conditions was performed in 1985 for the tannery owner by Goldberg-Zoino & Associates, Inc., to support redevelopment of the Site. Investigative activities completed during the initial characterization provided the first detailed information concerning the extent of contamination at the Site.

Since that time the NH DES and EPA have conducted several investigations at the Site. The investigations of the Site as well as the Nashua River completed during the late 1980's and 1990's have included a Preliminary Assessment of Mohawk Tannery in July of 1987 (EPA), a Screening Site Inspection in July of 1989 (EPA), an Expanded Site Inspection in December of 1993 (NH DES), and a Final Site Inspection Prioritization Report in November of 1996 (NH DES).

In July of 2000, EPA prepared an Approval Memorandum calling for the completion of an Engineering Evaluation/Cost Analysis (EE/CA). The purpose of the EE/CA was to further characterize the nature and extent of contamination in the unlined lagoons and disposal areas at the Site and to evaluate removal options for these materials. EPA's consultant, Tetra Tech NUS, Inc., completed the EE/CA field investigation activities during August/September of 2001. A final EE/CA was released to the public in July of 2002, and was then followed by a 30-day public comment period for EPA's recommended cleanup approach for the Site. During the comment period EPA held a public information meeting and a public hearing.

The Site was evaluated for public health implications by the Agency for Toxic Substances and Disease Registry (ATSDR) in a Public Health Assessment (August 22, 2001). ATSDR concluded that although current exposures are probably low, remediation of the Site is needed because, in the future, changes in land use or a large flood of the Nashua River could increase exposures to levels that could potentially cause adverse health effects.

3. Physical Location and Site Characteristics

Mohawk Tannery is located at 11 Warsaw Avenue in the City of Nashua, Hillsborough County, New Hampshire. The Site is located in a residential neighborhood directly across the river from the 325-acre Mine Falls Park. The tannery property slopes steeply toward the Nashua River, with a topographic relief of approximately 70 feet from the eastern boundary to the western boundary along the Nashua River. Groundwater was measured between 7 and 14 feet below ground surface in monitoring wells located in the vicinity of disposal Areas 1 and 2, and approximately 70 feet below ground surface in the eastern portion of the Site adjacent to Warsaw Avenue. The lower portion of the Site, which contains Areas 1 and 2 and approximately 90 percent of the waste disposed of at the Site, is located predominantly within the 100-year floodplain of the river.

4. Release or Threatened Release into the Environment of a Hazardous Substance, or, Pollutant or Contaminant

Several private, State, and Federal investigations have confirmed the presence of numerous contaminants of potential concern (COPCs) at the Site. Most recently, as part of the EE/CA, EPA identified a number of COPCs at the Site as shown in the attached Table 1. The COPCs, which include VOCs, SVOCs, and metals, were selected based on a comparison of the maximum concentrations found in the waste disposal areas at the Site to the risk-based COPC screening levels identified for residential land use. Of the COPCs identified, the following compounds were detected at the greatest frequency and levels :

- Dioxins
- Semi-volatile Organic Compounds (including 4-methylphenol, pentachlorophenol)
- Metals (including antimony, chromium,)

Dioxin, 4-methylphenol (also known as p-cresol), pentachlorophenol, antimony, and chromium are hazardous substances as defined in Section 101(14) of CERCLA and as listed in 40 C.F.R. 302.4. Sampling results obtained during the EE/CA identified the following maximum concentrations in the waste disposal areas for the compounds discussed above: dioxin at 2.6 ppb; 4-methylphenol at 1,300 ppm; pentachlorophenol at 120 ppm; antimony at 547 ppm; and chromium at 67,800 ppm. Elevated levels of other VOCs, SVOCs, and metals were also identified at the Site as shown in the attached Table 2.

The past use of the property as a leather tannery is consistent with the presence of the hazardous substances which have been identified above as being released at the Site. The use of chromium as a tanning agent and phenolic compounds such as pentachlorophenol and 4-methylphenol as preservatives and biocides, is well documented in effluent limitation guideline documents developed by EPA for the leather tanning and finishing industry. It is also reported in literature that dioxin is a common impurity found in technical-grade formulations of pentachlorophenol.

The Streamlined Human Health Risk Evaluation conducted as part of the EE/CA for the NTCRA focused on the risks to humans from the soil and wastes contained in the six unlined disposal areas at the Site. The findings of the risk evaluation strongly indicate that there are unacceptable risks at the Site in the future for residents, if the property is developed in accordance with the current residential zoning. The potential future risks identified at the Site exceed EPA's acceptable target cancer risk range (see attached Table 3) and non-cancer hazard index value (see attached Table 4). Additional details concerning the Streamlined Human Health Risk Evaluation can be found in Section 2.0 of the EE/CA.

EPA also completed a Streamlined Ecological Risk Evaluation during the EE/CA to investigate the current and future impacts of the waste disposal areas at the Site to on-site ecological receptors. This screening-level evaluation used conservative screening values to identify whether or not contaminants at the Site pose a potential ecological risk that might warrant further investigation. The results of the ecological evaluation indicate that contaminants at the Site pose a real concern for on-site receptors and potentially off-site receptors in the event of a release. The magnitude by which contaminants such as chromium and 4-methylphenol exceed their respective screening level benchmarks (both by approximately 30,000 times in the sediment found in Area 1), demonstrates a high potential for ecological risk and the need for further study. Although the relationship between the magnitude of exceeding such benchmarks and actual toxic effects is not necessarily linear, it can be used as a rough approximation of the extent of potential risks.

Over 50,000 of the approximately 60,000 cubic yards of waste buried at the Site (see attached Table 5) are located in Areas 1 and 2 next to the Nashua River. Areas 1 and 2, which are predominantly located within the 100-year floodplain of the river, have not been designed, constructed, operated, or maintained to prevent the washout of hazardous substances. In addition, over 50 percent of the waste found in these two areas is buried beneath the water table. Accordingly, this waste is not in compliance with State of New Hampshire regulations which do not allow waste below the water table to be left in place. Groundwater in contact with the waste in these two areas is likely migrating into the Nashua River, given the close proximity of Areas 1 and 2 to the Nashua River. The impacts of the waste disposal areas at the Site on the groundwater will be evaluated during the State-lead RI.

The potential for a release from the disposal areas is certainly a real concern as evidenced by NH DES personnel reportedly observing an area of dark liquid leaking from the base of the berm surrounding Area 1 into the Nashua River in 1987. A catastrophic event such as a flood, could release tens of thousands of cubic yards of waste into the Nashua River, an important component of the regional wildlife habitat. In addition, there is a drinking water intake located approximately 14 miles downstream of the Site on the Merrimack

River which serves a population of over 100,000. The Nashua River joins the Merrimack River approximately 3 miles downstream of the Site.

In conclusion, there is a clear human health risk and strong potential for ecological risks associated with the waste present in the disposal areas at the Site. Additionally, a catastrophic event such as a flood could present additional risks for human and ecological receptors located downstream of the Site. The Removal Action proposed as part of the NTCRA will eliminate these risks.

5. NPL Status

The Site was proposed on the National Priority List (NPL) on May 11, 2000, based upon letters of support from both the City of Nashua and the State of New Hampshire. In July of 2002, the City of Nashua submitted a letter to Senator Bob Smith of New Hampshire requesting that the finalization of the Mohawk Tannery Site on the NPL be delayed at this time. It is EPA's understanding that the City is exploring alternative means for funding the cleanup of the Site in lieu of placing the Site on the NPL. In response to the City's request, the Mohawk Tannery Superfund Site was not included in the most recent group of sites to be finalized on the NPL in September of 2002.

The NTCRA follows the completion of a Time-Critical Removal Action at the tannery (January of 2001) and the initiation of a Remedial Investigation (fall of 2002). Additional details for both of these actions are provided in Section B, below.

B. Other Actions to Date

1. Previous Actions

Since the mid 1980's, there have been several private response actions completed at the Site. The first of these activities occurred in 1985, when work was completed on behalf of the property owner to determine the impacts of the waste disposal areas on the groundwater and Nashua River. A report documenting the results of this investigation was finalized by Goldberg-Zoino & Associates in October of 1985. In late 2000, a private development team completed an investigation of the two largest disposal areas at the site (Areas 1 and 2). The purpose of the Brownfields Recovery Corporation (BRC) investigation was to further characterize the extent of contamination in the largest disposal areas and to determine the feasibility of a private party cleanup and redevelopment of the Site. Based on the results of their investigation and financial analysis, BRC advised the NH DES in November of 2000 that private cleanup of the property was not economically feasible due to the significant waste disposal costs. At the request of the NH DES, the property owner in July of 2001 arranged for the removal of some oily waste material from the Site. The cost of such removal was reportedly approximately $5,000.

EPA conducted a Time-Critical Removal Action at the Site beginning in September of 2000 and concluding in January of 2001. Actions taken during this removal action included: removing and disposing of asbestos-containing material from the old tannery building; characterizing and disposing of the contents of 42 drums, a large above ground storage tank, and a large clarifier tank; and removing approximately 110 empty drums and 360 laboratory-type containers and disposing of these materials at permitted off-site facilities. EPA also repaired a number of gates and posted warning signs about the dangers of trespassing to better secure the Site.

2. Current Actions

EPA entered into a Cooperative Agreement with the NH DES to perform the RI for the Mohawk Tannery Site as a State-lead project. The investigation is necessary for other portions of the Site which may have been potentially impacted by past waste disposal activities. The other areas that will require investigation include: the on-site buildings; the groundwater; the Nashua River; and, the undeveloped parcel located to the south of the tannery. The investigation will initially focus on the groundwater and on-site buildings and it is anticipated that these RI activities will begin during the spring of 2003. The NH DES has selected Sanborn, Head & Associates to perform the RI. If the RI does not identify any additional sources of contamination or risks exceeding acceptable EPA target risk ranges for the groundwater and on-site buildings, then the completion of the NTCRA may address all of the short-term goals as well as the long-term remedial measures needed to bring the Site back into productive use. An investigation of the parcel to the south and the Nashua River would still be necessary, but this could occur separately and independently of any future redevelopment or other use of the tannery property.

C. State and Local Authorities' Roles

1. State and Local Actions to Date

The NH DES has performed numerous tasks at the Site including extensive characterization and investigative activities. However, the State does not have the financial resources to address the significant problems which currently exist at the Site. In response to requests from the State, EPA performed emergency removal activities and proposed the Site on the NPL. Through a Cooperative Agreement with EPA, the NH DES is currently initiating a Remedial Investigation of the groundwater and on-site buildings. EPA and the NH DES continue to enjoy a close and cooperative working relationship.

The City of Nashua has also been consulted and regularly involved in cleanup related activities occurring at the Site. EPA and the NH DES have met with City Officials on numerous occasions to discuss topics which have included: the potential for private development of the property; future ownership of the property; the status of cleanup work; the status of listing the Site on the NPL; and waste disposal options. As mentioned previously, the City of Nashua, although initially supportive of the listing of the Mohawk Tannery Site on the NPL, submitted a letter to Senator Bob Smith of New Hampshire on July 8, 2002, requesting that finalization of the Site on the NPL be delayed at this time. Representatives from the City have stated that they want to explore alternative means for funding the cleanup of the Site in lieu of placing the Site on the NPL. As a result, the Mohawk Tannery Superfund Site has not been finalized on the NPL.

2. Potential for Continued State/Local Response

Since the NH DES is the lead agency for the RI, the State will continue to play a key role in the completion of RI activities. The Cooperative Agreement with the State currently does not contain funding sufficient to complete the RI/FS for the Nashua River and the undeveloped parcel to the south. Therefore the status and timing of these additional investigations is currently not known. It is assumed that the City of Nashua will continue to play an active role in site-specific issues such as those mentioned above.

III. Threats to Public Health or Welfare or the Environment

A. Threats to the Public Health or Welfare

Section 300.415(b) of the National Contingency Plan (NCP) provides that EPA may conduct a removal action when it determines that there is a threat to human health or welfare or the environment based on one or more of the eight factors listed in 300.415(b)(2) of the NCP. The following factors listed below are present at this Site:

1. "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;" [300.415(b)(2)(i)].

With regard to actual or potential exposure to nearby human populations, EPA has documented elevated levels of hazardous substances including, but not limited to, dioxin, 4-methylphenol, pentachlorophenol, antimony, and chromium in six unlined waste disposal areas at the Site. At least one of the disposal areas (Area 1) at the abandoned tannery remains open and uncovered, with wastes easily accessible to trespassers entering the property. The Site abuts a densely settled neighborhood and there is evidence of children (mainly adolescents) entering the

Site and playing in and around Area 1 potentially exposing themselves to the hazardous substances present there. The remainder of the waste disposal areas have been covered with fill, but the thickness of the fill as well as its ability to limit human exposure and migration of contaminants in the future is questionable at best. Additionally, the Site has been zoned residential and future development of the property is likely, given its close proximity to downtown Nashua. Development of the Site without any further remediation would have the potential to expose future residents (both children and adults) to hazardous substances found at the surface and buried in many of the disposal areas.

The Streamlined Human Health Risk Evaluation conducted as part of the EE/CA for the NTCRA focused on the risks to humans from the soil and wastes contained in the disposal areas at the Site. The findings of the risk evaluation strongly indicate that there are unacceptable risks at the Site in the future for residents, if the property is developed in accordance with the current residential zoning. The potential future risks identified at the Site exceed EPA's acceptable target cancer risk range and non-cancer hazard index value (see attached Tables 3 and 4, respectively).

The potential for a release from the disposal areas is certainly a real concern as evidenced by NH DES personnel reportedly observing an area of dark liquid leaking from the base of the berm surrounding Area 1 into the Nashua River in 1987. A catastrophic event such as a flood, could release tens of thousands of cubic yards of waste into the Nashua River impacting the river, recreational users, and potentially downstream communities which use the Merrimack River as a drinking water source (the Nashua River joins the Merrimack River several miles downstream of the Site).

2. "High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;" [300.415(b)(2)(iii)].

High levels of hazardous substances have been found in waste and soil largely at or near the surface of the Site. Although several of the waste disposal areas have been covered with fill, the thickness of the fill as well as its ability to limit the migration of contaminants is questionable at best. The migration of contaminants from the waste disposal areas through overland flow and erosion is likely, given the topography of the Site (i.e., the steep relief sloping down toward the Nashua River) and the lack of a designed and engineered cover for these areas.

As discussed in the EE/CA, a majority of the waste contained in Area 2 (estimated volume of approximately 30,000 cubic yards) is located within the 100-year floodplain of the Nashua River. The Area 1 lagoon is not located within the 100-year floodplain due to the elevation of the earthen berm that has been constructed around its perimeter. If the berm were ever breached during a 100-year flood event, then the contents of the lagoon, approximately 25,000 cubic yards of waste which are located below the 100-year flood elevation, could be released into the river. It is clear from the physical condition of both areas (i.e., lack of erosion control and/or scouring prevention measures) and an earlier documented release from Area 1 into the Nashua River in 1987, that Areas 1 and 2 have not been designed and constructed to prevent the migration of hazardous substances.

3. "Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;" [§300.415(b)(2)(v)].

The lower portions of the Site which contain the two largest waste disposal areas (e.g., containing 90 percent of the waste disposed of at the Site) are located predominantly in the 100-year floodplain of the Nashua River. These two areas, which abut the river, have not been designed, constructed, operated, or maintained to prevent the washout of hazardous substances in the event of a flood. The release of approximately 50,000 cubic yards of waste into the river would have a detrimental effect on the Nashua River from both a recreational use and wildlife habitat standpoint. It should also be noted that a release of contaminants into the Nashua River could also potentially impact the drinking water intake for the City of Lowell which is located approximately 14 miles downstream of the Site on the Merrimack River. This water intake serves a population of over 100,000.

4. "The availability of other appropriate federal or state response mechanisms to respond to the release;" [§300.415(b)(2)(vii)].

There are no other known federal or state funds or response mechanisms available to finance this action.

B. Threats to the Environment

1. "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;" [300.415(b)(2)(i)].

The Area 1 lagoon remains open and uncovered with wastes easily accessible to likely environmental receptors. Potential receptors include plants, invertebrates, and terrestrial wildlife. In addition, a significant portion of the wastes at the Site have been placed unprotected within the 100-year floodplain of the Nashua River.

EPA completed a Streamlined Ecological Risk Evaluation during the EE/CA to investigate the current and future impacts of the waste disposal areas at the Site to on-site ecological receptors. This screening-level evaluation used conservative screening values to identify whether or not contaminants at the Site pose a potential ecological risk that might warrant further investigation. The results of the ecological evaluation indicate that contaminants at the Site pose a real concern for on-site receptors and potentially off-site receptors in the event of a release. The magnitude by which contaminants such as chromium and 4-methylphenol exceed their respective screening level benchmarks (both by approximately 30,000 times in the sediment found in Area 1), demonstrate a high potential for ecological risk and the need for further study. Although the relationship between the magnitude of exceeding such benchmarks and actual toxic effects is not necessarily linear, it can be used as a rough approximation of the extent of potential risks. A catastrophic event such as a flood, could release tens of thousands of cubic yards of waste into the Nashua River, an important component of the regional wildlife habitat. In conclusion, there is a clear potential for unacceptable ecological risks associated with the waste as presently disposed of at the Site and in the future if the waste were released into the Nashua River.

IV. Endangerment Determination

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may continue to present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. Exemption from Statutory Limits

CERCLA §104(c) states that removal actions can exceed the 12-month and/or the $2 million statutory limits if conditions meet either the "emergency exemption" criteria or the "consistency exemption" criteria. The consistency exemption requires that the proposed removal be appropriate and consistent with the remedial action to be taken. As described below, conditions and proposed actions at the Site meet the criteria for a consistency exemption.

A. Appropriateness

EPA OSWER directive 9360.0-12, "Guidance on Implementation of the Revised Statutory Limits on Removal actions", April 6, 1987, states that an action is appropriate if the activity is necessary for any ***one*** of the following reasons:

1. To avoid a foreseeable threat;
2. To prevent further migration of contaminants;
3. To use alternatives to land disposal; **or,**
4. To comply with the off-site policy

The NTCRA described in Section VI below **meets criteria one and two identified above**.

The risk evaluation conducted as part of the EE/CA and summarized in this Action Memorandum demonstrates that contaminants in the waste disposal areas at the Site pose a foreseeable threat for future residents, if the property is developed in accordance with the current residential zoning. The potential future risks identified at the Site exceed EPA's acceptable target cancer risk range and non-cancer hazard index value. Removal of the contaminated wastes will reduce the risk of these health effects and avoid a foreseeable threat.

Approximately 50,000 cubic yards of the waste disposed of at the Site is located within the 100-year floodplain of the Nashua River. The waste has not been placed in areas which have been designed, constructed, operated, or maintained to prevent the washout of hazardous substances in the event of a flood. A release from one of the disposal areas into the Nashua River has already been documented by NH DES personnel in 1987. Therefore, the removal of these contaminated wastes would prevent further migration of contaminants into the Nashua River.

B. Consistency

This Site is proposed on the National Priority List. The earlier Time-Critical Removal Action and this NTCRA have been coordinated by the Removal and the Remedial Programs and their completion are likely to enhance the effectiveness of any further remedial action measures. The NH DES has been involved in all planning activities associated with this proposed action to ensure consistency with State regulations. At a minimum, the NTCRA will complete a significant portion, if not all, of the source control measures needed for the Site. In addition, the removal of the waste disposal areas may be sufficient to achieve the long-term remedial goals for the groundwater (i.e., active restoration of the groundwater may not be necessary once the source of the problem is removed). This may allow the Site to be put back into productive use while the Nashua River and the undeveloped parcel to the south are investigated in the future to determine if any further remedial action measures are necessary.

VI. Proposed Actions and Estimated Costs

A. Proposed Actions

Several technologies and process options were screened in the EE/CA as shown in the attached Table 6. Three technologies, excavation and off-site disposal, excavation and on-site disposal, and excavation and off-site treatment using incineration, best satisfied the screening criteria and were fully developed as removal alternatives for complete evaluation against the three required criteria; effectiveness, implementability, and cost. As shown in the Comparative Analysis, attached as Table 7, the alternatives evaluated in detail present similar initial challenges for implementation since all three alternatives require excavation of the waste. However, Alternative 1 (excavation of the waste and off-site disposal at a permitted facility) is overall the easiest to implement since this alternative has the fewest issues associated with locating an off-site disposal facility capable of accepting wastes from the Site. The time frame to implement Alternatives 1 and 3 (excavation and off-site treatment using incineration) are similar and are both estimated to take approximately 12 months to complete from the date of contractor mobilization to the Site. The time frame to implement Alternative 2 (excavation and disposal in an on-site landfill) would take a little longer, approximately 16 months, because of the additional design and construction effort needed.

The cost for Alternative 1 of approximately $15 million is less than the approximate $50 million cost for Alternative 3, but it is more than the approximate $6.3 million cost of Alternative 2. However, the perceived benefits of Alternative 1 appear to outweigh the cost advantage of Alternative 2 since excavation and off-site disposal permanently removes the contaminants from the Site and eliminates the possibility for people to be exposed to the contaminants at some future date.

All three alternatives are effective and protective of human health and the environment. When Alternatives 1 and 2 are compared for effectiveness, the primary advantage of Alternative 1 is that it does not require any long term operation and maintenance and it places fewer restrictions on the future use of the property. Based on these advantages, excavation and off-site disposal (Alternative 1) was selected for the NTCRA and is more fully described below.

1. Proposed Action Description

The Removal Action includes excavating waste material from the six known disposal areas at the Site and then transporting the waste off-site to a permitted facility for disposal. All waste found in these disposal areas at concentrations in excess of the Preliminary Remediation Goals (PRGs) identified in Table 8 would be excavated and taken off-site for disposal. EPA has estimated that there are approximately 60,000 cubic yards of waste at the Site which exceed the PRGs. Based on the sampling information obtained during the EE/CA, EPA believes that this waste can be safely disposed of in a Subtitle D landfill (a landfill designed for non-hazardous wastes). A hazardous waste determination completed by the NH DES in April of 2002, also supports the current assumption that the waste from the Site would not be considered a RCRA hazardous waste.

Erosion and sedimentation control measures would be installed prior to the implementation of any intrusive Site activities. Given the proximity of the disposal areas to the Nashua River, such controls will have to be closely monitored and maintained over the life of the project. After installing erosion and sedimentation control measures, some of the next steps to occur would be: clearing and grubbing of vegetation; demolition and removal of structures which might interfere with the implementation of the NTCRA; and construction of site improvements (e.g., access roads, stockpile areas). Where possible, overlying fill which has been placed over the waste disposal areas will be segregated and stored for the subsequent backfilling of excavated areas. It is estimated that there may be approximately 9,500 cubic yards of overlying fill material at the Site.

Prior to commencing excavation in Area 1, all surface water would have to be pumped from this open lagoon and staged in a portable water storage tank at the Site while awaiting sampling and analysis. Contingent on the results of the laboratory analysis, the surface water would be discharged into the City of Nashua wastewater system via the on-site sewer line. Because excavation of wastes from Areas 1and 2 (and possibly Area 3) will likely extend to depths below the water table, excavation and removal of these saturated wastes will require the design of a dewatering system. Similar to the procedures described above for the surface water in Area 1, standing water encountered during excavation would be pumped into a tank where solids would be allowed to settle. From there, the water would be pumped into another storage tank to await sampling and analysis. Based on some initial sampling results of the surface water in Area 1, it has been assumed that the surface water as well as dewatering liquids would not require additional treatment (other than settling) prior to their discharge into the sewer.

Given the odorous nature of the waste at the Site, it is likely that engineering controls will be needed during excavation activities to prevent odors and fugitive dust emissions. Odor control technologies and other controls such as dust suppressants and water sprays will be applied as appropriate during excavation, stockpiling, and hauling. A preliminary conceptual approach for implementing odor control was developed for the EE/CA as described below. Additional details will be developed during the pre-design investigation or during implementation of the removal action.

Sulfide compounds appear to be the major cause of the objectionable odors associated with the waste at the Site. Such odors could be neutralized during excavation through the delivery of an atomizing mist to the active excavation area. The mist would consist of a solution of potable water mixed at varying ratios with a neutralizing reagent. Neutralizing reagents, which are commercially available, have been developed specifically to deal with sulfide as well as other objectionable odors. The odor control solution would be delivered through a distribution line installed around the perimeter of the active excavation area. The distribution line would contain up to several hundred nozzles which would be spaced to optimize coverage of the area of concern.

In order to improve the handling as well as the stability of the excavated wastes it is likely that bulking agents, such as lime, would have to be added to the wastes prior to their transport off-site. The need for bulking agents would be dependent primarily on the off-site disposal facility's requirements as well as the moisture content of the waste as it is placed in the on-site stockpile. The need for lime or other bulking agents would be assessed during pre-design investigations and/or through periodic assessments of conditions during the NTCRA.

Excavated wastes would be segregated into stockpiles while awaiting results of the waste characterization analysis required by the disposal facility. It is currently assumed that waste stockpile samples will be collected at a rate of one sample per 500 tons of excavated material. It is assumed that, similar to earlier results, waste characterization samples will confirm that the material is suitable for disposal at a RCRA Subtitle D landfill. However, for costing purposes in the EE/CA, cost scenarios have been evaluated to account for the potential that the waste from Area 1 is determined to be a RCRA characteristic hazardous waste. Hence the lower end of the $15 to $23 million cost range reflects all of the waste being disposed of off-site as non-hazardous; the upper end assumes that all of the material from Area 1 would be disposed of off-site as a RCRA characteristic hazardous waste subject to land disposal restrictions.

A number of options are being considered for transporting the wastes off-site. Given the significant volume of waste that will have to be disposed of and the densely settled residential neighborhood surrounding the Site, transportation has been identified as one of the neighboring community's biggest concerns. EPA is currently evaluating both truck and rail transport as well as alternatives for getting the waste from the Site to the nearest highway or rail spur. It is likely that a decision on the method of disposal will depend on the results of the bidding process and contract negotiations for the project. Accordingly, there will be additional opportunities in the future for the public to provide input on this issue before a final decision is reached.

Following completion of excavation, the former waste disposal areas will be backfilled using clean fill. All excavations would be backfilled to an elevation no higher than the original grade. At certain locations it may be appropriate to backfill to below the original grade. Thus, the flood storage capacity of the Site should not be impacted in a negative manner by the NTCRA. Following backfilling, cleared or denuded areas would be graded and revegetated to reduce erosion and sediment transport.

Implementation of the Removal Action is expected to have limited short-term impacts on the local community, workers, and the environment. To minimize the potential impacts, steps will be taken to control dust, odors and noise during excavation and off-site transportation. EPA will work closely with the community to identify appropriate transportation routes and hours of operation for the cleanup. Workers who implement the cleanup will be protected through the use of appropriate protective gear and proper safety practices. The public as well as workers will be further protected through air monitoring for the principle contaminants of concern.

The only anticipated Post-Removal Site Control (PRSC) activity associated with this Removal Action would be to inspect and maintain, during the first few years after implementation, the new vegetative cover and erosional control measures put in place at the Site. The proposed alternative was not modified significantly as a result of public comment.

2. Contribution to Remedial Performance

The NH DES has just initiated an RI which will evaluate the need for, and the extent of, remedial action for areas of the Site not being addressed by the NTCRA. The RI will focus on the groundwater, on-site buildings, and any other known areas of the Site where past waste disposal practices may have impacted the soil. Based on current information, the final overall cleanup action for the Mohawk Tannery Site would be anticipated to include a source control component and potentially a management of migration component. It is possible that the implementation of the NTCRA (i.e., removal of known waste disposal areas) will effectively complete all of the source control measures necessary for the Site. In addition, if the RI identifies that there are no unacceptable risks associated with the groundwater, on-site buildings, and other areas of the Site, then no further long-term remedial measures may be necessary for the Site. It should be noted that the current level of RI funding is not sufficient to complete the investigation of the Nashua River as well as the undeveloped parcel located to the south of the tannery. As such, these areas will have to be investigated separately from those areas addressed in the current RI.

3. Description of Alternative Technologies and Actions

In accordance with Section 4.0 (Development of Removal Action Alternatives) and Section 5.0 (Analysis of Removal Action Alternatives) of the EE/CA, a number of alternatives appropriate for addressing the removal action objectives were screened, identified and assessed. One of the three alternatives to make it beyond the screening process, Alternative 3 (excavation and off-site treatment using incineration), involved treatment, while the other two alternatives (Alternative 1 - excavation and off-site disposal in a landfill; and Alternative 2 - excavation and disposal in an on-site landfill) involved land disposal. The technologies were screened against the three selection criteria (e.g., effectiveness, implementability, and cost) as shown in attached Table 7. Based on the advantages identified in Table 7, excavation and off-site disposal (Alternative 1) was selected for this NTCRA.

4. Engineering Evaluation/Cost Analysis ("EE/CA") or Equivalent

Section 300.415(b)(4) of the NCP states that whenever a planning period of six months exists before on-site activities must be initiated, and the lead agency determines a removal action is appropriate, the lead agency shall conduct an EE/CA or its equivalent. An Approval Memorandum to perform an EE/CA for this NTCRA was approved by the OSRR Division Director on July 12, 2000. EPA issued the EE/CA report in July 2002 and held a 30-day public comment period from July 30, 2002 to August 29, 2002. During the public comment period, EPA held a public meeting on August 7, 2002, to present the results of the EE/CA, and a public hearing on August 20, 2002, to accept public comments.

The State and the community have provided comments on the EE/CA, and have expressed a general acceptance of the recommended Alternative 1. EPA has provided written responses to comments received on the EE/CA. The responses are included in the Responsiveness Summary provided in Appendix C to this Action Memorandum.

5. Applicable or Relevant and Appropriate Requirements (ARARs)

40 CFR 300.415(i) requires that Fund-financed removal actions at CERCLA sites meet Applicable or Relevant and Appropriate Requirements (ARARs) to the extent practicable considering the urgency of the situation and the scope of the removal. ARARs are promulgated, enforceable federal and state, environmental or public health requirements that are determined to be legally applicable or relevant and appropriate to the hazardous substances, cleanup actions, or other circumstances occurring at a CERCLA site.

TBCs (standards and guidance To Be Considered) are non-promulgated advisories or guidance issued by federal or state government that are not legally binding, but may be considered during the development of alternatives. There are three types of ARARs and TBCs that must be considered in planning CERCLA actions: chemical-specific, location-specific, and action-specific.

Chemical-specific ARARs and TBCs are typically health or risk based numerical values that are used to establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the environment. Location-specific ARARs and TBCs are restrictions placed on the conduct of activities solely because they are in specific areas. Action-specific ARARs and TBCs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous waste.

A complete listing and explanation of all ARARs and TBCs for this NTCRA are included in attached Tables 9 through 11. The following discussion provides a brief overview of the ARARs discussion provided in Section 3.0 of the EE/CA.

Chemical-Specific ARARs

The EPA Region IX Preliminary Remediation Goals, EPA's OSWER Directive *Approach to Addressing Dioxin in Soil at CERCLA and RCRA Sites*, and the NH DES Risk Characterization and Management Policy Method 1 soil standards and background concentrations of metals in soils are among the TBCs that were used in the data evaluation and the Streamlined Human Health Risk Evaluation to identify contaminants of potential concern and to identify PRGs.

Location-Specific ARARs

The majority of the federal and state location-specific ARARs and TBCs relate to actions which may impact wetlands (Executive Order 11990), occur in a floodplain (Executive Order 11998), or require dredging or filling (40 CFR 230). During the EE/CA, a wetlands determination was completed for the 15-acre developed parcel to the north on which the tannery is situated as well as on the 15-acre undeveloped parcel to the south. No wetland areas were identified on the tannery property itself, and the two wetland areas found on the undeveloped parcel to the south of the tannery will not be impacted by the Removal Action. Disposal areas 1 and 2 are located within the 100-year floodplain of the Nashua River and, thus, work within the floodplain cannot be avoided. However, steps will be taken to prevent any impacts to the floodplain capacity of the Site. All identified ARARs will be attained.

Action-Specific ARARs

A variety of federal and state action-specific ARARs were identified dealing primarily with issues of facility standards (RCRA), water quality monitoring (CWA), air monitoring (CAA), and fugitive dust and emissions (CAA). In many instances, the State of New Hampshire has been delegated the responsibility for implementing these federal programs and as such it is the State action-specific standards which have been identified in Table 11. The determination of whether RCRA regulations are applicable or relevant and appropriate at the Site is dependent upon whether the waste is classified as a RCRA characteristic hazardous waste. The NH DES completed an updated hazardous waste determination for the Site in April of 2002, using the data gathered during the EE/CA. The data and the NH DES determination support the current assumption that the waste from the six unlined disposal areas at the Site would not be considered a hazardous waste. A final decision on the regulatory status of the waste will be made during implementation of the removal action based on the results of the waste characterization samples. All identified ARARs will be attained.

6. Project Schedule

It is estimated that the overall Removal Action will take approximately 12 months to complete from the date that a contractor mobilizes to the Site. This schedule is dependent upon the weather and could be extended by several months if severe weather conditions are encountered. EPA anticipates submitting its request for funding for the NTCRA during the fall of 2002.

B. Estimated Costs

EPA recently completed a Time-Critical Removal Action at the Mohawk Tannery Site. The overall cost incurred by EPA at the Site through June 6, 2002, was approximately $1.3 million. As discussed in Section V and consistent with Section 104(c)(2) of CERCLA, a $2 million dollar "consistency" exemption is being requested as part of this Action Memorandum.

As the Mohawk Tannery Site was not operated by a state or political subdivision, pursuant to Section 300.525(b) of the NCP, there is no requirement for a state cost-share for the NTCRA. The following costs are estimated for this NTCRA.

Extramural Costs

NTCRA Response Contractor	$13,581,134
10% Project Contingency	$ 1,358,113
Annual PRSC*	$ 4,000
Total Extramural Costs	$14,943,247

*Post-Removal Site Control (i.e., inspections of Site)

Intramural Costs

EPA Regional Personnel	$ 100,000
TOTAL NTCRA PROJECT CEILING	**$15,043,000**

For additional information on the costs breakdown and assumptions used in the extramural cost estimate, please refer to Appendix L of the EE/CA.

It should be noted that for costing purposes in the EE/CA, disposal costs for the waste were based upon transportation by truck to a nearby Subtitle D facility in New Hampshire. Since the completion of the EE/CA, EPA, the NH DES, and City of Nashua Officials have had some preliminary discussions with other transportation vendors and it appears that there may be a significant cost savings of between one to two million dollars if rail transport and disposal facilities beyond the immediate area are considered. The project would likely be bid in a manner to consider all modes of transportation to take advantage of such potential cost savings.

VII. Expected Change in the Situation Should Action be Delayed or Not Taken

A delay or lack of action will increase the risks to human health and the environment by allowing for: (1) the potential direct contact, ingestion, and adsorption of dioxin and other hazardous substances by future residents who might come into contact with wastes; and (2) the potential continued migration of waste contaminated with dioxin and other hazardous substances into the groundwater and the Nashua River.

VIII. Outstanding Policy Issues

A. Dioxin Reassessment

The EPA Dioxin Reassessment effort began in 1991, when EPA announced that it would conduct a scientific reassessment of the health risks resulting from exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and chemically similar compounds collectively known as dioxin. The process for developing the Dioxin Reassessment has been open and participatory. Each portion of the reassessment has been developed in collaboration with scientists from inside and outside the federal government. In September, 1994, EPA released the public review draft of the Dioxin Reassessment Documents, which included three major reports:

Estimating Exposure to Dioxin-Like Compounds, Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds, and Risk Characterization of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds. The September 1994 release of the draft Dioxin Reassessment Documents was followed by a 150-day comment period and 11 public meetings around the country to receive oral and written comments. In addition to this public review, each document was reviewed by EPA's Science Advisory Board (SAB). In response to the SAB, public comments, and newly available scientific information, EPA has been working to revise and updated the 1994 draft.

On June 12, 2000, EPA released a second draft reassessment, which is entitled *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds.* Based on a more complete understanding of dioxin toxicity, the draft finds that risks to people may be somewhat higher than previously believed. Following completion of the public and scientific review, EPA will issue a final dioxin reassessment document. At the same time, EPA also plans to publish a draft dioxin Risk Management Strategy for public comment. The strategy will propose EPA policy and programs for dioxin using reassessment as its scientific basis.

EPA OSWER Directive 92000.4-26, *Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites,* issued on April 13, 2000, generally recommends 1 ppb (TEQs, or toxicity equivalent) to be used as a starting point for a residential soil cleanup level for CERCLA non-time critical removal sites and as a preliminary remediation goal (PRG) for remedial sites, pending release of the final dioxin reassessment document. These recommended levels also apply to sediments in the event that this environmental medium is considered to be a direct exposure pathway for human receptors. Based on this guidance, 1 ppb of dioxins (as 2,3,7,8-TCDD) has been established as the PRG for the Site since it is zoned residential.

It is anticipated that following issuance of the final dioxin reassessment report, OSWER will issue guidance, informed by the reassessment effort, that will provide a basis for the selection of dioxin cleanup levels. In accordance with the 1998 Guidance, EPA intends to review the Action Memorandum promptly following the release and analysis of the reassessment report and OSWER guidance, and, if necessary, to make changes to the Action Memorandum and cleanup actions, based on the information contained in the reassessment report and the OSWER guidance.

For additional information, please refer to EPA Dioxin Information Sheets 1 through 5, dated June 12, 2000, and EPA OSWER Directive 92000.4-26, *Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites,* issued on April 13, 2000, included in the Administrative Record.

IX. Enforcement

See attached. **(FOR INTERNAL DISTRIBUTION ONLY.)**

X. Recommendation

This decision document represents the selected NTCRA for the Mohawk Tannery Superfund Site in Nashua, New Hampshire. The removal action was developed in accordance with CERCLA, as amended, and is not inconsistent with the NCP. This decision document is based on documents contained in the Administrative Record established for the Site. (See Appendix D for the Administrative Record File Index)

Conditions at the Site meet the NCP §300.415(b)(2) criteria for removal and the CERCLA §104(c) consistency exemption from the $2 million limitation due to the presence of:

- "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, or pollutants or contaminants" [300.415(b)(2)(i)];

- "High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate" [300.415(b)(2)(iv)],

- "Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released" [300.415(b)(2)(v)],

- "The availability of other appropriate federal or state response mechanisms to respond to the release" [300.415(b)(2)(vii)], and

- "Continued response action is otherwise appropriate and consistent with the remedial action to be taken" [CERCLA §104(c)].

The removal actions proposed in this Action Memorandum will abate, prevent, minimize, stabilize, mitigate and/or eliminate the release or threat of release of hazardous substances at the Site. Therefore, I recommend your approval of this Action Memorandum.

Approval: ______________________ Date: Oct 29, 2002

Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration
EPA New England, Region I

Disapproval: ______________________ Date: __________

Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration
EPA New England, Region I

Attachments:

Appendix A: Tables
Appendix B: Figures
Appendix C: Responsiveness Summary
Appendix D: Administrative Record File Index

Enforcement Strategy (Confidential)

APPENDIX A

TABLES

Action Memorandum
Mohawk Tannery Site
Nashua, New Hampshire

TABLE 1
SUMMARY OF COMPOUNDS EXCEEDING SCREENING CRITERIA IN SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7
Volatile Organic Compounds (UG/KG)							
1,2-Dichlorobenzene						X	
1,4-Dichlorobenzene						X	
2-Butanone	X						
Carbon Disulfide	X	X		X			
Chlorobenzene						X	
Semivolatile Organic Compounds (UG/KG)							
2-Methylnaphthalene	X						
4-Methylphenol	X	X		X			X
Benzo(a)pyrene							X
Naphthalene		X	X			X	
Pentachlorophenol	X	X	X			X	X
Phenol		X					
Pesticides/PCBs (UG/KG)							
Aldrin		X					
Aroclor-1242							X
Heptachlor Epoxide		X					
Dioxins (NG/KG)							
2,3,7,8-TCDD	X	X	X			X	X
Toxicity Equivalency	X	X				X	X
Metals (MG/KG)							
Antimony	X	X	X	X	X	X	X
Arsenic	X	X	X	X	X	X	X
Barium						X	X
Cadmium							X
Chromium	X	X	X	X		X	X
Lead							X
Manganese	X			X			X
Mercury							X
Thallium				X		X	X
Vanadium						X	
Chromium VI (MG/KG)							
RCRA Analyses							
Paint Filter (ML/KG)				X			
Reactive Sulfide (MG/KG)	X						

TABLE 2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
120-82-1	1,2,4-Trichlorobenzene	35	J	570	J	ug/kg	MT-SL-601-0711	5/33	170 - 1300	570		65000 nc			NO	BSL
95-50-1	1,2-Dichlorobenzene	32	J	46000		ug/kg	MT-SL-601-0711	16/33	180 - 1300	46000		90000 nc_1			NO	BSL
106-46-7	1,4-Dichlorobenzene	15	J	25000		ug/kg	MT-SL-601-0711	12/33	180 - 1300	25000		3400 ca			YES	ASL
78-93-3	2-Butanone	510		2200		ug/kg	MT-SL-101-0010	5/33	170 - 1300	2200		730000 nc			NO	BSL
67-64-1	Acetone	210		4300		ug/kg	MT-SL-704-0207-AVG	12/33	170 - 710	4300		160000 nc			NO	BSL
75-15-0	Carbon Disulfide	54	J	6100		ug/kg	MT-SL-102-0012	14/33	180 - 1300	6100		36000 nc			NO	BSL
108-90-7	Chlorobenzene	25	J	77000		ug/kg	MT-SL-601-0711	7/33	170 - 1300	77000		15000 nc			YES	ASL
67-66-3	Chloroform	19	J	79	J	ug/kg	MT-SL-403-0510	9/33	180 - 1300	79		240 ca**			NO	BSL
100-41-4	Ethylbenzene	120	J	380	J	ug/kg	MT-SL-601-0711	2/33	170 - 1300	380		150000 nc_1			NO	BSL
79-20-9	Methyl Acetate	44	J	8900		ug/kg	MT-SL-102-0012	20/33	180 - 330	8900		2200000 nc			NO	BSL
127-18-4	Tetrachloroethene	170	J	170	J	ug/kg	MT-SL-401-0511	1/33	170 - 1300	170		5700 ca*			NO	BSL
108-88-3	Toluene	19	J	9200		ug/kg	MT-SL-402-0311	11/33	170 - 1300	9200		59000 nc_1			NO	BSL
1330-20-7	Total Xylenes	280	J	2300		ug/kg	MT-SL-601-0711	3/29	170 - 1300	2300		140000 nc_1			NO	BSL
95-95-4	2,4,5-Trichlorophenol	380	J	70000	J	ug/kg	MT-SL-602-0509	9/33	440 - 330000	70000		610000 nc			NO	BSL
91-58-7	2-Chloronaphthalene	1700	J	5200	J	ug/kg	MT-SL-201-0616	2/33	170 - 130000	5200		390000 nc			NO	BSL
91-57-6	2-Methylnaphthalene	1800	J	21000	J	ug/kg	MT-SL-102-0012	5/33	170 - 130000	21000		5600 nc			YES	ASL
59-50-7	4-Chloro-3-methylphenol	550	J	550	J	ug/kg	MT-SL-703-0215	1/33	170 - 130000	550		31000 ca			NO	BSL
106-44-5	4-Methylphenol	1200	J	1300000		ug/kg	MT-SL-102-0012	11/16	180 - 130000	1300000		31000 nc			YES	ASL
50-32-8	Benzo(a)pyrene	660	J	660	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	660		62 ca			YES	ASL
205-99-2	Benzo(b)fluoranthene	470	J	470	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	470		620 ca			NO	BSL
207-08-9	Benzo(k)fluoranthene	790	J	790	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	790		6200 ca			NO	BSL
117-81-7	bis(2-Ethylhexyl)phthalate	8900		15000	J	ug/kg	MT-SL-401-0511	2/33	170 - 130000	15000		35000 ca*			NO	BSL
218-01-9	Chrysene	590	J	590	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	590		62000 ca			NO	BSL
84-74-2	Di-n-Butylphthalate	23	JEB	61		ug/kg	MT-SL-501-0020-AVG	2/33	180 - 130000	61		610000 nc			NO	BSL
206-44-0	Fluoranthene	1100	J	1100	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	1100		230000 nc			NO	BSL
86-30-6	N-Nitroso-diphenylamine	7600	J	7600	J	ug/kg	MT-SL-602-0509	1/33	170 - 130000	7600		99000 ca			NO	BSL
91-20-3	Naphthalene	760	J	61000		ug/kg	MT-SL-202-0717-AVG	7/33	170 - 68000	61000		5600 nc			YES	ASL
87-86-5	Pentachlorophenol	120	J	120000	J	ug/kg	MT-SL-602-0509	12/33	440 - 330000	120000		3000 ca			YES	ASL
85-01-8	Phenanthrene	620	J	620	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	620		2200000 nc			NO	BSL
108-95-2	Phenol	390	JEB	52000		ug/kg	MT-SL-202-0717-AVG	9/33	170 - 130000	52000		3700000 nc			NO	BSL
129-00-0	Pyrene	900	J	900	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	900		230000 nc			NO	BSL
72-54-8	4,4'-DDD	3.4	J	34	J	ug/kg	MT-SL-601-0711	6/33	1.7 - 17	34		2400 ca			NO	BSL
72-55-9	4,4'-DDE	1.5	J	53	J	ug/kg	MT-SL-602-0509	15/33	1.7 - 6.5	53		1700 ca			NO	BSL
50-29-3	4,4'-DDT	1.8	J	5.6	J	ug/kg	MT-SL-602-0509	4/33	1.7 - 17	5.6		1700 ca*			NO	BSL
309-00-2	Aldrin	6.1	J	29		ug/kg	MT-SL-202-0717-AVG	3/33	0.87 - 3.4	29		29 ca*			NO	BSL
319-84-6	alpha-BHC	4.6		24	J	ug/kg	MT-SL-104-0010	4/33	0.87 - 8.9	24		90 ca			NO	BSL
5103-71-9	alpha-Chlordane	1.6		340		ug/kg	MT-SL-202-0717-AVG	19/33	0.87 - 3.4	340		1600 ca			NO	BSL
53469-21-9	Aroclor-1242	280		280		ug/kg	MT-SL-702-0011	1/33	17 - 170	280		220 ca			YES	ASL
11097-69-1	Aroclor-1254	4	J	180		ug/kg	MT-SL-401-0511	11/33	17 - 61	180		220 ca**			NO	BSL

TABLE 2 (CONT.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
319-85-7	beta-BHC	2.2		18		ug/kg	MT-SL-203-0619	5/33	0.87 - 3.4	18		320 ca			NO	BSL
319-86-8	delta-BHC	3.2		18		ug/kg	MT-SL-202-0717-AVG	3/33	0.87 - 3.4	18		440 ca*			NO	BSL
60-57-1	Dieldrin	4.4		12		ug/kg	MT-SL-202-0717-AVG	4/33	1.7 - 6.5	12		30 ca			NO	BSL
72-20-8	Endrin	5.8		5.9	J	ug/kg	MT-SL-601-0711	2/33	1.7 - 17	5.9		1800 nc			NO	BSL
53494-70-5	Endrin Ketone	5.8		26	J	ug/kg	MT-SL-601-0711	4/33	1.7 - 17	26		1800 nc			NO	BSL
5103-74-2	gamma-Chlordane	1.7		500		ug/kg	MT-SL-202-0717-AVG	18/33	0.87 - 3.4	500		1600 ca			NO	BSL
76-44-8	Heptachlor	28	J	56	J	ug/kg	MT-SL-104-0010	2/33	0.87 - 8.9	56		110 ca			NO	BSL
1024-57-3	Heptachlor Epoxide	1.5		48		ug/kg	MT-SL-202-0717-AVG	6/33	0.87 - 3.4	48		53 ca*			NO	BSL
35822-46-9	1,2,3,4,6,7,8-HpCDD	10.8		93940		ng/kg	MT-SL-702-0011	33/33	0 - 0	93940					NO	NTX
67562-39-4	1,2,3,4,6,7,8-HpCDF	1.2		17200	JEB	ng/kg	MT-SL-602-0509	33/33	0 - 0	17200					NO	NTX
55673-89-7	1,2,3,4,7,8,9-HpCDF	2.8	J	990	JEB	ng/kg	MT-SL-602-0509	30/33	0.45 - 5.2	990					NO	NTX
39227-28-6	1,2,3,4,7,8-HxCDD	0.71	J	390		ng/kg	MT-SL-103-0010-AVG	29/33	0.35 - 3.1	390					NO	NTX
70648-26-9	1,2,3,4,7,8-HxCDF	1.3	J	758	JEB	ng/kg	MT-SL-601-0711	30/33	0.2 - 2.7	758					NO	NTX
57653-85-7	1,2,3,6,7,8-HxCDD	3.1	J	4690	JEB	ng/kg	MT-SL-602-0509	32/33	0.35 - 0.35	4690					NO	NTX
57117-44-9	1,2,3,6,7,8-HxCDF	0.6	J	229	J	ng/kg	MT-SL-602-0509	29/33	0.2 - 2.7	229					NO	NTX
19408-74-3	1,2,3,7,8,9-HxCDD	1.6	JEB	1530	JEB	ng/kg	MT-SL-101-0010	32/33	0.35 - 0.35	1530					NO	NTX
72918-21-9	1,2,3,7,8,9-HxCDF	0.74	EMPC	10.8	EMPC	ng/kg	MT-SO-A6-OVCOMP	5/33	0.1 - 5.7	10.8					NO	NTX
40321-76-4	1,2,3,7,8-PeCDD	0.54	EMPC	395	JEB	ng/kg	MT-SL-101-0010	28/33	0.2 - 3.6	395					NO	NTX
57117-41-6	1,2,3,7,8-PeCDF	0.27	J	148		ng/kg	MT-SL-103-0010-AVG	13/33	0.09 - 2.4	148					NO	NTX
60851-34-5	2,3,4,6,7,8-HxCDF	1.3	J	488	JEB	ng/kg	MT-SL-602-0509	29/33	0.25 - 4.7	488					NO	NTX
57117-31-4	2,3,4,7,8-PeCDF	0.25	EMPC	91.9	JEB	ng/kg	MT-SL-601-0711	25/33	0.1 - 2.2	91.9					NO	NTX
1746-01-6	2,3,7,8-TCDD	0.39	J	1240	J	ng/kg	MT-SL-602-0509	30/33	0.25 - 1.8	1240		3.9 ca			YES	ASL
51207-31-9	2,3,7,8-TCDF	0.24	EMPC	26.9	J	ng/kg	MT-SL-601-0711	25/32	0.2 - 2.1	26.9					NO	NTX
3268-87-9	OCDD	99.9		922000	J	ng/kg	MT-SL-601-0711	33/33	0 - 0	922000					NO	NTX
39001-02-0	OCDF	2.6		33200	JEB	ng/kg	MT-SL-601-0711	33/33	0 - 0	33200					NO	NTX
37871-00-4	Total HpCDD	18.6		161180	J	ng/kg	MT-SL-702-0011	33/33	0 - 0	161180					NO	NTX
38998-75-3	Total HpCDF	4.2		75200	JEB	ng/kg	MT-SL-602-0509	33/33	0 - 0	75200					NO	NTX
34465-46-8	Total HxCDD	1.2		20400	JEB	ng/kg	MT-SL-601-0711	33/33	0 - 0	20400					NO	NTX
55684-94-1	Total HxCDF	5.6	JEB	27600	JEB	ng/kg	MT-SL-602-0509	32/33	0.75 - 0.75	27600					NO	NTX
36088-22-9	Total PeCDD	0.8		5100	JEB	ng/kg	MT-SL-101-0010	33/33	0 - 0	5100					NO	NTX
30402-15-4	Total PeCDF	2.5	J	1690	JEB	ng/kg	MT-SL-601-0711	31/33	0.25 - 0.3	1690					NO	NTX
41903-57-5	Total TCDD	0.48	EMPC	1550		ng/kg	MT-SL-103-0010-AVG	31/33	0.25 - 1.8	1550					NO	NTX
55722-27-5	Total TCDF	0.51	JEB	470	J	ng/kg	MT-SL-101-0010	30/33	0.2 - 1.4	470					NO	NTX
Dioxin TEQ	Toxicity Equivalency	0.13		2600	J	ng/kg	MT-SL-602-0509	33/33	0 - 0	2600		3.9 ca			YES	ASL
7429-90-5	Aluminum	2000		10600		mg/kg	MT-SL-602-0509	33/33	0 - 0	10600					NO	EPA I
7440-36-0	Antimony	1.2	J	547	J	mg/kg	MT-SL-602-0509	25/32	0.74 - 0.74	547		3.1 nc			YES	ASL
7440-38-2	Arsenic	1.2	J	15.7		mg/kg	MT-SL-603-0007	32/33	1 - 1	15.7		0.39 ca*			YES	ASL
7440-39-3	Barium	12.9		1480	J	mg/kg	MT-SL-703-0215	33/33	0 - 0	1480		540 nc			YES	ASL
7440-41-7	Beryllium	0.08		0.41	J	mg/kg	MT-SL-204-0618, MT-SL-603-0007, MT-SO-A7-UNCOMP	25/33	0.16 - 0.27	0.41		15 nc			NO	BSL

TABLE 2 (CONT.)

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All" Soil and Sludge Areas 1 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7440-43-9	Cadmium	0.74	J	16.8		mg/kg	MT-SL-702-0011	4/33	0.52 - 0.68	16.8		3 7 nc			YES	ASL
7440-70-2	Calcium	560		156000		mg/kg	MT-SL-103-0010-AVG	33/33	0 - 0	156000					NO	NUT
7440-47-3	Chromium	12.8		67800	J	mg/kg	MT-SL-602-0509	33/33	0 - 0	67800		12000 ca			YES	ASL
7440-48-4	Cobalt	1.8		7.4	J	mg/kg	MT-SL-104-0010	33/33	0 - 0	7.4					NO	EPA I
7440-50-8	Copper	4.4		274		mg/kg	MT-SL-703-0215	33/33	0 - 0	274					NO	EPA I
7439-89-6	Iron	3370		25500		mg/kg	MT-SL-702-0011	33/33	0 - 0	25500					NO	EPA I
7439-92-1	Lead	2.5		427		mg/kg	MT-SL-702-0011	33/33	0 - 0	427		400 nc			YES	ASL
7439-95-4	Magnesium	253		4010		mg/kg	MT-SL-201-0616	33/33	0 - 0	4010					NO	NUT
7439-96-5	Manganese	25.2		13300		mg/kg	MT-SL-102-0012	33/33	0 - 0	13300		180 nc			YES	ASL
7439-97-6	Mercury	0.02	J	4.5		mg/kg	MT-SL-702-0011	26/31	0.02 - 0.02	4.5		2 3 nc			YES	ASL
7440-02-0	Nickel	3.4		24.5		mg/kg	MT-SL-702-0011	33/33	0 - 0	24.5		160 nc			NO	BSL
7440-09-7	Potassium	74.7		2410	J	mg/kg	MT-SL-201-0616	33/33	0 - 0	2410					NO	NUT
7782-49-2	Selenium	1.3		1.3		mg/kg	MT-SL-103-0010-AVG	1/33	0.87 - 1.1	1.3		39 nc			NO	BSL
7440-22-4	Silver	1.7		6.2	J	mg/kg	MT-SL-102-0012	3/33	0.87 - 1.1	6 2		39 nc			NO	BSL
7440-23-5	Sodium	103	J	11300		mg/kg	MT-SL-102-0012	17/33	85.3 - 98.6	11300					NO	NUT
7440-28-0	Thallium	1.4		2.2	J	mg/kg	MT-SL-602-0509	4/33	0.99 - 2	2.2		0 52 nc			YES	ASL
7440-62-2	Vanadium	2.6		68.6		mg/kg	MT-SL-602-0509	31/33	0.64 - 0.64	68.6		55 nc			YES	ASL
7440-66-6	Zinc	12		330		mg/kg	MT-SL-702-0011	31/33	14.8 - 16.1	330		2300 nc			NO	BSL
18540-29-9	Chromium VI	3	J	28		mg/kg	MT-SO-A6-OVCOMP	2/33	2 - 10.9	28		30 ca**			NO	BSL
18496-25-8	Sulfide	8 8		300	J	mg/kg	MT-SL-402-0311, MT-SL-704-0207-AVG	20/33	5.1 - 16.6	300					NO	NTX

NOTES:

(1) Minimum/maximum detected concentration

(2) N/A - Refer to supporting information for background discussion.
Background values are the maximum of off-site background concentrations.

(3) Region IX PRG residential soil November 2000. Region IX PRGs for non-carcinogens have been adjusted by a factor of 0.1 to correspond to an HI of

(4) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
EPA Region I does not advocate quantitative risk evaluation of this contaminant.(EPA I)

Definitions
N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
ca = Carcinogenic
ca* = Carcinogenic where nc < 100X ca
ca** = Carcinogenic where nc < 10X ca
nc = Non-Carcinogenic
EB = present in equipment blank
nc_1 = Region IX PRG for this non-carcinogen was based on a ceiling limit or saturation
The value shown is 1/10 of the Region IX risk-based PRG

*Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 3

CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL** SOIL/SLUDGE AREAS 1-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
1,4-Dichlorobenzene	1	95%UCL		*		0.1	6.69E-07	2.11E-07	2.40E-02	1.00E+00	2.40E-02	1.61E-08	5.07E-09	2.11E-08
Chlorobenzene	1.7	95%UCL		*		0.1	6.69E-07	2.11E-07		1.00E+00				
4-Methylphenol	1300	Max		*		0.1	6.69E-07	2.11E-07		1.00E+00				
Benzo(a)Pyrene	0.66	Max		*		0.13	6.69E-07	2.75E-07	7.30E+00	1.00E+00	7.30E+00	3.22E-06	1.32E-06	4.55E-06
2-Methylnaphthalene	21	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Naphthalene	61	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Pentachlorophenol	120	95%UCL		*		0.25	6.69E-07	5.28E-07	1.20E-01	1.00E+00	1.20E-01	9.64E-06	7.61E-06	1.72E-05
Aroclor 1242	0.028	95%UCL		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-08	1.66E-08	5.40E-08
Dioxin TEQ	0.0026	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	1.31E-04	2.47E-05	1.55E-04
Antimony	506	95%UCL		*			6.69E-07			1.50E-01				
Arsenic	8.6	95%UCL		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	8.63E-06	8.18E-07	9.45E-06
Barium	154	95%UCL		*			6.69E-07			7.00E-02				
Cadmium	0.78	95%UCL		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Chromium	67800	Max		*			6.69E-07			1.30E-02				
Lead	67.6	95%UCL		*			6.69E-07							
Manganese	1810	95%UCL		*			6.69E-07			4.00E-02				
Mercury	0.76	95%UCL		*			6.69E-07			1.00E+00				
Thallium	0.81	95%UCL		*			6.69E-07			1.00E+00				
Vanadium	32.1	95%UCL		*			6.69E-07			2.60E-02				
														1.87E-04

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs

TABLE 4

NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL** SOIL/SLUDGE AREAS 1-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
1,4-Dichlorobenzene	1	95%UCL	*		0.1	5.48E-06	1.53E-06	3.00E-02	1.00E+00	3.00E-02	1.83E-04	5.11E-05	2.34E-04
Chlorobenzene	1.7	95%UCL	*		0.1	5.48E-06	1.53E-06	2.00E-02	1.00E+00	2.00E-02	4.66E-04	1.30E-04	5.96E-04
4-Methylphenol	1300	Max	*		0.1	5.48E-06	1.53E-06	5.00E-03	1.00E+00	5.00E-03	1.42E+00	3.99E-01	1.82E+00
Benzo(a)Pyrene	0.66	Max	*		0.13	5.48E-06	1.99E-06		1.00E+00				
2-Methylnaphthalene	21	Max	*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	5.75E-03	2.09E-03	7.85E-03
Naphthalene	61	Max	*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	1.67E-02	6.08E-03	2.28E-02
Pentachlorophenol	120	95%UCL	*		0.25	5.48E-06	3.84E-06	3.00E-02	1.00E+00	3.00E-02	2.19E-02	1.53E-02	3.73E-02
Total Aroclors	0.028	95%UCL	*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	[illegible]	3.01E-03	1.07E-02
Dioxin TEQ	0.0026	Max	0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	506	95%UCL	*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	6.93E+00		6.93E+00
Arsenic	8.6	95%UCL	1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	1.57E-01	1.32E-02	1.70E-01
Barium	154	95%UCL	*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	1.21E-02		1.21E-02
Cadmium	0.78	95%UCL	*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	8.55E-03	9.57E-04	9.51E-03
Chromium	67800	Max	*			5.48E-06		1.50E+00	1.30E-02	1.95E-02	2.48E-01		2.48E-01
Lead	67.6	95%UCL	*			5.48E-06							
Manganese	1810	95%UCL	*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	1.42E-01		1.42E-01
Mercury	0.76	95%UCL	*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	1.39E-02		1.39E-02
Thallium	0.81	95%UCL	*			5.48E-06		6.60E-05	1.00E+00	6.60E-05	6.72E-02		6.72E-02
Vanadium	32.1	95%UCL	*			5.48E-06		7.00E-03	2.60E-02	1.82E-04	2.51E-02		2.51E-02
													9.52E+00

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time
= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS_{oral} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time
= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS_{dermal} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = (EPC * Exposure Factor)/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration [illegible] water

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September [illegible]

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed [illegible] from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSF [illegible] When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the comb[illegible] with an absorbed CSF

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of de[illegible] any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 5
ESTIMATED SLUDGE/WASTE AND OVERLYING SOIL VOLUMES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Disposal Area	Estimated Area of Sludge/Waste (SF)	Estimated Thickness of Sludge/Waste (FT)	Estimated Volume of Sludge/Waste (CF)	Estimated Volume of Sludge/Waste (CY)	Estimated Thickness of Overlying Soil (FT)	Estimated Volume of Overlying Soil (CF)	Estimated Volume of Overlying Soil (CY)
1	40,000	17	680,000	25,185	NA	NA	NA
2	80,000	10	800,000	29,630	3	240,000	8,889
3	2,000	5	10,000	370	2	4,000	148
4	3,000	9	27,000	1,000	2	6,000	222
5	NA	NA	NA	NA	NA	NA	NA
6	3,500	5	17,500	648	2	7,000	259
7	8,000	12	96,000	3,556	0	0	0
			TOTAL VOLUME (CY):	60,389			9,519

Notes:
See Section 2.1.3 for assumptions made in the area/thickness/volume estimations for sludge/waste and overlying soil.
Overlying soil estimates evaluate only overlying soil considered practical to separate from underlying sludge/waste during excavation.
SF = Square Feet
FT = Feet
CF = Cubic Feet
CY = Cubic Yards
NA = Not Applicable. Field observations and chemical analysis indicate no sludge or tannery waste present, or no overlying soil.

TABLE 6
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Limited Action	Access Restrictions	Fencing	Installation and/or repair of site fencing to restrict access to contaminated areas.	Eliminated as a primary technology because it would not be effective in protecting ecological receptors or environment. However, may be used with other technologies such as on-site landfill to prevent access to a particular area of the site.
	Environmental Monitoring	Environmental Monitoring	Monitoring of groundwater, surface water, and sediment to determine whether contaminants are migrating from site sludge/soil.	Eliminated as a primary technology because it would not be effective in achieving any RAOs. However, may be used to monitor the effectiveness of other technologies such as on-site landfilling.
	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as excavation or residential development could be restricted under property deeds.	Eliminated. Would not prevent direct contact with overlying soil and/or sludge. Would not protect ecological receptors or the environment or promote restoration of site to residential use.
		Zoning Ordinances	Administrative action by municipality to change permitted use of land to prevent particular types of development such as residential use. Typically applicable to an area, not an individual parcel.	Eliminated. Would not prevent direct contact with overlying soil and/or sludge. Would not protect ecological receptors or the environment or promote restoration of site to residential use.

TABLE 6 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment	Horizontal Barriers	Low permeability cap	Clay, asphalt, concrete, or multi-media cover over areas of contamination to prevent direct contact and minimize leaching of contaminants from the sludge/waste into groundwater and subsequent discharge to the Nashua River.	Eliminated. Not effective for preventing the release of contaminants to environment due to sludge/waste located below the water table in Areas 1 and 2. May not be viable in floodplain area (Area 2); would alter flood capacity.
		Permeable cover	Crushed stone or vegetative cover to prevent direct contact and minimize erosion and surface migration of sludge/waste contaminants.	Eliminated. Not effective for preventing the release of contaminants to environment because infiltration not restricted and sludge/waste located below the water table in Areas 1 and 2. May not be viable in floodplain area (Area 2); would alter flood capacity.
	Vertical Barriers	Slurry Walls	Trench filled with clay or cement slurry to form low permeability wall to restrict horizontal migration of sludge/waste contaminants.	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.
		Grout Injection	Use of pressure-injected cement grout to form impermeable or semi-permeable barrier to restrict horizontal migration of sludge/waste contaminants.	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.

TABLE 6 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment (cont'd)	Vertical Barriers (cont'd)	Sheet Piling	Steel or precast concrete sheet piles used to form barrier to restrict horizontal migration of contaminants	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.
In-Situ Treatment	Thermal Treatment	In-Situ Vitrification	An electrical network is used to melt contaminated soils in-place. Metals are immobilized within a vitreous mass, organics are destroyed by pyrolysis.	Eliminated. Not suitable due to high moisture content of sludge and presence of saturated sludge. Would require excessive energy consumption (and cost) to be effective.
		In-Situ Thermal Desorption	Use of electrically heated in-situ blanket and/or well system to volatilize and oxidize organic contaminants.	Eliminated. Not applicable to inorganic site contaminants of concern. Effectiveness for organics is limited by presence of fine-grained constituents, which increase reaction time due to binding of contaminants.
	Physical/ Chemical Treatment	In-Situ Solidification/ Stabilization	Mixing equipment is used to apply treatment reagents to contaminated soils. Contaminants are physically and/or chemically immobilized in a cement-like mass.	Eliminated. Not applicable to organic site contaminants of concern. Solidification/ stabilization of sludge below the water table would be difficult to implement effectively. May not be viable in floodplain area (Area 2); would alter flood capacity.

TABLE 6 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
In-Situ Treatment (cont'd)	Physical/ Chemical Treatment (cont.)	Soil Flushing	In-situ process which employs a water-based extraction fluid and an injection/extraction well system to flush contaminants.	Eliminated. Less effective in low permeability materials such as site sludge. Not suitable in Areas 1, 2, and 3 due to site hydrogeology (proximity to river). May be difficult to control and direct flow of extraction fluid.
	Biological Treatment	In-Situ Enhanced Bioremediation	Indigenous or inoculated microorganisms (e.g., fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants found in soil/sludge, converting them to less harmful end products. Water, nutrients, and/or electron receptors (such as oxygen or nitrate) may be added to enhance degradation. Biodegradation may be aerobic or anaerobic depending on contaminants present and soil/sludge matrix.	Eliminated. Not applicable to inorganic site contaminants of concern. Bioremediation of organic site contaminants may be possible, but process would likely be difficult to enhance and control due to low permeability sludge matrix and close proximity to river.
Ex-Situ Treatment	Immobilization	Solidification/ Stabilization	Mixing of excavated contaminated materials with treatment reagents to physically and/or chemically bind and decrease the mobility of contaminants. Common treatment reagents include cement, pozzolanic materials, thermoplastics, polymers, and asphalt.	Potentially applicable for secondary treatment of residuals from thermal treatment of sludge/soil. Eliminated as a primary treatment option due to inability to effectively treat organic site contaminants of concern.
	Thermal Treatment	Vitrification	Melting of wastes to entrain contaminants in a stable vitreous residual.	Eliminated. Not suitable due to high moisture content of site sludge. Not applicable to wastes containing >25% moisture content (causes excessive fuel consumption).

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont'd)	Thermal Treatment (cont.)	Thermal Desorption	Contaminated soils are treated at elevated temperatures to volatilize organics, which are subsequently removed and captured or destroyed.	Eliminated. Effectiveness is reduced by binding of contaminants to fine particles in sludge. Not applicable to inorganic site contaminants of concern. Applicability to dioxin waste is limited.
		Incineration	Contaminated soils are heated extremely high temperatures where organic compounds are destroyed through oxidation.	Eliminated as on-site treatment alternative. Not implementable in densely developed residential area. Retained as an off-site treatment alternative.
	Physical/ Chemical Treatment	Soil Washing	Water-based process in which soils are separated into coarse and fine fractions to reduce the volume of materials requiring intensive treatment or disposal.	Eliminated. Complex waste mixtures (e.g., metals with organics) make soil washing difficult and costly. Abundance of fine particles in sludge (onto which contaminants tend to bind) would hinder volume reduction during sludge separation, rendering soil washing ineffective.
		Solvent Extraction	Desorption of contaminants through washing with a solvent solution.	Eliminated. Complex waste mixtures (e.g., metals with organics) make formulating an effective washing fluid difficult and costly. Effectiveness reduced by binding of contaminants to fine particles.

TABLE 6 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont'd)	Biological Treatment	Slurry Phase Biological Treatment	Sludge is combined with water and other additives to create a slurry that is mixed into a bioreactor to keep solids suspended and microorganisms in contact with the sludge contaminants. Oxygen, nutrients, and microorganisms may be added to the bioreactor to optimize the rate of biodegredation. Upon completion of the process, the slurry is dewatered and the treated solids are disposed of.	Eliminated. Not applicable to inorganic site contaminants of concern. Adundance of fine constituents in site sludge would make mixing and aeration difficult and not cost-effective.
Disposal	Landfill	Off-Site Landfill	Transport and disposal of untreated or treated sludge/waste off-site to an approved hazardous waste or solid waste landfill.	Retained.
		On-Site Landfill	Disposal of sludge/waste in a specially constructed hazardous waste or solid waste landfill on-site.	Retained.
	Land Disposal/ Backfill	On-Site Disposal	On-site use of treated soil/sludge as fill material.	Eliminated. Not feasible for materials that are treated off-site.

TABLE 7
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION Into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS			
Overall Protection of Human Health and the Environment	Would meet NTCRA removal action objectives and be consistent with long-term remedial actions.	Would meet NTCRA removal action objectives, but would be less acceptable than Alternatives 1 and 3 in meeting the future residential use RAO	Same as Alternative 1.
	Would prevent direct contact with and ingestion of contaminated sludge/waste, prevent contaminant leaching to groundwater, and reduce erosion and off-site migration of contamination.	Same as Alternative 1 provided that the landfill is properly operated and maintained and is not allowed to erode or degrade.	Same as Alternative 1.
	No unacceptable short-term impacts would be anticipated.	Same as Alternative 1.	Same as Alternative 1.
Compliance with ARARs	Discharge of dewatering effluent to the Nashua sewer system would be implemented to comply with all federal, state and local requirements.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with federal and state floodplain regulations.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state testing and waste identification regulations.	Same as Alternative 1.	Same as Alternative 1.

TABLE 7 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Compliance with ARARs (cont.)	Would comply with state regulations for generators of hazardous waste.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with federal and state regulations for solid and hazardous waste storage facilities.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state air pollution control regulations.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state solid waste regulations.	Same as Alternative 1.	Same as Alternative 1.
Long-term Effectiveness and Permanence	No residual risks, above selected PRGs, would remain at the site.	Residual risk would exist in the form of contaminated sludge/waste in the on-site landfill. If degradation or failure of the engineered landfill liner system were to occur, contaminants could pose a threat to the environment and human and ecological receptors.	Same as Alternative 1.

TABLE 7 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Long-term Effectiveness and Permanence (cont.)	Would be effective in the long term and would be permanent.	Would be effective in the long term and would be permanent provided that the landfill system is properly operated and maintained. Long-term operation and maintenance of the landfill is required to ensure Alternative 2's continued effectiveness.	Same as Alternative 1.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No treatment involved under Alternative 1.	No treatment involved under Alternative 2.	Off-site treatment performed under Alternative 3 (incineration) would reduce the toxicity and volume of contamination in sludge/waste through treatment. Stabilization of treatment residuals (if necessary) would reduce the mobility of contaminants in sludge/waste residuals.
	Would not satisfy statutory preference for treatment.	Same as Alternative 1.	Would satisfy statutory preference for treatment.

TABLE 7 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Short-term Effectiveness	Limited impacts to community, on-site workers, and environment.	Same as Alternative 1.	Same as Alternative 1.
	Increase in heavy vehicle traffic in site vicinity anticipated. Would be addressed through traffic control and coordination with community and state agencies.	Comparable to Alternative 1. Alternative 2 would require less truck traffic to and from the site since excavated sludge/waste would not be transported off of the site. However, duration of site work would be longer.	Same as Alternative 1.
	Potential for sulfide odor and dust emissions (metals, SVOCs, dioxins) during excavation. Emissions monitoring and control measures would prevent or minimize potential problems.	Same as Alternative 1. Emissions issues could be slightly more problematic due to additional onsite handling of sludge/waste during landfill construction.	Same as Alternative 1.
	Increased noise due to site and construction activities. Would coordinate with community to lessen impacts.	Same as Alternative 1.	Same as Alternative 1.
	Estimated duration of on-site removal activities: 11 months.	Estimated duration of on-site removal activities: 16 months.	Estimated duration of on-site removal activities: 11 months.

TABLE 7 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY			
Technical Feasibility	Excavation of sludge/waste below the water table could be technically difficult and adversely impact production rates, but would be technically feasible. Excavation of wastes in vicinity of sewer interceptor would require extra caution, but would be feasible. All other aspects of the Alternative would be readily implementable.	Excavation difficulties same as Alternative 1. May be difficult to design and construct on-site landfill that would contain large volume of waste, and be aesthetically acceptable to nearby residents.	Same as Alternative 1.
	Additional response actions could be implemented, if needed.	Similar to Alternative 1, but additional actions may be more difficult and costly if actions involve modifying the on-site landfill.	Same as Alternative 1.
	Would contribute to the site's long-term remedial action.	Comparable to Alternative 1. Contaminated sludge/waste would remain on site, but would be contained by the landfill liner and cover systems.	Same as Alternative 1

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY (cont.)			
Administrative Feasibility	No permits for on-site work needed.	Approval process for the construction of the on-site landfill may be difficult and time-consuming.	Same as Alternative 1.
	Alternative 1A: Administrative feasibility for off-site disposal of non-hazardous waste would be high. Alternative 1B: Off-site disposal of Area 1 sludge at a RCRA C facility would not provide any additional administrative feasibility issues beyond those for Alternative 1A. Alternative 1C: Administrative issues related to the disposal of Area 1 sludge at a Canadian landfill would be slightly more difficult than those for Alternatives 1A and 1B.	Alternatives 2A and 2B: Since no off-site disposal of sludge/waste would be performed under Alternatives 2A and 2B, no administrative action would be required for disposal. Alternative 2C: Administrative issues related to the off-site disposal of Area 1 sludge at a Canadian landfill would make Alternative 2C more difficult to implement from an administrative standpoint.	Alternative 3-US: Administrative actions required for off-site treatment and disposal of non-hazardous or hazardous waste at an American facility would not be difficult. Alternative 3-CAN: Administrative actions required for the off-site treatment and disposal of sludge/waste at a Canadian incinerator would be more difficult to implement than for Alternative 3-US.
	Administrative approval and analytical data required for discharge of dewatering effluent to the city sewer system.	Same as Alternative 1.	Same as Alternative 1.
	Would require coordination with NHDES and the City of Nashua for construction of the site access road and for traffic controls on Broad Street.	Same as Alternative 1.	Same as Alternative 1.

TABLE 7 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY (cont.)			
Availability of Services and Materials	Qualified contractors for all on-site activities would be available for competitive bidding.	Same as Alternative 1.	Same as Alternative 1.
	Qualified national off-site disposal facilities (RCRA D, RCRA C, and in Canada) capable and willing to receive dioxin-containing waste have been identified during preparation of the EE/CA. Final acceptability of site sludge/waste at any facility would be contingent on the results of waste characterization samples collected during the removal action.	No off-site disposal of sludge/waste would be necessary under Alternatives 2A and 2B. Qualified Canadian facilities have been identified that would be capable of receiving dioxin-containing waste should Alternative 2C be implemented.	Qualified national and international off-site incineration facilities capable and willing to receive dioxin-bearing wastes have been identified during preparation of the EE/CA. Fewer facilities are available than for Alternative 1, particularly in United States. Final acceptability of site sludge/waste at any facility would be contingent on the results of waste characterization samples collected during the removal action.
State Acceptance	To be addressed after close of public comment period.	Same as Alternative 1.	Same as Alternative 1
Community Acceptance	To be addressed after close of public comment period.	Same as Alternative 1.	Same as Alternative 1

TABLE 7 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
COST			
Capital Costs	Alternative 1A: $14,939,000 Alternative 1B: $20,428,000 Alternative 1C: $22,819,000	Alternative 2A: $5,572,000 Alternative 2B: $5,572,000 Alternative 2C: $18,428,000	Alternative 3-US: $69,715,000 Alternative 3-CAN: $50,152,000
Annual PRSC Costs	Years 1-2: $4,000 Years 3-30: $0	Years 1-2: $155,275 Years 3-5: $60,075 Years 6-30: $37,275	Years 1-2: $4,000 Years 3-30: $0
Total Present Worth Costs	Alternative 1A: $14,946,000 Alternative 1B: $20,435,000 Alternative 1C: $22,826,000	Alternative 2A: $6,300,000 Alternative 2B: $6,300,000 Alternative 2C: $19,156,000	Alternative 3-US: $69,722,000 Alternative 3-CAN: $50,160,000

TABLE 8
SELECTION OF PRELIMINARY REMEDIATION GOALS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Contaminants of Concern[1]	Units	PRG[1] based on CR=10-6	PRG[1] based on CR=10-5	PRG[1] based on CR=10-4	PRG[1] based on HI=0.1	PRG[1] based on HI=1.0	NH RCMP Background Soil Conc.[2]	NH S-1[3]	Proposed PRG[4]
Benzo(a)Pyrene	ug/kg	145	1450	14500				700	145
Pentachlorophenol	ug/kg	6958	69580	695800				3300	6958
4-Methylphenol	ug/kg				71289	712890		5000	712891
Dioxin TEQ	ng/kg	16.7*	167*	1670*					1000+
Antimony	mg/kg				7.3	73	1.64	8	73
Arsenic	mg/kg	0.91	9.1	91	5.1	51	11	11	51
Barium	mg/kg				1278	12780		750	12780
Cadmium	mg/kg				8.2	82	1.9	32	82
Chromium#	mg/kg				27375	273750	33	1000	273750
Manganese	mg/kg				1278	12775			12775
Vanadium	mg/kg				128	1278			1278

PRG = Preliminary Remediation Goal

CR = Cancer Risk

HI = Hazard Index

1 The COCs and risk-based PRGs were determined based on the Streamlined Human Health Risk Evaluation presented in Section 2.4. The COCs include all compounds that have a cancer risk greater than 1.0E-06 or a non-cancer HI greater than 1.0 for any exposure scenario. The risk-based PRGs were calculated based on the future residential exposure scenario. See Section 3.2 and 3.2 for additional details.

2 NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5, Table 1; January 1998, revised April 2001.

3 NHDES RCMP Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001. The NH S-1 standards are presented here for reference; however they were not used in selecting the proposed PRGs because they are non-promulgated criteria used as default standards in cases where a site-specific risk assessment has not been performed. Because a site-specific risk evaluation was conducted for this site, the calculated risk-based PRGs are used in place of the S-1 standards.

4 The proposed PRGs for all contaminants except dioxin TEQ are the lower of the site-specific PRGs calculated for a cancer risk of 1.0E-6 and hazard index of 1.0. If the selected risk-based value is below the NH RCMP background soil concentration, then the background concentration is selected as the proposed value.

+ The proposed PRG for dioxin TEQ is EPA's recommended cleanup goal for residential settings (EPA OSWER Directive 9200.4-26: Approach for Addressing Dioxins in Soil at CERCLA and RCRA Sites, U.S. EPA, 1998). This value is proposed for use pending completion of EPA's comprehensive reassessment of the toxicity of dioxin.

* The identified PRGs for dioxin TEQs were calculated using the currently available cancer slope factor (CSF) from IRIS (2002). If the CSF proposed in EPA's recently prepared Draft Dioxin Reassessment (1.0E+6) were used to calculate the PRGs the values would be: 2.5 ng/kg for CR=10-6, 25 ng/kg for CR=10-5, and 250 ng/kg for CR=10-4.

The PRGs for chromium are based on trivalent chromium because hexavalent chromium was detected at the site only sporadically and at low concentrations (below screening levels).

TABLE 9
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 µg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 µg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 9 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

TABLE 10
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate*	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

TABLE 10 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 1 will comply with the substantive requirements of this regulation. Alternative 1 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alteration of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.08 and 353.09)	Relevant and Appropriate*	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

TABLE 11
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 – EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 1 would comply.
State Regulatory Requirements	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including excavation, construction, and bulk hauling.	Alternative 1 would comply with this ARAR since fugitive dust emissions would be controlled and monitored during remedial activities.
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 11 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 – EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

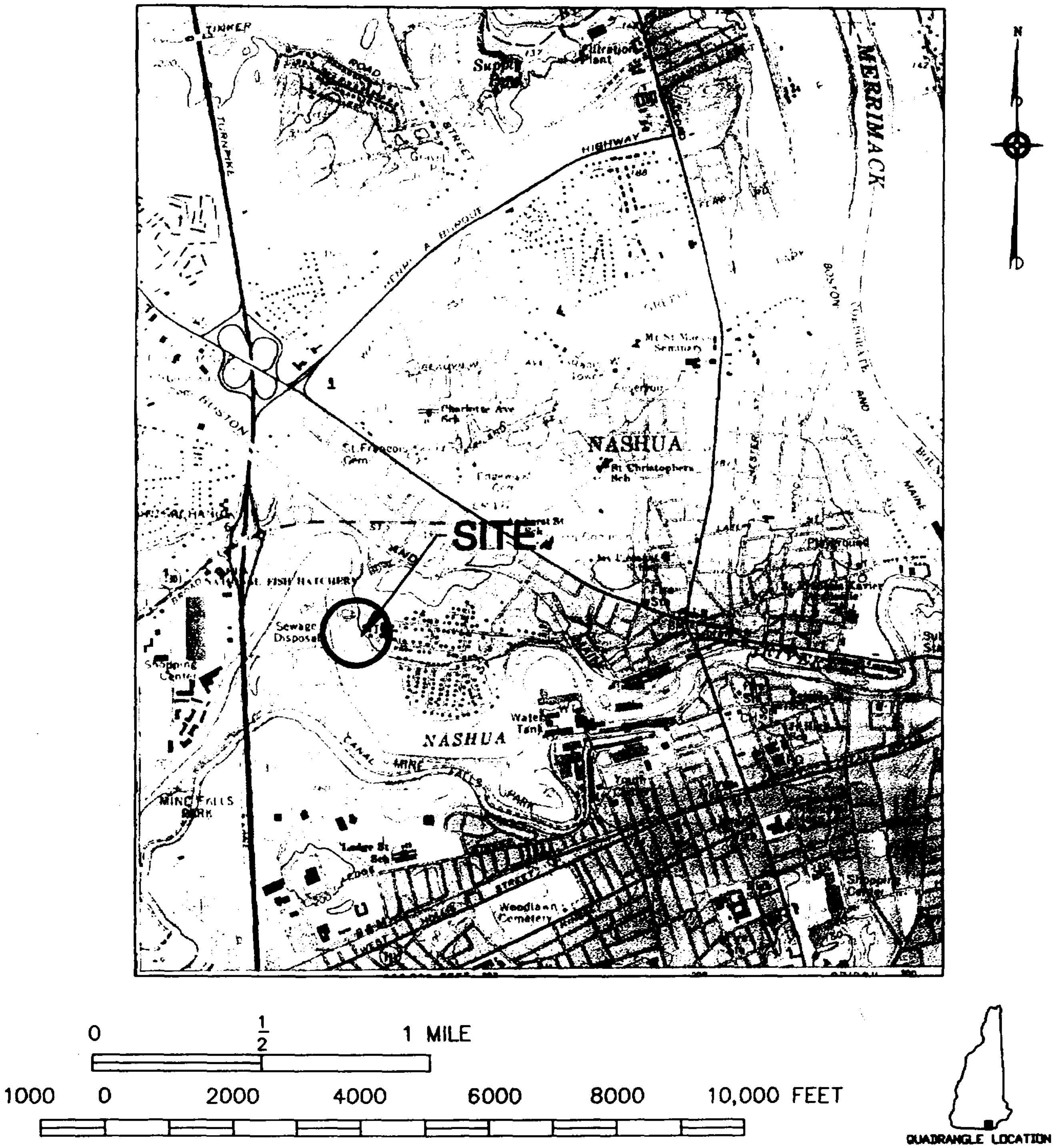
AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements (Cont'd)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid wastes that are subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 1 will comply with the substantive provisions of these regulations.
	New Hampshire General Requirements for Owners and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate*	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	If the excavated waste is characterized as hazardous, Alternative 1 will comply with the substantive provisions of these regulations.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate*	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

APPENDIX B

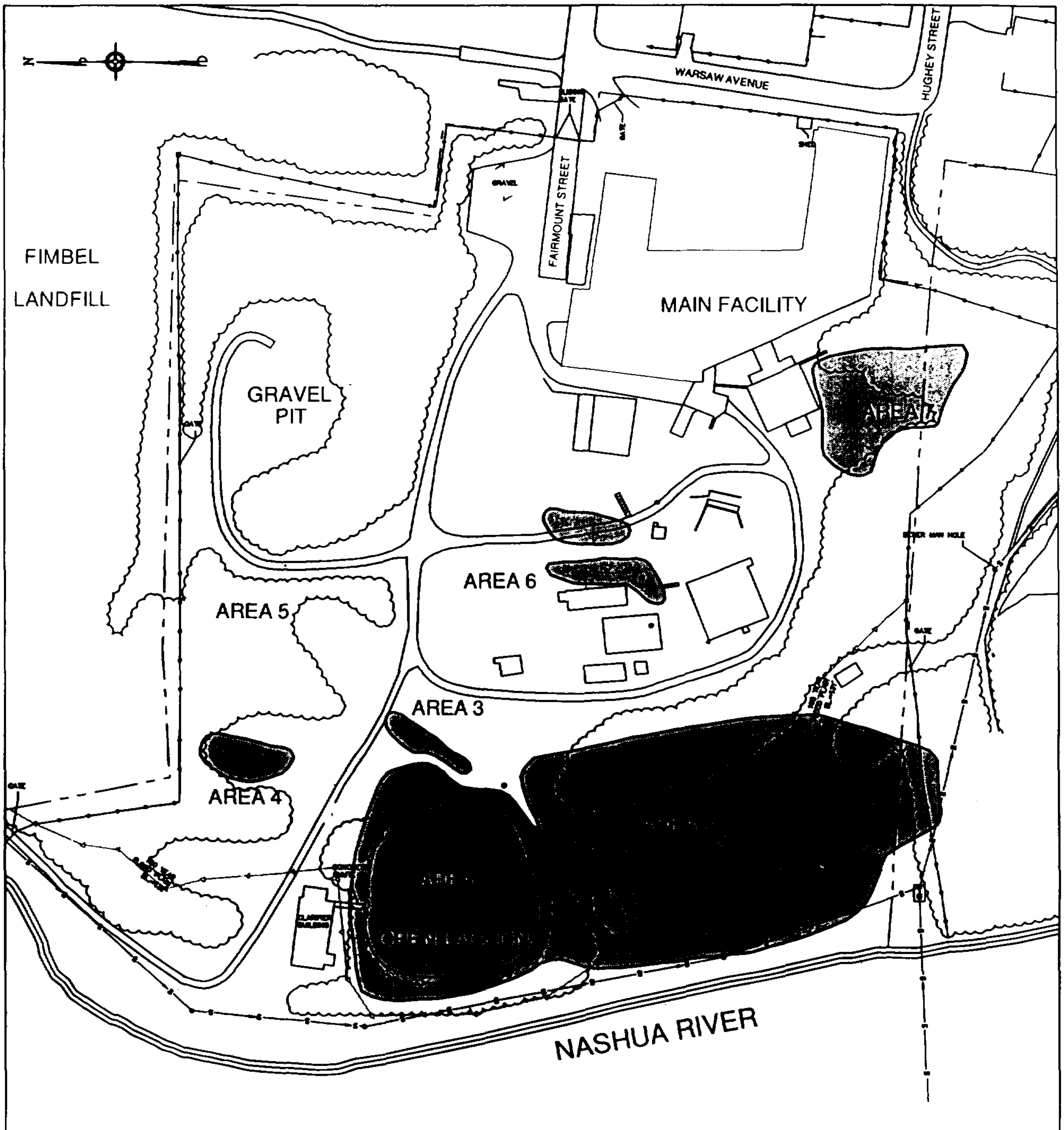
FIGURES

Action Memorandum
Mohawk Tannery Site
Nashua, New Hampshire



NOTE: Base Map from U.S.G.S. Nashua North Quadrangle, New Hampshire, 7.5 Minute Series, 1968, Photorevised 1985

SITE LOCATION				FIGURE 1
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASHUA, NEW HAMPSHIRE				
DRAWN BY:	R.G. DEWSNAP	REV.:	0	55 Jonspin Road Wilmington, MA 01887 (978)658-7899
CHECKED BY:	S. VETERE	DATE:	APRIL, 2002	
SCALE:	AS SHOWN	ACAD NAME:	\DWG\4111\1010\FIGURE_1-1.DWG	



NOTES:
1. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.
2. PLAN NOT TO BE USED FOR DESIGN.

LEGEND

- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- APPROXIMATE PROPERTY LINE
- ESTIMATED LIMITS OF SLUDGE/WASTE

GRAPHIC SCALE
0' 150'
1 INCH = 150 FEET

FIGURE 2
EXTENT OF SLUDGE/WASTE
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

APPENDIX C

RESPONSIVENESS SUMMARY

Action Memorandum
Mohawk Tannery Site
Nashua, New Hampshire

RESPONSIVENESS SUMMARY

MOHAWK TANNERY SUPERFUND SITE

NASHUA, NEW HAMPSHIRE

OCTOBER 2002

UNITED STATE ENVIRONMENTAL PROTECTION AGENCY

NEW ENGLAND REGION

INDEX

PREFACE

The U.S. Environmental Protection Agency (EPA) held a 30-day public comment period, from July 30, 2002, through August 29, 2002, to provide an opportunity for interested parties to comment on EPA's recommended cleanup plan to address the six unlined waste disposal areas at the Mohawk Tannery Superfund Site (the Site) in Nashua, New Hampshire. The cleanup plan, which consists of excavating the waste from the six disposal areas and transporting this waste off-site for disposal, is an interim remedial action, referred to as a Non-Time-Critical Removal Action (NTCRA). The NTCRA is being implemented to accelerate the removal of hazardous substances found in the disposal areas at the Site which may present a risk in the future for residents, if the property is developed in accordance with the current residential zoning. The NTCRA also addresses the risk of future migration of the waste from the Site in the event of a flood.

The cleanup proposal was selected after EPA developed an Engineering Evaluation/Cost Analysis (EE/CA) report that evaluated a number of different options for addressing the waste disposal areas at the Site. EPA presented its recommended cleanup plan in a fact sheet issued to the public at the start of the comment period that began in July of 2002. On August 7, 2002, EPA conducted a public meeting to discuss the EE/CA and the recommended cleanup plan for the Site. On August 20, 2002, EPA held a formal public hearing to receive comments on the recommended cleanup plan. A number of individuals spoke at the public hearing and provided comments. In addition, written comments were provided by several individuals during the 30-day public comment period.

The purpose of this responsiveness summary is to document EPA's response to the comments and questions raised during the public comment period. EPA considered all of the comments summarized in this document before selecting the final cleanup plan to address the waste disposal areas at the Site.

The EE/CA and the public involvement process were developed consistent with EPA's *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (EPA 1993).

The responsiveness summary is divided into the following sections:

Section 1.0. Overview. This section discusses the Site history, outlines the objectives of the EE/CA, identifies the alternatives evaluated in the document, and identifies and summarizes the general reaction to EPA's recommended cleanup plan.

Section 2.0. Background on Community Involvement and Concerns. This section contains a summary of the history of community interest and concerns regarding the Mohawk Tannery Site.

Section 3.0. Comments Received During the Public Comment Period and EPA's Response to Those Comments. Each oral and written comment received on the EE/CA and the recommended cleanup plan is responded to directly.

Attachment A This attachment provides a copy of the written comments provided to EPA during the public comment period.

Attachment B This attachment is the transcript of the public hearing held in Nashua, New Hampshire on August 20, 2002.

Attachment C This attachment provides a copy of the revised cancer and noncancer risk summary tables.

1.0 OVERVIEW

The Mohawk Tannery Site (a.k.a. Granite State Leathers) is located at the intersection of Fairmount Street and Warsaw Avenue in Nashua, New Hampshire. The Mohawk Tannery Site (the Site) is the former location of a leather tanning facility which operated on the property from 1924 to 1984. The Site consists of two adjacent properties, a developed parcel to the north and an undeveloped parcel to the south. Each parcel is about 15 acres. The inactive tannery facility, which is the focus of the Non-Time-Critical Removal Action (NTCRA), is situated on the northern parcel. The tannery is bordered by the Nashua River to the west, the Fimbel Door Company to the north, and residential areas to the east and southeast. As of 1990, the total number of people living within one mile of the Site was 1,470.

Several structures used in tannery operations, as well as debris from several demolished structures, still remain at the Site. Remaining structures include: the main facility building; a smaller control building attached to the main building; and portions of the former wastewater treatment system. Although the tannery shut down in 1984, portions of the main building have been used since then by the owner and several renters for storage purposes. The property, although formerly industrial, has been re-zoned residential by the City of Nashua. Future development of the Site is very likely, given its close proximity to downtown Nashua.

Little is known about the tannery's effluent treatment practices prior to the 1960's. In general, industry practice prior to that time did not require any treatment of wastewater prior to its discharge into nearby waterways. In the 1960's the facility began providing some treatment of wastewater prior to its discharge into the Nashua River. Two unlined lagoons were constructed along the western side of the Site approximately 60 feet from the Nashua River. These lagoons are located predominantly within the 100-year floodplain of the Nashua River.

Initially, treatment within the two lagoons consisted of combining acid and alkaline waste streams and allowing the solids to settle out before the liquid fraction was discharged to the river. Periodically, the sludge from the two lagoons was dredged and disposed of in several other disposal areas on the property. During the 1970's, a new treatment facility was constructed at the Site and it was reported that sludge located in the vicinity of the new treatment facility was transferred to several other areas at the Site. In 1980, materials including hide scraps and other miscellaneous refuse that were located near the main facility were excavated and moved to the southwest in preparation for the construction of the control building.

A majority of the lagoons and disposal areas at the Site have been covered with varying amounts of fill material and allowed to naturally revegetate. The one exception is the Area 1 lagoon, an open lagoon approximately one acre in size, that contains approximately 25,000 cubic yards of wet odorous waste material.

During the 1980's, dried sludge from the tannery was placed in a PVC-lined landfill on the adjacent Fimbel Door Company property (Fimbel Landfill). The Fimbel Landfill has since been capped with a low permeability cover and closed under New Hampshire State Regulations. The Fimbel Landfill was not evaluated as part of this NTCRA.

While operating, the tannery used numerous hazardous substances in the preparation and tanning of animal hides including chromium, pentachlorophenol, and 4-methylphenol. Dioxin has also been found at the Site and is believed to be a by-product associated with the use of pentachlorophenol and other chlorinated phenolic compounds in the treatment of hides. Based on earlier investigations it appears that the southern undeveloped parcel has not been impacted by contamination associated with past operations and waste disposal practices at the tannery.

EPA investigations concluded that during the time that the tannery operated, hazardous substances, such as those mentioned above, were discharged directly into the Nashua River and deposited into the lagoons and waste disposal areas at the Site. There are approximately 60,000 cubic yards of waste at the Site. A majority of the waste is located within the 100-year floodplain of the Nashua River. The waste at the Site has not been disposed of in a manner which would prevent human exposure nor the washout of materials in the event of a flood.

The Site was proposed for inclusion on the National Priorities List (NPL) in May of 2000, based upon letters of support from both the City of Nashua and the State of New Hampshire. In July of 2002, the City of Nashua submitted a letter to Senator Bob Smith of New Hampshire requesting that finalization of the Site on the NPL be delayed at this time. It is EPA's understanding that the City is exploring alternative means for funding the cleanup of the Site. In response to the City's request, the Mohawk Tannery Superfund Site was not included in the most recent group of sites to be finalized on the NPL on September 5, 2002.

With regard to actual or potential exposure to nearby human populations, EPA has documented elevated levels of hazardous substances including, but not limited to, dioxin, 4-methylphenol, pentachlorophenol, antimony, and chromium in the six unlined waste disposal areas at the Site. At least one of the disposal areas (Area 1) at the abandoned tannery remains open and uncovered, with wastes easily accessible to persons trespassing on the property. The Site abuts a densely settled neighborhood and there is evidence of children (mainly adolescents) entering the Site and playing in and around Area 1 potentially exposing themselves to the hazardous substances present there. Additionally, the Site has been zoned residential and future development of the property is likely, given its close proximity to downtown Nashua. Development of the Site without any further remediation would have the potential to expose future residents (both children and adults) to hazardous substances buried in many of the disposal areas.

The findings of the Streamlined Human Health Risk Evaluation strongly indicates that there are unacceptable risks to the public, primarily to future residents, if the property is developed in accordance with the current residential zoning.

One of the primary substances of concern in the six waste disposal areas is dioxin. Levels of dioxin in the six waste disposal areas typically exceed 1 ppb, and concentrations at the Site have been detected as high as 2.6 ppb. EPA recommends that 1 ppb (TEQs, or toxicity equivalent) be used as a starting point for the residential soil cleanup level for CERCLA non-time critical removal sites and as a preliminary remediation goal (PRG) for remedial sites (Approach for Addressing Dioxin on Soil at CERCLA and RCRA Sites, OSWER Directive 9200.4-26, April 13, 1998).

The EE/CA report identified the following removal action objectives to address the risks and hazards at the Site:

- Prevent, to the extent practicable, the exposure of human and ecological receptors to contaminants exceeding PRGs established for the Site.
- Prevent, to the extent practicable, the migration of contaminants exceeding PRGs from the Site into the groundwater and the Nashua River.
- Address tannery sludge/waste and associated soil with contaminants exceeding PRGs to restore the Site to its intended residential use.

Over ten different technologies and processes were screened in the EE/CA for their ability to meet the above removal action objectives. The three which best satisfied the screening criteria were fully developed and evaluated as removal alternatives. The three removal alternatives which were evaluated against the required criteria (i.e., effectiveness, implementability, and cost) were:

- Alternative 1 - excavation and off-site disposal in a permitted facility
- Alternative 2 - excavation and on-site disposal in a landfill

- Alternative 3 - excavation and off-site treatment using incineration

1.1 Proposed Cleanup Plan

EPA selected Alternative 1 - excavation and off-site disposal in a permitted facility as its recommended cleanup approach for the NTCRA at the Site. The proposed cleanup plan includes:

- Clearing and grubbing of areas at the Site where excavation, staging, and transportation will take place.
- Improvements to features at the Site such as construction of staging area and grading of roads to facilitate removal action.
- Dewatering of disposal areas which have surface water or waste buried below the groundwater.
- Excavation of contaminated waste and addition of bulking agents and odor control agents, as needed.
- Sampling of stockpiled waste to ensure that disposal facility criteria are met.
- Transportation of waste off-site to a permitted facility.
- Backfilling and grading of excavated areas with clean fill material.
- Re-seeding of excavated areas to prevent erosion.

Alternative 1 best meets the removal action objectives identified for the Site.

1.2 General Reaction to Proposed Cleanup Plan

The overall reaction to EPA's recommended NTCRA cleanup proposal, both at the public meeting held on August 7, 2002, and the public hearing held on August 20, 2002, was favorable. The public was very supportive of the efforts of EPA and the New Hampshire Department of Environmental Services (NH DES) to clean up the Site. Several persons expressed some confusion and concern about the City of Nashua's efforts to delay finalization of the Site on the National Priority List and the potential impacts such efforts might have on the progress as well as the extent of the cleanup. During interviews and public meetings several residents expressed their frustration that the City has not been responsive to their efforts to deal with the tannery. As a result, the relationship between the neighborhood and the City has become strained. This sentiment was evident in some of the oral as well as written comments provided by local residents during the public comment period.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Many of the older residents living in the community abutting the tannery have had, at some point during the operation of the tannery, some involvement and interaction with representatives of either the City of Nashua or the tannery. This involvement and contact may have been through individual conversations, actions of quasi-formal neighborhood groups, or through running for local elected office. The level of community involvement and interest appears to have peaked between the 1960's and the 1980's when odor problems at the tannery were reported to be at their worst. Most of the individuals interviewed as part of the preparation of the community relations plan for the Site indicated that their involvement with tannery officials as well as City officials were less than satisfactory.

Since the tannery closed in 1984, the level of community involvement has decreased. However, many of the residents who lived in the area while the tannery was operating, continue to be distrustful of the tannery owner and the City as a result of past problems. The major historical concerns as identified by the community at public meetings and community interviews had to do with odors and potential health effects associated with the operation of the tannery. More recently though, the community has expressed concerns about the lack of progress in cleaning up the Site, truck traffic going to and from the Site, open access to the Site as a result of "renters" who currently use some of the on-site buildings for storage leaving the front gate open, the owner potentially profiting from the cleanup of the Site, and being able to participate in the decision-making process for determining an appropriate future use for the Site.

3.0 COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES

The following individuals provided comments in support of EPA's recommended cleanup approach for the Site, although it should be noted that some support was conditional.

Written Comments:

- New Hampshire Department of Environmental Services (NH DES) (O'Brien)
- Paula Johnson (Alderman-at-Large)
- Deborah Chisholm
- Stephanie Dufoe
- David Ownen
- Robert Power

Verbal Comments:

- Jeff Rose (Aide to Senator Smith)
- David Gleneck (State Representative, Ward 4)
- John Regan (NH DES)
- Sandy Belknap
- Catherine Corkery (Sierra Club)
- Paula Johnson (Alderman-at-Large)
- Jim Dufoe
- Mary Gorman (State Representative, Ward 4)
- George Crombie (City of Nashua, Public Works Director)
- Stephanie Dufoe
- Dora Yuknovitch
- Mark Plamondon (Alderman, Ward 4)
- Kathy Belknap
- Phil O'Brien (NH DES)

EPA received one other set of written comments which were provided on behalf of the current tannery owner that were critical of the recommended cleanup approach for the Site.

Written Comments:

- Ridgway Hall (Law firm of Crowell& Moring) & Environ (Environmental Science & Engineering Firm retained by Crowell & Moring)

3.1 Response to Comments

<u>Comment 1 - Confusion And/Or Concerns Voiced About City Of Nashua's Alternative Cleanup Plan ("Plan B")</u>

A number of individuals who provided both verbal and written comments expressed confusion and/or concerns about what came to be known at the August 20, 2002, public hearing as the City of Nashua's alternative cleanup plan or "Plan B". Such individuals providing comments on the alternative cleanup plan included: David Gleneck (verbal comment in transcript at pg.33), Sandy Belknap (verbal comment in transcript at pg. 38), Catherine Corkery (verbal comment in transcript at pg. 43), Jim Dufoe (verbal comment in transcript at pg. 49), Mary Gorman (verbal comment in transcript at pg.51), Stephanie Dufoe (verbal comment in transcript at pg. 54, written comment at pg. 1), Kathy Belknap (verbal comment in transcript at pg. 60), Robert Power (written comment at pg. 1), and Philip J. O'Brien (verbal comment at pg. 61 and written comment at pg. 1).

The City of Nashua's plan, as clarified by George Crombie, Director of Public Works, (verbal comment in transcript starting at pg. 51) consists of getting the clean up of the waste disposal areas at the Site (i.e., EPA's recommended cleanup approach for the NTCRA) completed without listing the tannery on EPA's National Priority List (NPL). In attempting to clarify the thought process behind this approach, Mr. Crombie identified that the City was concerned about the length of time it takes to cleanup a site when it is part of the Superfund process and the fact that the listing of a site on the NPL does not guarantee funding for the cleanup. In addition, Mr. Crombie stated that EPA has the ability to perform certain work such as a NTCRA before a site is listed.

EPA Response: The Mohawk Tannery Site was proposed for inclusion on the NPL in May of 2000 based on letters of support provided by the State of New Hampshire (Governor Jeanne Shaheen) and the City of Nashua (Mayor Bernard Streeter). In July of 2000, the City of Nashua submitted a letter to Senator Bob Smith of New Hampshire requesting that finalization of the Site on the NPL be delayed at this time. It is EPA's understanding that the City is exploring alternative means for funding the cleanup of the Site in lieu of placing the Site on the NPL. In response to the City's request, the Mohawk Tannery Superfund Site was not included in the most recent group of sites to be finalized on the NPL on September 5, 2002.

EPA has the authority to perform a NTCRA regardless of whether a site is proposed or finalized on the NPL. However, for funding purposes the distinction of whether a site is proposed or finalized on the NPL can be significant. Sites which are proposed on the NPL are only eligible to request funding for removal activities (i.e., such as the earlier Time-Critical Removal Action at the Site, the NTCRA which is proposed for the waste disposal areas, and the State-lead Remedial Investigation of other potentially impacted areas at the Site). Sites which are proposed but not finalized on the NPL, are not eligible to request funding for remedial activities. An example of remedial work which may be necessary at the tannery, is the cleanup of the groundwater or the cleanup of the Nashua River. Accordingly, EPA can request and compete for funding of the NTCRA as an NPL proposed site. However, EPA would be constrained from requesting any additional funding for the cleanup of the groundwater and/or Nashua River were this to prove necessary, unless the Site were to be finalized on the NPL.

In summary, the distinction between the City of Nashua's plan and EPA's recommended cleanup approach for the Site has to do with whether the Site is finalized on the NPL or not. The method for cleaning up the waste disposal areas at the tannery through a NTCRA, and the cleanup standards which would apply to the NTCRA are the same. EPA is aware that the City of Nashua is attempting to obtain alternative means of funding the cleanup of the Site. However, the likelihood of obtaining alternative funding may be limited.

Comment 2 - Future Use Of The Mohawk Tannery Site

State Representative David Gleneck (verbal comment in transcript at pg.33) stated that he was concerned that the cleanup of the property was being accelerated to aid a developer. Mr. Gleneck wanted to know whether there was a plan for the use of the land after it is cleaned up and whether there was information concerning such a plan which was not being shared with the local community.

Sandy Belknap (verbal comment in transcript at pg. 40) wanted to know what would happen to the Site once it was cleaned up and indicated that the surrounding community's preference for the property was that it to be used as some type of park rather than residential housing.

Alderman Paula Johnson (verbal comment in transcript at pg. 46 and written comment at pg. 1) stated that she has concerns with the future use of the Site whether it is used for housing or recreational space. Ms. Johnson stated that her concerns relate to what contamination might remain at the Site even after the cleanup is completed. Ms. Johnson wanted to know how the public might be informed about such potential risks and what sort of long-term monitoring would be used to protect the public after the Site is cleaned up.

Alderman Mark Plamondon (verbal comment in transcript at pg. 58) stated that his personal goal is to turn the property into parkland and annex it to Mine Falls Park.

EPA Response: EPA has stated previously that the determination of the most appropriate future use of the Site after it is cleaned up, is a local decision. Based on the current zoning, EPA has used residential standards to guide its proposed cleanup of the Site. However, the use of this cleanup standard is not an endorsement of any one use over another. Again, the determination of the future use of the property must be made locally.

EPA has not been privy to, nor is EPA aware of any discussions between City of Nashua Officials and a private developer concerning the future use of the property. The speed with which EPA and the NH DES have moved to implement the cleanup of this Site reflects an attempt on the part of both agencies to be as responsive as possible to the surrounding community and City of Nashua Officials. Both the community and the City have clearly expressed a preference for having the cleanup of the Site proceed as quickly as possible.

As part of the implementation of the NTCRA, EPA will take confirmation samples of the remaining soil upon the removal of the waste from the disposal areas to ensure that the risks identified by EPA as part of the Engineering Evaluation/Cost Analysis have been eliminated. In addition, upon completion of the confirmation sampling, the excavated areas would be backfilled with clean fill. In some cases, there may be as much as 15-20 feet of clean fill placed above the areas which are excavated. The clean fill will provide an additional buffer to persons living or recreating at the Site. It is also likely that there will be a need for post-excavation monitoring of the groundwater to determine what impacts the removal of the wastes have had on the groundwater. The extent and duration of such monitoring would be determined based on the results of the ongoing Remedial Investigation at the Site. Information obtained during the NTCRA as well as during any long-term monitoring would become part of the public record for Site. Such information would continue to be made available at the Nashua Public Library, the local repository for the Site.

Comment 3 - Mohawk Tannery Site's Relationship To Brownfield's Revitilization Efforts

State Representative David Gleneck (verbal comment in transcript at pg.33) requested clarification as to why the Mohawk Tannery Site is linked to the Brownfield's Revitilization efforts which are associated with a number of properties located along Broad Street in Nashua, New Hampshire.

Stephanie Dufoe requested clarification (written comments at pg. 1) on whether Brownfield's funding was going to be used for the cleanup of the tannery.

EPA Response: The Mohawk Tannery Site was initially mentioned as part of the Brownfield's Pilot Assessment fact sheet published by EPA on its Brownfield's Web Site in March of 1999. At the time of the fact sheet, a decision had not been reached on whether to pursue the cleanup of the Mohawk Tannery Site under EPA's Superfund program. It was not until approximately March of 2000, that EPA was requested by both the State of New Hampshire and the City of Nashua to place the tannery on the NPL. With the proposed listing on the NPL in May of 2000, the Site became eligible to use Superfund money for the cleanup. Once eligible for Superfund money, the site was no longer eligible to be part of the Brownfield's Pilot Assessment nor could the Site receive funding associated with the Brownfield's program.

Comment 4 - Regarding The Current Use Of The Mohawk Tannery Site And The Owners Ability To Profit From The Cleanup Of The Site

Sandy Belknap stated (verbal comment in transcript at pg. 40) that the community does not want the current property owner to continue to profit from the Site after the cleanup is completed. She also expressed concerns regarding the commercial business activities that continue to occur at the property and the associated truck traffic.

David Owen asked (written comment at pg. 1) whether the current owner of the Site will be permitted to continue operations at the site if the EPA cleanup occurs.

EPA Response: Although the details of EPA's enforcement efforts against the current property owner are outside the scope of this public comment period, EPA intends to aggressively pursue the recovery of cleanup costs incurred at the Site from all responsible parties, including the property owner. The placement of a lien on the property is one example of the cost recovery efforts implemented by both EPA and the State of New Hampshire. The proceeds realized by the owner through the sale of the property, would have to be used to offset the cleanup costs incurred by EPA and the State of New Hampshire as a result of these liens. The costs incurred by EPA and the State are likely to be significantly higher than the value of the property after it is cleaned up. As a result, it is unlikely that the property owner will profit from the cleanup.

The appropriateness of current and future commercial use of the Site and associated truck traffic is a local zoning and enforcement issue. EPA and the NH DES will continue to work with City of Nashua Officials to monitor the Site and ensure that current commercial activities do not impact the proposed cleanup of the Site.

Comment 5 - Disposition Of Wastes From The Mohawk Tannery Site

David Owen requested clarification (written comment at pg. 1) as to how the waste from the Site will be disposed of. Mr. Owen wanted to know how the waste could be disposed of in a landfill if it was a hazardous waste.

Paula Johnson stated (verbal comment in transcript at pg. 45) that she was concerned that wastes from the tannery were going to be taken to the City landfill as part of the proposed cleanup approach for the Site.

EPA Response: In April of 2002, the NH DES completed an updated hazardous waste determination for the sludge/waste from the Site using data gathered during the EE/CA. The data and the NH DES determination support the current assumption that waste from the Site would not be considered a RCRA hazardous waste. Accordingly, the approach identified for the NTCRA is to excavate the contaminated waste found in the six unlined disposal areas at the Site and then transport the material off-site for disposal in a RCRA Subtitle D landfill (i.e., a municipal solid waste landfill). During implementation of the NTCRA, excavated waste will be segregated into stockpiles while awaiting the sampling results required by the disposal facility. The waste will be shipped to a permitted Subtitle D landfill assuming the sampling results continue to demonstrate that the waste is non-hazardous. In the event that any waste is determined to be a RCRA hazardous waste, EPA will make the appropriate arrangements to have the waste taken to a facility which is permitted to accept hazardous waste.

EPA and the NH DES did have some initial discussions with City of Nashua Officials concerning the possibility of using the City landfill for disposal of some or all of the waste from the Site. Due to a number of issues which were raised during these preliminary discussions, the use of the City landfill did not appear to be a viable alternative. The selection of the final disposal facility will be determined as part of the contractor bidding and selection process, and there will be additional opportunities before then for the public to provide input on this issue.

Comment 6 - Cost Of Cleaning Up Superfund Sites

David Owen requested information (written comment at pg. 1) on how much taxpayer money is used to clean up superfund sites.

EPA Response: As of January 2002, EPA has spent over $124 million on sites listed on the NPL in New Hampshire. A further breakdown of the dollars spent by EPA on NPL Sites throughout New England can be found in EPA New England's 2001 Superfund Annual Report, a copy of which can be viewed at EPA's website located at: http://www.epa.gov/ne/superfund/resource/report01/index.htm. On a national level, in 2002, EPA expects to have spent more than $735 million to conduct site response work and support state and tribal programs. Of this amount, $155 million was spent for removal actions; $272 million was spent for assessment, investigation, remedy selection and design, and state, tribal and community involvement; and $308 million was spent for long term cleanup work (remedial actions and long-term response actions).

Comment 7 - Off-Site Transportation Of Waste From The Site

Deborah Chisholm stated (written comment at pg. 1) that she was concerned with one of the alternative routes being considered by EPA for transportation of waste from the Site to its ultimate off-site disposal location. Specifically, Ms. Chisholm was concerned about EPA using the railroad tracks to the north and east of the Site, or a path for vehicular traffic leading from the Site across Fimbel property toward Broad Street. Ms. Chisholm is concerned about the proximity of the above transportation routes to the Creative Years Development Center located on Broad Street.

EPA Response: EPA is at the very early stages of identifying potential routes and modes of transportation for taking the waste off-site. However, given the tannery's physical location, there are a limited number of options available for transporting the waste off-site. Waste can either be transported from the Site through the densely populated residential neighborhood located along Fairmount Street or to the north across the Fimbel

Door commercial property which is located behind the Creative Years Development Center on Broad Street. EPA will continue to work closely with the community to determine the safest and most appropriate way to remove the waste from the Mohawk Tannery Site and will not make a decision regarding the final route and mode of transportation until after a contractor has been selected to design and perform the actual cleanup work. The selected contractor may have additional suggestions regarding transportation options. There will be additional opportunities for the public to provide input on this issue before a final decision is reached.

Comment 8 - No Present Health Risk At The Site And Future Use Scenario

Ridgway Hall states in his comments (written comment at pgs. 3 and 4) that the U.S. Department of Health and Human Services performed a public health assessment for the Site and issued a report dated August 22, 2001, which concluded that the Site posed "No Apparent Health Hazard". Mr. Hall also states that EPA and the NH DES have reached a similar conclusion but have recommended a response action based on anticipated future residential use of the property. Mr. Hall further states that it is not realistic for EPA to assume that residential housing would be built in the flood plain areas or in any of the former sludge disposal areas (Areas 1-7). Instead, Mr. Hall states that any such residential units would be built in the upland areas to the east where the groundwater is located 70 feet below the surface and where there is no historic site contamination. Accordingly, Mr. Hall states that it is highly questionable whether such future use requires the excavation of 60,000 cubic yards of soil.

EPA Response: There are several important things to note in regard to the Public Health Assessment completed by the New Hampshire Department of Health and Human Services Bureau of Environmental and Occupational Health (NH DHHS) in consultation with the Agency for Toxic Substances and Disease Registry (ATSDR) on August 22, 2001. First, the Public Health Assessment was based upon historical data gathered prior to EPA's completion of the EE/CA and does not reflect the recent data which was made available to the public along with the release of the EE/CA in July of 2002. Overall, the sampling completed during the EE/CA was more extensive and comprehensive than the earlier investigations and there are significant differences between the earlier results and the results of the EE/CA. For example, the concentrations of dioxin detected in older data from Area 1, which was used as the basis for the conclusions drawn in the Public Health Assessment for the current use or trespassers scenario, were much lower (by at least an order of magnitude) than those found during the EE/CA. The higher concentrations identified in the EE/CA might have impacted the final conclusions drawn in the Public Health Assessment for the current use exposure pathway.

Secondly, the Mohawk Tannery Site Public Health Assessment also included the following two public health conclusions: 1) that exposure to dioxin buried in the sludges could potentially result in adverse health effects for future Site users, if the Site were to be redeveloped; and 2) that an event, like a 100-year flood, could cause the release of contaminated sludges to the river, thereby increasing opportunities for exposure for human receptors downstream of the Site. To address these concerns, the Public Health Assessment recommended that residential or other public uses of the Site not occur until the contaminated sludges in Areas I and II and other contamination at the Site have been remediated. In addition, the Public Health Assessment further recommended that the contaminated sludges in Areas I and II should be removed in a timely manner to prevent a release of contaminants following a catastrophic event such as a major flood. In summary, the recommendations provided in the Mohawk Tannery Site Public Health Assessment reach the same overall conclusion as identified by EPA in the EE/CA, that potential future risks at the Site support a Non-Time-Critical Removal Action.

EPA does not agree with the premise that there would be no potential for exposure or contact by persons living at the Site with the waste located in the floodplain or in any of the former sludge disposal areas because it is unlikely that residential development would take place in any of these areas. EPA believes that persons living at or frequenting the Site would have the potential to be exposed to unacceptable risks whether or not development physically takes place in the waste disposal areas. Although several of the waste disposal areas have been covered with fill, the thickness of the fill as well as its ability to limit human exposure and migration of contaminants in the future is certainly questionable.

It should be noted that any consideration for leaving the waste at the Site would require that all waste located below the water table be removed, treated, or contained either on-site or off-site in accordance with State regulations. Approximately 50 percent of the waste placed in Areas 1 and 2, the two largest disposal areas at the Site, is located below the water table. Thus, State requirements would not be satisfied by leaving the waste in place and covering the material with fill because State regulations do not allow waste below the water table to be left in place.

In effect, the approach and the requirements for leaving any waste in place at the Site would be similar to what EPA has identified as Alternative 2 in the EE/CA (e.g., excavation and on-site disposal in a landfill). As explained in greater detail in the EE/CA, an on-site landfill, although protective of human health and the environment, was not selected for the Site because of the long term operation and maintenance required to ensure its protectiveness and because it places greater restrictions on the future use of the property.

Comment 9 - The Sludge Is Not A RCRA Hazardous Waste

Ridgway Hall states in his comments (written comment at pgs. 4 - 6) that EPA and Tetra Tech have correctly determined that the sludge and contaminated soil at the Site are not "RCRA hazardous" and therefore can be properly disposed of at a municipal solid waste landfill. In Mr. Hall's ensuing discussion, he provides additional details affirming his belief that the waste is not hazardous and explains why it would be legally unsound for the EPA and the NH DES to base a finding of "reactivity" within the regulatory definition based upon guidance which EPA has withdrawn and which therefore has no legal or regulatory force or effect whatsoever.

EPA Response: Sampling data and the results of the NH DES waste determination support the conclusion that it is appropriate to dispose of the waste from the Site as a non-hazardous waste. However, this conclusion will be confirmed through a waste characterization sampling program that will be put into place during implementation of the NTCRA. Excavated waste will be segregated into stockpiles and tested for a number of different parameters including the Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics.

The withdrawal of the cyanide and sulfide guidelines for determining the RCRA hazardous waste characteristic of reactivity, will likely mean that EPA and the NH DES will have to base a future determination for reactivity on the regulatory criteria identified in 40 CFR Part 261.23. This section of the regulations states that a solid waste exhibits the characteristic of reactivity if a waste, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in quantities sufficient to present a danger to human health or the environment.

Comment 10 - There Are No Impacts From the Site To Off-Site Receptors

Ridgway Hall states in his comments (written comment at pg. 6) that the EE/CA report in its ecological effects assessment appears to express some concern for benthic organisms, river sediment and aquatic receptors which could only be exposed to contamination from the Site if there was ongoing migration of surface water or groundwater to the river or other off-site receptors. Mr. Hall questions whether there is any evidence of such impact from the Site to off-site receptors.

Environ in its comments (written comment at pg. 2) states that the streamlined ecological risk evaluation was a screening-level analysis that identified only the potential for adverse ecological effects. Therefore, Environ states that the streamlined ecological risk evaluation may indicate that a more detailed ecological assessment is warranted but it does not demonstrate that a removal action is warranted.

EPA Response: The streamlined ecological risk evaluation completed during the EE/CA did not attempt to quantify potential impacts to off-site receptors from factors including: the direct discharge of wastewater from the tannery into the Nashua River over its many years of operation; the migration of contamination from the waste into the groundwater; and the catastrophic release of wastes from the Site into the Nashua River in the event of a flood. Such risks will be considered during the Remedial Investigation (RI) which is being completed separately from the NTCRA. There is clearly a need for such an investigation, given the proximity of the waste disposal areas to the Nashua River and the groundwater, and the operational history of the tannery during which hundreds of millions of gallons of wastewater, both treated and untreated, were discharged into the Nashua River.

Instead, the streamlined ecological risk evaluation completed during the EE/CA focused on the current and future impacts of the waste disposal areas at the Site to on-site ecological receptors. This screening-level evaluation used conservative screening values to identify all contaminants which might pose an ecological risk. Contaminant concentrations were compared against screening values to identify contaminants of potential concern (COPCs). COPCs do not necessarily pose a risk to ecological receptors, but rather indicate a potential risk that might warrant further investigation.

The ecological risk evaluation identified potential risks to ecological receptors from exposure to wet sludge and surface water in Area 1 and surface soils in Areas 2 through 7. These exposure pathways exist for ecological receptors that are likely to be currently using the Site. Such receptors include: red-tailed hawks, crows, bluejays, white-tailed deer, woodchuck, raccoon, beaver, rabbit, and rodent sized mammals. Sightings of wildlife within the Area 1 disposal area, an open lagoon containing up to several feet of standing water, include painted turtles, bull frogs, green frogs, mallards, and Canada geese. The results of the ecological evaluation indicate that, based upon the magnitude by which several contaminants exceed their respective screening level benchmarks, that contaminants at the Site pose a real concern for ecological receptors. The conclusions of the streamlined ecological risk evaluation also discusses the need for performing a more in-depth ecological risk assessment for the Site in the future, but suggests that if there is insufficient time to perform such an assessment, that the removal of tannery waste is justified based on the current ecological screening results.

Although the scenario of potential impacts to off-site receptors was not addressed as part of the streamlined human and ecological risk evaluations, a catastrophic event such as a flood could release tens of thousands of cubic yards of waste into the Nashua River. The Nashua River is an important component of the regional wildlife habitat. In addition, there is a drinking water intake located approximately 14 miles downstream on the Merrimack River which serves a population of over 100,000. Accordingly, there could be increased opportunities for human and ecological exposures downstream of the tannery to contaminants from the Site in the event of a future release.

Comment 11 - Potential Impacts on Groundwater Quality

Ridgway Hall notes in his comments (written comment at pg. 6) that the groundwater beneath the Site is not used for drinking water and refers to a statement made in the EE/CA concerning the sampling of two residential wells located approximately one-half mile southeast of the Site as further proof that there isn't any site-related impact to the groundwater. The EE/CA identifies that the two residential wells were sampled for volatile organic compounds and metals by the NH DES in October 1994 and that there was no evidence of contamination related to the Site.

Environ in its comments (written comment at pgs. 2 - 3) states that the results of the EE/CA investigation do not demonstrate that migration of contaminants from the Site to the groundwater has adversely affected (or has the potential to affect) drinking water supplies or the Nashua River. Environ refers to the groundwater monitoring data obtained by the NH DES (2001), which Environ states was not reported in the EE/CA, as further proof that the Site is not having an adverse effect on groundwater.

EPA Response: The streamlined human health risk evaluation contained in the EE/CA focused on the risks posed to human health by the Site in its current abandoned condition, as well as in the future for residents if the property is developed in accordance with the current residential zoning. As discussed in Section 2.4 of the EE/CA, the purpose of the streamlined evaluation is to evaluate the exposure scenarios associated with the media of concern that could pose the greatest potential risks. As a result, the streamlined risk evaluation did not investigate or quantify potential risks associated with any groundwater exposure pathways. The groundwater exposure pathways and associated risks will be studied during the RI at the Site which is expected to begin during the Spring of 2003.

It should be noted that a brief discussion of the NH DES groundwater sampling event (May of 2001) is provided in the last paragraph of Section 2.3 (pg. 2-36) of the EE/CA. The groundwater sampling results indicate the presence of several contaminants in the groundwater, which were also found associated with the tannery waste, at concentrations above State of New Hampshire Ambient Groundwater Quality Standards. In summary, EPA believes that the risks identified in the EE/CA for future residents are sufficient to support the NTCRA. The potential for past waste disposal practices to have also impacted the groundwater supports the need for future investigation of this media as well.

Comment 12 - The Site Does Not Qualify For The NPL

Ridgway Hall in his comments (written comment at pg.7) questions whether a hazard ranking score in excess of the cut-off level of 28.5 is warranted for the Site based on the current factual status of the Site including the completion of a removal action at the Site by EPA in January, 2001.

EPA Response: This comment addresses matters which are not the subject of the public comment period for the EE/CA and EPA's proposed cleanup plan for the Site. Comments concerning the listing of the Site on the NPL, which were submitted to EPA during the May 2000 public comment period for the proposed listing of the Site, will be responded to by EPA Headquarters as part of the Mohawk Tannery NPL Comment Response Package.

Comment 13 - Potential Impact of Flooding Events

Environ in its comments (written comments at pgs. 3 - 4) states that all of the disposal areas with the exception of Area 1 have soil covers that are generally several feet thick, are essentially uncontaminated, and are vegetated so that there is no reasonable potential for overland migration of waste during normal precipitation events. Environ acknowledges that preventing sludge in Area 1 from entering the Nashua River in the event of a severe flood is an appropriate objective for remedial actions at the Site. However, Environ states that the EE/CA did not evaluate the effectiveness of the existing berm for achieving this objective or consider measures short of complete sludge removal that might be more appropriate (such as closing the lagoon in place with a soil cover, perhaps after removal of the uppermost portion of the sludge).

EPA Response: As discussed in the EE/CA, a majority of the waste contained in Area 2 (estimated volume of approximately 30,000 cubic yards) is located within the 100-year floodplain of the Nashua River. The Area 1 lagoon is not located within the 100-year floodplain due to the elevation of the earthen berm that has been constructed around its perimeter. If the berm were ever breached during a 100-year flood event, then the contents of the lagoon, approximately 25,000 cubic yards of waste which are located below the 100-year flood elevation, could be released into the river. Neither the soil cover over the waste in Area 2 nor the earthen berm surrounding Area 1 were evaluated for their effectiveness in meeting a 100-year flood event as part of the EE/CA. However, it is clear from the physical condition of both and an earlier documented release from Area 1 into the Nashua River in 1987, that they have not been designed and constructed to prevent the washout of hazardous substances.

It should also be noted that the implication that the long-term risks at the Site would be eliminated and that all of the regulatory requirements would be met by removing the uppermost portion of the waste and covering the remainder with fill is not correct. Under NH DES regulations, all waste located below the water table would have to be removed, treated, or contained either on-site or off-site in accordance with State regulations. Thus, State requirements would not be satisfied by leaving the waste in place and covering it with fill.

Comment 14 - Appropriateness Of Data Used To Evaluate Potential Exposures For Current Trespassers and Future Residents

Environ in its comments (written comments at pgs. 4 - 5) states that the evaluation in the EE/CA of potential exposures for current trespassers to surface material which extends to depths greater than 2 feet below ground surface (bgs), and in the future for residents exposed to soil and sludge in Areas 1 to 7 from depth to 10 feet bgs, is unrealistic and inappropriate. Environ states that if the evaluation of potential exposures of trespassers and future residents to surface material were instead based on the surface soil data for Area 2 to Area 7, the estimates of site-related cancer and non-cancer risks for these areas likely would not exceed a cancer risk of 10^{-4} or a non-cancer hazard index (HI) of 1, respectively.

EPA Response: All of the waste disposal areas, with the exception of Area 1, have been covered to some extent with fill material ranging from 2 to 4 feet in thickness. The surface soil and waste samples obtained from Areas 2 to 7 during the EE/CA attempted to characterize the chemical characteristics of the surface/fill material over its entire depth. A similar approach was taken for obtaining representative samples from Area 1, the open lagoon, during the EE/CA. Since there is no fill material over the waste in Area 1, composite samples were taken from the surface down to the base of the waste material found in this lagoon which was approximately 10-12 bgs.

The results used by EPA to determine the potential risks posed to current trespassers from surface/fill material in Areas 2 to 7 and waste material in Area 1 did extend to depths greater than two feet. However, EPA believes that due to the relatively homogeneous nature of the surface/fill and waste material, that the evaluation of potential trespasser exposures was based on appropriate soil and waste characterization data. In addition, through this approach, EPA was able to maximize the usefulness of the sampling information gathered and thereby address additional data quality needs at no additional cost (e.g., such as determining whether surface/fill material was sufficiently clean to be used as backfill at the Site).

EPA also believes that the evaluation of potential future residential exposure to soil and waste in Areas 1 to 7 at depths of up to 10 feet bgs was based on appropriate soil and waste characterization data. EPA guidance for conducting risk assessments in New England clearly states that subsurface soil exposures are assessed using soil/waste data from 0 to 10 feet bgs. This definition of subsurface soil is based on the general depth of frost penetration in New England soil and the typical depth of excavation for home construction in the region. Typically, soil is excavated to the depth of frost penetration or deeper when constructing a foundation for a house. Mixing of soil occurs due to frost heaving and also due to excavation. EPA assumes that the excavated soil is used as grade material; hence, exposures to soil composited from 0 to 10 feet are assessed under a future land use scenario. In several of the waste disposal areas, wastes were encountered at depths below 10 feet bgs. As a result, some composite samples of the waste in these areas extended to depths greater than 10 feet bgs. EPA believes that due to the relatively homogeneous nature of the waste material contained in these areas such an approach was appropriate.

EPA as part of the streamlined human health risk evaluation did evaluate the potential exposure of a trespasser to soil from Areas 2 to 7 (see Tables 2-25.2a and 2-26.2a attached to the responsiveness summary). The results of the evaluation indicate that the estimates of site-related cancer and non-cancer risks for these areas likely would not exceed a cancer risk of 10^{-4} or a non-cancer hazard index (HI) of 1, respectively. Thus, EPA did not identify in the EE/CA that such a potential trespasser exposure to soil from Areas 2 to 7 would be outside of EPA's acceptable cancer and non-cancer risk values.

For the potential future residential exposure pathway, EPA evaluated soil and waste data from Areas 1 to 7. EPA felt that it was appropriate to include the data from all waste disposal areas, including the open Area 1 lagoon, as part of the potential residential exposure pathway. As discussed above, for a residential exposure scenario EPA assumes that mixing of soil occurs due to frost heaving and excavation. Accordingly, it is appropriate to include the results of the soil column from 0 to 10 feet for exposure calculations as was done for Areas 2 to 7. In the case of Area 1, EPA cannot predict or determine what the ultimate result of mixing Area 1 waste with fill material might be, if fill were to be placed over this area in the future. As a result, EPA has assumed that future residents could potentially be exposed to Area 1 waste (at current concentrations). EPA still believes that the assumption is appropriate given the lack of alternative data. The results of the future residential exposure calculations, which are included in Tables 2.25.3 and 2-26.3 attached to the responsiveness summary, demonstrate that the estimates of site-related cancer and non-cancer risks for these areas exceeds EPA's acceptable cancer and non-cancer risk values (i.e., cancer risk of 10^{-4} and a non-cancer HI of 1, respectively). Thus, EPA believes that an unacceptable cancer and non-cancer risk could exist for potential future residents living at the Site.

Comment 15 - Background Levels of Metals Should Be Accounted For In Risk Identified At the Site

Environ in its comments (written comments at pg. 5) makes several statements about the risks from various metals detected in soil at the Site and questions whether the metals found are related to waste disposal activities at the Site. Environ suggests that the concentrations of some metals (antimony, arsenic, chromium, mercury) may be representative of natural background conditions and bases this statement on comparisons of soil and waste from the Site to a range of concentrations found in the Eastern United States (reference provided by Environ is Dragun and Chiasson, 1991).

EPA Response: EPA compared metal concentrations found in soil and waste at the Site with the state-wide background concentration values identified by the NH DES in the Risk Characterization and Management Policy (NH RCMP). In the absence of site-specific background metal concentrations, these background values were determined to be the most appropriate values to use for the Site as discussed further in Section 2.1.1 and 2.1.2 of the EE/CA. In terms of the general importance and use of background concentrations in the Superfund cleanup process, it is important to note that such concentrations are used by EPA to help with the selection of cleanup goals rather than as a comparison value to be used to eliminate contaminants of potential concern (COPCs) from risk calculations.

The concentrations of arsenic detected in the overlying or surface soils in Areas 2 through 7 were less than the background value identified in the NH RCMP for this compound. Therefore, the arsenic concentrations found in these areas may be representative of background conditions. However, it should be noted that the risk calculations for arsenic in Areas 2 through 7 did not exceed the acceptable values identified by EPA for cancer and non-cancer risks.

Antimony, chromium, and mercury concentrations in one or more of the overlying soil samples analyzed from Areas 2 through 7 exceeded their respective NH RCMP background values. As such, the risks associated with these compounds may be attributable to tannery operations at the Site. However, risk calculations in the overlying soils from Areas 2 through 7 for these metals did not exceed the acceptable values identified by EPA for cancer and non-cancer risks.

Comment 16 - Potential Trespasser Exposure Pathway For Area 1 Did Not Account For Actual Physical Conditions Of Open Lagoon

Environ in its comments (written comments at pg. 6) states that the potential exposure of trespassers to sludge at Area 1 is apparently based on a scenario that ignores the fact that the sludge is submerged under approximately 6 inches of water. Because the sludge is underwater, the degree of a trespasser's contact with sludge would be minimized by the tendency for the water to wash sediment off a trespasser who might wade into the lagoon. Environ does acknowledge that it is at least theoretically possible that a trespasser could be exposed to near-shore, surficial sludge in Area 1. However, the risk evaluation does not explain why it is assumed that the Area 1 sludge data from the borings locations that had to be accessed from a floating platform represent near-shore conditions.

EPA Response: The amount of water covering the waste contained in Area 1 is weather dependent. During the wetter months of the year (spring and fall) the depth of water as well as the extent of sludge covered by the water increases. Conversely, during the dryer months (summer), when it is most likely that adolescent trespassers might be entering the Site, more of the waste is exposed. Even during the wetter seasons there is a significant amount of waste exposed around the periphery of this open lagoon, and during an extremely dry year, such as the drought that existed this summer in much of New England, less than approximately 50 percent of the waste is covered by water.

The most likely scenario for the potential exposure of an adolescent trespasser to waste in Area 1 is through teenagers playing or walking around the edges of the lagoon in direct contact with the waste rather than wading through the water. Given the high organic content and finely grained, wet, cohesive nature of the waste, it acts more like a mud rather than a sediment. Trespassers who come in contact with the waste are likely to be exposed to higher sediment ingestion and dermal loading rates, and hence higher risk estimates, as a result of the mud-like properties of the waste.

Earlier investigations of Area 1 focused primarily on the waste located around the periphery of the open lagoon since these were the areas most easily accessible. In order to better characterize other less accessible portions of the disposal area, EPA's contractor, Tetra Tech NUS, Inc., focused its investigation during the EE/CA on the central portions of the disposal area. Access to the central portions was obtained using a floating platform due to the standing water which was present in that portion of Area 1. Based upon the comparison of sampling results and boring logs from the EE/CA to earlier investigations of Area 1, it appears that the waste encountered throughout Area 1 has similar physical and chemical properties. Thus, the data obtained from the central submerged portion of the Area 1 lagoon is representative of the chemical concentrations and texture found in the near-shore area.

Comment 17 - The Risk Estimates For Potential Trespasser Exposures To Area 1 Were Derived Incorrectly

Environ in its comments (written comments at pg. 6) states that the risk calculations for the trespasser exposure scenario for Area 1 are incorrect for a number of reasons including: 1) exposure point concentrations were incorrectly based on what appears to be dry weight concentrations when they should have been calculated on wet weight basis; 2) the sludge-to-skin soil adherence factor of 231mg/cm^2 used in the risk evaluation is inappropriately high and a value of 21 mg/cm^2 should have been used; and 3) the dermal absorption factor used in the children-in-mud scenario is overly conservative.

EPA Response: The exposure point concentrations for the trespasser exposure scenario for Area 1 should have been calculated on a wet weight basis as identified by Environ. Tables 2-25.1 and 2-26.1 in the EE/CA were recalculated to include the average percent solids value in the non-cancer and cancer risk calculations. The revised risk tables are attached to the responsiveness summary.

EPA selected the 95th percentile soil adherence factor to combine the high end adherence factor (231mg/cm^2) with a typical activity ("children-in-mud") for the Area 1 disposal area, so as to achieve a "high end of a mean" as supported by the EPA Supplemental Guidance for Dermal Risk Assessment (2001). In retrospect this approach may have been overly conservative. Therefore, EPA has recalculated the trespasser exposure scenario for Area 1 using the 50th percentile soil adherence factor of 21 mg/cm^2. The revised risk tables (Tables 2-25.1 and 2-26.1) are attached to the responsiveness summary.

The dermal absorption factors used in the streamlined human health risk evaluation in the EE/CA are those recommended in the EPA Supplemental Guidance for Dermal Risk Assessment (2001). Based on that guidance, the absolute effect of soil loading on soil-to-skin adherence values and dermal absorption values is not sufficiently understood to warrant adjustment of the experimentally determined values. As a result, no changes were made to the dermal absorption factors used in the EE/CA risk evaluation.

Comment 18 - The Risk Estimates For Potential Trespasser Exposures To Areas 2 to 7 Were Derived Incorrectly

Environ in its comments (written comment at pg. 8) states that the risk calculation for the trespasser exposure scenario for Areas 2 to 7 is incorrect because the soil adherence factor of 0.4 mg/cm^2 used is inappropriately high.

EPA Response: The EPA Supplemental Guidance for Dermal Risk Assessment (2001) states that two options exist for selecting soil-to-skin adherence factors. Either a 50th percentile soil-to-skin adherence factor may be used with a high-end activity, or a 95th percentile soil-to-skin adherence factor may be used with a typical activity to achieve a "high-end of a mean". The 0.4 mg/cm^2 soil-to-skin adherence value selected for the trespasser contacting soils in Areas 2 through 7 is the 95th percentile value for children playing in dry soil, a central tendency or typical activity. As a result, no changes were made to the soil adherence factor used in the EE/CA for the trespasser exposure risk calculations for Areas 2 to 7.

Comment 19 - Approach To Evaluating Ingestion Exposures For Trespasser and Residential Scenarios Is Incorrect

Environ in its comments (written comment at pg. 8) states that the adjustment of oral reference dose (RfD) values to account for gastrointestinal (GI) absorption in evaluating ingestion exposures appears to be incorrect for both the trespasser and residential scenarios.

EPA Response: The appropriate methodology was used by EPA for determining ingestion risks associated with the trespasser and residential scenarios. Where available, oral absorption factors for specific contaminants in soil should be included in the estimation of the dose and that dose should be combined with RfD or CSF values that have been adjusted to account for gastrointestinal absorption. Unfortunately, there are very few chemicals for which oral absorption values from soil are available. Therefore, no adjustment to the methodology used by EPA is warranted. It should be noted that an error was identified in the spreadsheets used to calculate non-cancer risks (Tables 2-25.1, 2-25.2a, 2-25.2b, and 2-25.3). The error, which involved the inadvertent use of the "RfDabsorbed" values instead of the "RfDadministered" values to calculate the non-cancer ingestion risks, resulted in the over-calculation of non-cancer ingestion risks for selected metals. Revised tables correcting this error are attached to the responsiveness summary.

Comment 20 - Computation Of Exposure Point Concentrations Uses An Outdated Methodology For Calculating 95% Upper Confidence Limits

Environ in its comments (written comments at pgs. 8-10) states that the computation of exposure point concentrations used a method that follows outdated EPA guidance for computing 95% upper confidence limit (UCLs) for lognormally distributed data. As a result, the calculated 95% UCLs in the EE/CA are usually higher than the maximum detected concentrations, so that maximum concentrations were used as exposure point concentrations. This resulted in the EE/CA overstating actual exposure point concentrations. Environ also states that data sets that were determined to not follow either a normal or lognormal distribution should not have been assumed to follow a lognormal distribution and instead the 95% UCLs for these data sets should have been calculated using a nonparametric method such as the bootstrap method.

EPA Response: The methodology for determining the 95% UCL in the EE/CA was calculated in accordance with EPA Region I Risk Update No. 2 (August, 1994), consistent with the current EPA New England practice. The Region I Risk Update recommends that the 95% UCL be calculated according to EPA Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Publ. 9285.7-081, 1992. This guidance also recommends that the maximum concentration be used as the exposure point concentration if the 95% UCL is greater than the maximum, noting that the true mean still may be higher than this maximum value. With regard to the use of probabilistic methods such as bootstrapping, such procedures are appropriate only for randomly sampled data that is not focused on contamination hot spots. Sampling for the EE/CA was not necessarily random; in some areas the sampling was directed to locations more likely to be contacted by humans. Therefore, bootstrapping is not appropriate.

Comment 21 - Basis For EPA Not Computing 95% Upper Confidence Limits For Sample Sets Consisting Of Less Than Ten Samples

Environ in its comments (written comment at pg.10) questions the basis for EPA using the maximum concentrations for data sets consisting of 10 samples or less instead of computing the 95% upper confidence limit (UCLs) for the data set.

EPA Response: EPA did not calculate 95% UCLs for data sets with 10 samples or less because EPA guidance (EPA Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Publ. 9285.7-081, 1992) states that small data sets provide poor estimates of the mean concentration. It is standard practice within EPA New England to assume that data sets of 10 samples or less are "small" and contain insufficient data for estimating the mean concentration. Therefore, EPA used the maximum concentration as an estimate of the exposure point concentration for data sets with 10 samples or less.

Comment 22 - Soil/Sludge Ingestion Rate For Trespassers Should Have Been Applied With a Fraction Ingested Term Of Less Than One

Environ in its comments (written comment at pg. 10) states that the soil/sludge ingestion rate for trespassers should have been applied with a fraction ingested (FI) term of less than one, because trespassers were assumed to be at the Site for only 4 hours/day and the assumed ingestion rates are based on a full day (16 hours) of soil contact.

EPA Response: For this exposure scenario, EPA has assumed that an adolescent represents the most likely trespasser to the Site. EPA has also assumed that the 4 hours/day that the teenager spends at the Site represents their full daily allotment of soil intake (i.e., during the remainder of the day the teenager is indoors). EPA believes that it is reasonable to assume that an adolescent, given the higher level of play activity they are likely to exhibit, could ingest a similar amount of soil at the Site during those four hours of exposure as an adult could ingest in a full day of outdoor exposure. Thus, EPA believes that an appropriate fraction ingested term was applied to the trespasser exposure scenario.

Comment 23 - Hazard Index Values that Exceed 1 Should be Re-evaluated And Segregated According To The Mechanism Of Toxicity

Environ in its comment (written comment at pg.10) states that Hazard Index (HI) values that exceed 1 should be re-evaluated and segregated according to mechanism of toxicity.

EPA Response: In a streamlined risk evaluation, it is standard practice to segregate non-cancer risks as identified by their respective hazard indices by organ-specific toxicity only when hazard indices are slightly above 1 and no hazard indices for individual contaminants exceed 1. After the recalculation of the non-cancer risks as discussed previously in EPA Comment Responses # 17 and #19, the revised non-cancer risk results, which are attached to the responsiveness summary, were evaluated to see if there was a need to segregate hazard indices by organ-specific toxicity. The results are as follows:

- Trespassers exposed to waste in Area 1 have a HI of 1. The principle contaminant contributing to the non-cancer risk associated with the waste in Area 1 is 4-methylphenol, with a HI value of 1. The primary target organ for 4-methylphenol is the Central Nervous System (CNS). Manganese also effects the CNS, however its contribution to the total HI is minor.

- Trespassers exposed to surface soil/waste in Areas 2 through 7 have a HI of less than 1, thus there is no need to segregate hazard indices by organ-specific toxicity.

- Future residents exposed to surface soil/waste in Areas 2 through 7 have a HI of slightly greater than 1. No individual contaminant HI exceeds 1. The primary target organ for both arsenic and Aroclor 1242 is the skin. However, when added together, the HI's for these two contaminants do not exceed 1. None of the other contaminants when grouped by organ-specific toxicity have an HI which exceeds 1.

- Future residents exposed to all surface soil/waste from Areas 1 through 7 have an HI of 10. Antimony and 4-methylphenol have an HI of greater than 1, with values of 7 and 2, respectively. The primary target organism for antimony is the blood. None of the other contaminants affect the blood. The primary target organ for 4-methylphenol is the CNS. Manganese also effects the CNS, however its contribution to the total HI is minor. None of the other organ-specific HI's exceed 1.

Comment 24 - Number Of Significant Digits Expressed In Risk Assessment Results Should Reflect Uncertainty Associated With Assumptions

Environ in its comment (written comment at pg.10) states that HI estimates (as well as cancer risk estimates) should be expressed with only one significant digit because the assumptions on which these estimates are based (e.g., toxicity values) are not sufficiently precise to warrant the use of more significant digits.

EPA Response: EPA typically retains more than one significant digit when adding up risks in the supporting tables so that the reader can reproduce the calculation results and so that intermediate risks are not rounded prematurely. EPA has included the results of the hazard index and cancer risk estimates expressed with only one significant digit in the revised Summary of Receptor Risks and Hazards Table (Table 2-27) which is attached to the responsiveness summary.

ATTACHMENT A

Written Comments Provided to EPA During the Public Comment Period

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
(603) 271-3644 FAX (603) 271-2181

August 29, 2002

Mr. Neil Handler
Project Manager
U.S. Environmental Protection Agency
One Congress Street, Suite 1100 (HBO)
Boston, MA 02114-2023

SUBJECT: Nashua, Mohawk Tannery, Engineering Evaluation/Cost Analysis – Comments

Dear Mr. Handler,

The Department of Environmental Services (Department) commends EPA on their presentations and your forthright response to questions at the August 7, 2002 Information Meeting and the August 20, 2002 Public Hearing. The two meetings were informative and initiated substantive discussions with the public. In response to those discussions the Department has several questions.

1. NPL Listing Status - Effect on Removal Funding Priority. Currently the Mohawk Tannery Site is proposed for NPL listing and is under consideration to receive final NPL listing. There was considerable discussion at the August 20, 2002 public hearing about whether to proceed with NPL listing for the site. Our understanding is that upon completion of the Action Memo the project will compete for funding to remove the tannery wastewater sludge as a Non Time Removal Action within the Superfund program.

   If a decision is made to no longer proceed with NPL listing, what is the potential effect on the priority to receive the funding to implement the recommended alternative of the Engineering Evaluation/ Cost Analysis (EE/CA)? Specifically, if the NPL listing process stops, does that action change the priority to obtain the needed funding?

2. NPL Listing Status – Effect on Remedial Investigation Funding. The Department is proceeding with the Remedial Investigation (RI). With the available funding the RI is focused on the impacts surrounding the main operational areas of the former tannery. At this time there is not sufficient funding to investigate potential impacts on the Nashua River and there may be a need for additional funding to complete investigations around the building areas. The existing cooperative agreement does not provide money to perform the Feasibility Study (FS) The FS evaluates potential remedial alternatives to address any risks to public health and the environment that are identified in the RI. If NPL listing does not proceed what will be the impact of the ongoing RI work and what is the impact on obtaining additional funding to investigate the Nashua River and complete the Feasibility Study?

The Department has enjoyed working with EPA and City officials on this project and is hopeful that funding can be obtained to remove the sludge as recommended in the EE/CA. The Department appreciates your hard work on the EE/CA. Please do not hesitate to contact John Regan or me if you have questions regarding our comments.

Sincerely

Philip J. O' Brien Ph.D., Director
Waste Management Division

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cc: file
Michael Jasinski, USEPA
Eve Vaudo, USEPA
Angela Bonarigo, USEPA
Peter Roth, AGO
George Crombie, Nashua DPW
Carl Baxter, NHDES via e-mail
Richard Pease, NHDES via e-mail
John Splendore, NHDES via e-mail
Thomas Andrews, NHDES via e-mail
Warren Keane

"Chisholm, Deborah" <ChisholmD@ttnus.com>

08/29/2002 05:38 PM

To: Neil Handler/R1/USEPA/US@EPA
cc:
Subject: Mohawk Tannery Formal Comments

Mr. Neil Handler
Project Manager
US EPA
Suite 1100 (HBO)
1 Congress St
Boston, MA 02114

Dear Neil,

This letter serves as my formal written comments regarding the proposed cleanup plan for the Mohawk Tannery Site waste disposal areas. I concur that the EPA's proposed alternative (excavation and transportation of waste off-site to a permitted facility for disposal and backfilling with clean fill) is the best alternative for this site.

EPA has strongly suggested to local residents that an alternative to Fairmount Street as a route for transporting wastes off-site will be used. The two alternatives currently being considered include the railroad tracks located north and east of the site, as well as a path leading from the site, across the Fimbel property toward Broad Street. I am opposed to either of these routes, and I urge EPA to use the existing Fairmount Street as the transportation route for all vehicles entering and exiting the site.

As a parent of children attending Creative Years Development Center on Broad Street, I oppose using any northerly route to enter or exit the site because a truck or rail route in that direction would pass directly behind Creative Years. Increased rail or truck traffic in that area would adversely impact the ability to conduct classes, and transportation of hazardous excavated materials would present a danger, be it real or perceived, to the 165 children, their parents, and staff of the facility.

Additionally, the distance between the railroad tracks as they cross Broad Street, and the building which houses Nashua Outdoor Power would preclude construction of a road wide enough to safely accommodate trucks, while still allowing vehicle traffic in and out of the parking lot of Nashua Outdoor Power. This would place an undue hardship on this business.

In closing, I submit that any alternative northerly route would have more of an adverse impact on the local community than the use of the existing Fairmount Street. I urge EPA to continue to keep the community involved in the cleanup process.

Regards,

Deb Chisholm
15 Shelburne Road
Nashua, NH 03063

Robert Power
<powerr@nashua.edu>

08/23/2002 01:57 PM

To: Neil Handler/R1/USEPA/US@EPA
cc: "'roopow@earthlink.net'" <roopow@earthlink.net>, Robert Power <powerr@nashua.edu>
Subject: Mohawk Tannery Meeting

Dear Neil,

I was in attendance for the first time the other night in Nashua regarding the Mohawk Tannery so my knowledge of this situation is just beginning. I reside at 14 Orlando Street in Nashua and I am a fairly new resident of Nashua(3 years)

It was an interesting meeting and I learned a lot. The EPA proposed alternative seems to make sense in theory and I endorse it. It just seems that the EPA has the most experience in this matter. It was, however, very confusing following the comments from the city. Supposedly the city has another plan, but the plan was not clearly articulated. Instead, it seemed to me the city representatives merely gave reasons why the EPA proposal should not include the Superfund. These reasons may be extremely valid, but I was confused by the method the city would use to actually clean-up the site, which remains the heart of the issue. As a result, when I left the meeting at 8:45PM I had an understanding of the EPA alternative(PLAN A), an understanding of city's criticism of this plan, but a feeling that there was no real PLAN B. Specifically, if the city were to do the job, who would do the work? Would the EPA still manage the project? If so where would the money come from? In addition, why could the city do the job for 7 million while PLAN A would cost 15 -22 million?

I think the meeting suffered from a lack of a planned agenda.The EPA presentation was succinct and clear. Then it was like trying to follow my fifteen month old son around. There was a lot of rambling topics to grasp.In the future, I would prefer to stick with one topic at a time, such as how will the site be cleaned up and when will it be cleaned up? As a resident, I want the most comprehensive and thorough cleanup possible. That should be the goal. Period. Keep the main thing the main thing.

Sincerely,

Rob Power

Owen David
<muddyfox007@yahoo.com>

08/22/2002 07:02 AM

To: Neil Handler/R1/USEPA/US@EPA
cc:
Subject:

I would like to thank the EPA for it's recent public hearing on the Mohawk Tannery Site in Nashua, NH.

Please accept my written comments below.

Exactly how will the waste from this site be disposed of? If it is hazardous waste how can it be disposed of in a landfill? Is this not just shifting the hazard to another community as landfills by their nature leak and many have become superfund sites as well?
Have other alternatives to land-filling the waste been looked into and if so what are the other options?

If the site gets superfund funding will the current resident of the site be permitted to continue operations on the site?

Will the EPA please provide a list of superfund sites showing exactly how much taxpayer money is used to clean-up these sites since the superfund tax has been cancelled by the current administration?

Thank you.

Owen David
180 N. Main St D-1
Boscawen, NH 03303

Plj53@aol.com
08/08/2002 12:40 AM

To: Neil Handler/R1/USEPA/US@EPA
cc:
Subject: (no subject)

Thank you for coming to Nashua and discussing the Mohawk Tannery Site issues and updating/listening to the public.

I have concerns with the toxicity of the clean up area when done. I hope that either the Fed's of the State would consider monitoring the area over a long period of time whether we use this site for housing, recreational space, etc.. People have the right to know what previously existed in this area.

I hope that the Fed's fund this project; the people who have been living in this area need to finally get relief and closure to this mess.

Please thank Angela for a well organized presentation. Neil you did a great job giving us the facts with the timeline, which the public could understand.

Paula Johnson
Alderman-at-Large

Dufoe1@aol.com

08/29/2002 11:08 PM

To: Neil Handler/R1/USEPA/US@EPA
cc:
Subject: Mohawk Tannery Site

I am very concerned about The Mohawk Tannery Site being taken off the EPA's National Priority List. Our New Hampshire politicians Senator Bob Smith and Mayor of Nashua Bernie Streeter have conceived a plan to have the site cleaned up by private contractors quickly and less expensively. No one knows better than a neighbor of The Mohawk Tannery how dangerous those plans are. A few concerns are:

1. What if Senator Bob Smith does not get reelected in early November? Will Bob Smith still be able to acquire the funds necessary to cleanup the Site.

2. Quickly and less expensively -- translates to improperly, haphazardly and more dangerously. More dangerously to those removing the waste as well as those living in the area. If the private contractors find unidentified chemicals or waste, will they just remove it? Will their contractors be wearing the proper gear? Will the neighborhood be evacuated or even warned if necessary?

We would rather have the United States Department of Environmental Services monitor, be in charge of, and cleanup The Tannery's hazardous waste site. We will feel confident that the cleanup is proceeding in the safest and proper manner. We are not in a rush to get this site cleaned up. We just want to feel safe while it is being done. We want to make sure that the waste is disposed of safely and legally. With private contractors in control, the waste could end up anywhere -- I"ll let you good people use your imagination.

I can just imagine some beautiful weekday or even weekend -- perhaps night -- these private contractors working away and we are hearing their heavy equipment, their floodlights, the odor ruining our sleep, ruining our playtime, ruining our get-togethers. No control. Everything is out of our control. No one will listen. There is no one around to answer the phones. No one cares about us. That's how its always been.

Unfortunately, our City is run by the developers. We're pleading with you please, do not take us off the EPA's National Priority List. After August 20th's Public Hearing, Mayor Streeter and I continued to argue. I was trying to tell him about all we've been through and he refused to listen. Whenever I told him a piece of history/fact about our previous fights with The City, prior to the EPA's involvement, Mr. Streetor would say, "I don't know anything about that; I wasn't here then." What more can I say.
He didn't even bother to read up on the history between The Mohawk Tannery/Granite State Leather before he wrote to the EPA and asked to be taken off of National Priority List.

3. Is Senator Bob Smith using Brownfield's Funds to cleanup The Tannery Site? If so, does that Act allow the owner of the offending property any rights? Any rights to ownership? -- Free and clear after the work is done?

I wrote to Senator Bob Smith regarding The Brownfield's Act and Our Superfund Site and he responded by putting me on his mailing list. I never received a return email about my concerns, a letter, note or phone call. But I'm on his mailing list.
This is the email:

Subj: Re: SMITH APPLAUDS SENATE PASSAGE OF BROWNFIELDS REVITALIZATION
Date: 6/20/01 11:46:05 AM Eastern Daylight Time
From: Dufoe1
To: smith_bob@SMITH.SENATE.GOV

The Mohawk Tannery/Granite State Leathers in Nashua is being cleaned up by the EPA right now. Warren Keane owner of this Tannery site has not paid taxes to the City in about 15 years. The City says it is afraid to take the property for back taxes because of the liability they might incur. The City and the Federal Government says he does not have any money to put towards the cleanup. I do know that he owns his own real estate firm, rental property on my street, Hughey Street, Nashua -- along with other real estate holdings that I know nothing about. He has rented the Mohawk site ever since the Tannery closed down til the present time -- while the cleanup is going on -- to a landscaping company, a construction company, a limousine service, and home contractor -- and that is all that I know about. The City has ordered Warren Keane to evict all tenants, but he blatantly ignores the order and the EPA also is waving that demand. Therefore, it looks like the federal government is cleaning the property for free and Warren Keane will become a billionaire developing the property. The new fear that your proposal brings -- is that Warren Keane will use your protection laws to reclaim this property, liability free, under another business name or alliance.

I believe your proposal may make wealthy murderers of the environment and who knows how many people they have made ill or die, billionaires. I would hope your language would strongly take every cent away from these people, relinquish their rights to ever own property again and put a claim against any further income that they earn.

Stephanie A. Dufoe

Thank you, any of you that have taken the time to read this letter. Our neighborhood is so happy to have The U.S. Environmental Services involved and working towards the ever so important cleanup of this superfund site. Please again, if you have any control, do not allow The City of Nashua to convince you that private contractors can and will do right by the residents abutting The Mohawk/Granite Leather site.

Kindest Regards,
Stephanie Dufoe

P.S. My husband and I walked the path that begins at the west end of Hughey Street to the Nashua River a few days ago. This path took us to a swimming hole directly aside of the Mohawk Site. If you follow this path you will see the evidence that people/children do currently swim in the river -- downriver -- right aside of The Superfund Site.

1001 Pennsylvania Avenue, NW, Washington, DC 20004-2595 ▪ p202 624-2500 ▪ f202 628-5116

crowell moring

Ridgway M. Hall, Jr.
202-624-2620
rhall@crowell.com

August 29, 2002

Mr. Neil Handler
Project Manager
U.S. Environmental Protection Agency –
Region 1
1 Congress Street, Suite 1100 (HBO)
Boston, MA 02114-2023

Re: Mohawk Tannery Site
Nashua, New Hampshire

Dear Mr. Handler:

These comments are submitted on behalf of the Chester Realty Trust, owner of the Mohawk Tannery site in Nashua, New Hampshire, in response to EPA's proposed Non-Time-Critical Removal Action ("NTCRA") and the Engineering Evaluation/Cost Analysis ("EE/CA") report prepared by Tetra Tech NUS, Inc. for EPA Region 1 in support of the proposed NTCRA. As you know from prior submissions by the Chester Realty Trust ("CRT"), the Trust has very limited assets and, indeed, its only substantial asset is the Mohawk Tannery site property itself, consisting of approximately 30 acres located along the banks of the Nashua River. Although CRT lacks the means to contribute financially to a proposed NTCRA, CRT and its Trustee, Warren W. Kean, have from the outset adopted a policy of full cooperation with EPA and the New Hampshire Department of Environmental Services with respect to the site, and will continue to do so. This includes among other things providing site security and also providing ready access to the site for EPA and the state and their contractors. In addition, in July 2001, at the request of the state, the owner arranged for the removal of some oily waste materials from the site at a cost of approximately $5,000.

With respect to the proposed NTCRA, CRT's position is that whatever response action EPA decides to take at the site should be based upon sound science, reliable facts, and a demonstrated need. Based primarily on the EE/CA report, EPA is proposing that "approximately 60,000 cubic yards of contaminated waste", consisting of soil and sludge, be excavated from the site and disposed of at an off-site landfill at an estimated cost of between $15 million and $22 million.

The proposal is more fully described in the *Mohawk Tannery Site Fact Sheet* issued by EPA and the New Hampshire Department of Environmental Services "NHDES") in July, 2002. It was also described in the presentation which you made on behalf of EPA at the public hearing in Nashua on August 7, 2002, as well as in the EE/CA report itself.

The EE/CA report describes the results of field investigations at the site, consisting primarily of the sampling of surface water in Area 1, soil and sludge in Areas 1 through 7, and consideration of historical site monitoring data gathered at various locations on the site during previous studies. Using these data, Tetra Tech conducted an exposure assessment and a "Streamlined Human Health and Ecological Risk Evaluation". Because the data evaluation is at the heart of the proposed removal action, this is the part of the EE/CA which in our view requires the closest scrutiny to be sure that the methods, procedures and assumptions are sound, and that the conclusions and recommendations based thereon are well grounded and reasonable.

Because the performance of exposure assessments and human health and ecological risk evaluations require special expertise and training, CRT retained the environmental science and engineering firm of Environ International Corporation to conduct a focused review of the EE/CA report. Environ is an international firm which is widely respected and possesses extensive experience and expertise in precisely the disciplines which are at issue in this matter, including exposure assessment, risk evaluation, the selection of response measures, and associate costs. These are the areas of the EE/CA report and the proposed NTCRA on which Environ has focused its analysis. The result of this analysis is set forth in the attached report by Environ entitled *Comments On Risk Evaluations In EPA's Engineering Evaluation/Cost Analysis (EE/CA) For The Mohawk Tannery Site, Nashua, New Hampshire.* The lead authors of the report are Stephen Song, Ph.D., and Stephen T. Washburn, both Principals in Environ's Princeton, New Jersey, office. Their *curriculum vitae* are attached as an Appendix to this report.

The Environ Analysis of Tetra Tech's Risk
Evaluations and EE/CA Conclusions

As more fully set forth in the enclosed report, the Environ analysis of the EE/CA demonstrates that Tetra Tech's human health risk evaluation for trespassers and future residents utilized approaches and assumptions which are technically flawed, inconsistent with current EPA guidance and significantly overestimated potential exposures and risks. Revising the risk evaluation consistent with accepted risk assessment principles and current EPA guidance and risk thresholds for response actions under CERCLA would demonstrate that potential risks associated with reasonable maximum exposures under current and expected future activities at the site do not support the proposed removal action. At most, removal of the liquid contents and several feet of sludge from Area 1, followed by appropriate cover, might be warranted. Similarly, the streamlined ecological risk evaluation provides no basis for a removal action.

In addition, the results of the EE/CA do not demonstrate that migration of contaminants from the site to groundwater has adversely affected, or has the potential to affect, either drinking water supplies or the Nashua River. This is consistent with historical monitoring data gathered by NHDES in October, 1994, and again in February, 2001, (the former were reported by Tetra Tech and are discussed below; the latter were not, and are discussed in the Environ report).

The Environ report demonstrates that in its EE/CA Tetra Tech significantly overstated the potential human and ecological risks posed by current and anticipated future conditions, and exposures, at the site. As a result, the EE/CA does not demonstrate that the risks posed by the site warrant a removal action under 40 C.F.R. §300.415, and certainly not the need for the large-scale excavation proposed by EPA. In fact, the traffic risk created by EPA's proposal to transport the excavated material along local roads may well off-set any theoretical risk reduction offered by the proposed removal.

We urge EPA to revise its risk evaluations, including exposure assumptions, consistent with the Environ report. Properly conducted human health risk and ecological risk evaluations, based on current EPA guidance and risk assessment principles and practices generally accepted in the profession, will vastly reduce the scope of any removal action which might be necessary. This in turn will result in a substantial reduction in cost.

No Present Health Risk at the Site

While our most important points are set forth in the Environ report, CRT wishes to provide several additional comments. First, the U.S. Department of Health and Human Services performed a public health assessment for this site and issued its report dated August 22, 2001 (AR32897).[1] In that report the U.S. Department of Health and Human Services concluded that the site posed "No Apparent Public Health Hazard" (pp.2 and 41). EPA and NHDES have reached a similar conclusion (*e.g.*, AR32978, letter from Philip Trowbridge, N.H. Dept. of

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[1] "AR__" references are documents which are in the Supplemental Engineering Evaluation/Cost Analysis administrative record file compiled as of July 30, 2002, and placed by EPA in the Nashua, New Hampshire, public library, as well as in its own document center in Boston.

Health and Human Services to Neil Handler, March 13, 2001), but have recommended response action based on anticipated future use of the property, including possible residential use by people, including children, over the long term.

Future Use Scenario

Any response action must be predicated on realistic exposure assessments and scientifically sound risk evaluations. Realistically, any future residential housing will not be built in the flood plain areas or in any of the former sludge disposal areas (Areas 1-7). Instead, any such residential units will be built on the upland areas to the east, where Tetra Tech's own data shows that groundwater is 70 feet below the surface (EE/CA Report p.1-2), and where there is no historic site contamination. While EPA may determine that some contaminated soil should be removed and disposed of off-site, any future use of the property would include cover and revegetation with respect to the Areas 1 through 7, rendering them safe for those who may in the future walk about and generally enjoy the land. For the reasons set forth in the Environ report, it is highly questionable whether such future use requires the excavation and removal of anything close to 60,000 cubic yards of soil.

The Sludge Is Not RCRA Hazardous

Next, EPA and Tetra Tech have correctly determined that the sludge and contaminated soil at the site are not "RCRA hazardous" and therefore can be properly disposed of at a municipal solid waste landfill. The Tetra Tech report raises the possibility that a portion of the waste in Area 1 could be considered hazardous because of the presence of sulfide, but appears to correctly reject that conclusion. However, because the Tetra Tech report appears to leave open the possibility that that conclusion might be reconsidered, we address it as follows. The EE/CA report at p.4-2 states as follows:

> As noted in Section 3.7.3, based on site data and an April 2002 hazardous waste determination for site sludge/waste completed by NHDES, it does not appear likely that the sludge/waste will be classified as RCRA hazardous. However, based on the reactive sulfide concentrations found in Area 1 during the EE/CA investigation, it is possible that sludge/waste may be encountered in Area 1 during implementation of the NTCRA that could cause the material to be considered hazardous.

The issue specifically involves whether one or two samples of waste taken in Area 1 would cause the waste to be regarded as hazardous by virtue of reactivity. As the EE/CA noted, a classification of the waste as RCRA hazardous "could have considerable impacts on the implementability and cost of the removal action." *(Id.)*

This issue was addressed in an exchange of letters between EPA and NHDES earlier this year, specifically a letter from Neil Handler to John Splendore, NHDES, dated March 20, 2002 (AR32061), enclosing sampling data, and a reply from David Bowen, hydrogeologist in the Hazardous Waste Remediation Bureau of NHDES to Mr. Handler dated April 10, 2002 (AR32960). EPA's March 20 letter noted that with respect to reactivity, there was a "regulatory guidance threshold of 500 mg/kg for sulfide reactivity" and said that the only sample on the long list of data provided which exceeded this was one sample in the Area 1 lagoon "where sulfide reactivity concentrations were detected at around 694 mg/kg." The regulatory guidance in question was dated July 1985 and was withdrawn by EPA on April 21, 1998, as noted in the EPA letter. Thus, the EPA letter states:

> Given the current uncertainty of how the regulatory guidance threshold for sulfide reactivity should be applied and/or interpreted as discussed in the EPA memorandum dated April 21, 1998 (*Withdrawal of Cyanide and Sulfide Reactivity Guidance*), it appears unlikely that at these concentrations Area 1 would exhibit the RCRA characteristic for sulfide reactivity. We would welcome your agencies thoughts on this matter.

The NHDES reply first addresses dioxin issues and states that the low-level presence of dioxin in the soil/sludge "is not classified as a hazardous waste . . . and may be disposed of at an approved solid waste landfill." Turning to the sulfide issue, NHDES notes that the average sulfide concentrations in the sampling are "89.1 ppm, well below the 500 ppm level", and concludes:

> The Department concludes that the excavated soil/sludge when managed as proposed by EPA is not regulated as a reactive hazardous waste (D003). As such, the Department would allow the disposal of the consolidated soil/sludge at an approved solid waste landfill.

Furthermore, it would be legally unsound for EPA or NHDES to base a finding of "reactivity" within the regulatory definition based upon guidance which EPA has withdrawn and which therefore has no legal or regulatory force or effect whatsoever. The regulatory (and therefore the legal) definition of reactivity is set forth at 40 C.F.R. §261.23 (2001). This contains no sulfide test or other reference to sulfide. Accordingly, the conclusions reached in the correspondence cited above are sound not only on the merits as set forth in the NHDES letter, but because a determination of RCRA hazardousness cannot lawfully be made based on a guidance document which EPA revoked in 1998.[2]

There Are No Impacts From The Site On Off-Site Receptors

The EE/CA report in its ecological effects assessment appears to express some concern for benthic organisms, river sediment and aquatic receptors (*e.g.*, p.2-75), which could only be exposed to contamination from the site if there were ongoing migration of surface water or groundwater to the river or other off-site receptors. The groundwater flow at the site is generally to the west or southwest (*Id.*, p.2-34). However, no evidence is presented that any such exposure exists. Given the fact that the site was operated as a tannery for 60 years prior to 1984, if there were migration of contaminants to the river or off-site groundwater, there would be evidence of that in the Nashua River, which there is not. Also of importance, the EE/CA notes that groundwater beneath the site is not used as drinking water. The report notes that two residential wells approximately 30 feet deep are reported to be located one-half mile southwest of the site, that these were sampled by NHDES for VOCs and metals in October, 1994, and that no evidence of contamination related to the site was found (EE/CA report at p.2-34). Thus, the site does not appear to be impacting any off-site receptors.[3]

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2 See also letter from John Splendore to Neil Handler of February 27, 2001, stating that the sludge is "not classified as hazardous according to the TCLP" (AR32959).

3 The preceding statement is inconsistent with a subsequent statement in Section 3.2, in which Tetra Tech is formulating removal action objectives. Tetra Tech states there that sludge in Areas 1 and 2 extends as much as 6 and 9 feet, respectively, below the water table. Tetra Tech adds "the presence of contaminated sludge below the water table and the usage of the groundwater as a drinking water supply for populations nearby the site provides the potential for contamination of an important drinking water supply." (p.3-2). Tetra Tech adds that in the past sludge and waste from the site was discharged to the river, and that these contaminations will be addressed as part of the "ensuing site-wide remedial investigation." However, as Tetra Tech notes earlier, the groundwater is not used as a drinking water supply. Nor is there any present evidence of adverse impacts resulting from discharges long ago to the Nashua River. Therefore, not only are these statements irrelevant to the contemplated removal action, but it is hard to see a need for remedial investigation either.

The Site Does Not Qualify For The NPL

Finally, EPA has maintained that a Superfund hazard ranking scoring in excess of the cut-off level of 28.5 is warranted for this site. However, EPA has declined to base that scoring on the current factual status of the site, including the fact that in a removal action carried out by EPA between September, 2000, and January, 2001, principal drivers of EPA's HRS score were removed from the site. Specifically, during that removal action, EPA removed 42 drums of waste material, a large above-ground storage tank and its contents, and a large clarifier tank and its contents, as well as approximately 110 empty drums and 360 laboratory-type containers and some asbestos containing material from the old tannery building (*See* EE/CA Report at 1-5). As we have previously pointed out, if a proper HRS scoring were done on this site using the current state of facts at the site, the HRS score would be substantially below the cut-off point of 28.5.[4] This is consistent with the fact that a properly conducted exposure analysis, and a properly conducted risk evaluation, do not support the need for a removal action of the magnitude and cost proposed by EPA.

We appreciate the opportunity to provide the foregoing comments, and in particular the expert analysis by Environ in the enclosed report. We urge EPA to give these matters careful consideration.

Respectfully submitted,

Ridgway M. Hall, Jr.
Counsel to
CHESTER REALTY TRUST

Enclosure
cc: John M. Regan, NHDES
Eve Vaudo, EPA

1935092

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4 See Comments submitted on behalf of Warren W. Kean in response to EPA's proposed addition of the Mohawk Tannery Site to the National Priorities List dated July 10, 2000, and Supplemental Comments dated July 19, 2000, including report of Vertex Engineering Services, Inc. In light of the removal action which took place after the submission of these comments, the HRS score should be far lower.

Comments on Risk Evaluations in EPA's Engineering Evaluation/Cost Analysis (EE/CA) for the Mohawk Tannery Site in Nashua, New Hampshire

At the request of Crowell & Moring, ENVIRON International Corporation (ENVIRON) has reviewed the United States Environmental Protection Agency's (EPA) Engineering Evaluation/Cost Analysis (EE/CA) for the Mohawk Tannery Site in Nashua, New Hampshire dated July 2002. The EE/CA was prepared for EPA by Tetra Tech NUS, Inc. The EE/CA included "streamlined" human health and ecological risk evaluations in support of a proposed removal action at the Site. ENVIRON's comments on these risk evaluations are presented in four sections:

- Section I, which summarizes the overall findings of ENVIRON's review.
- Section II, which provides detailed comments on the technical approaches and assumptions used by EPA to evaluate the trespasser and future residential scenarios.
- Section III, which illustrates how some of the results of the trespasser and future residential scenarios would be affected by making the changes described in Section II.
- Section IV, which provides our overall conclusions.

References are presented in Section V. The curriculum vitae of the two principal authors of these comments, Dr. Stephen Song and Mr. Stephen Washburn, are included as an attachment.

I. Summary of Overall Findings

The EE/CA investigation and streamlined risk evaluations have not demonstrated that site conditions warrant removal action under 40 CFR 300.415, and do not support the large-scale excavation proposed by EPA. This overall conclusion is based on the following findings:

Potential Exposures of Trespassers, Future Residents, and Ecological Species

- The results of the streamlined human health risk evaluation for trespassers and future residents are based on approaches and assumptions that are technically flawed, inconsistent with current EPA guidance, and significantly overestimate potential exposures and risks. Certain key aspects of the streamlined human health risk evaluation should be revised to use appropriate assumptions and methodology that are consistent with accepted risk assessment principles and current EPA guidance. Such a revision of the risk evaluation would almost certainly show that potential risks associated with reasonable maximum exposures under current and expected future land use at the Site do not warrant a removal action based on EPA's risk thresholds for action under CERCLA.

- The streamlined ecological risk evaluation was a screening-level analysis that identified only the potential for adverse ecological effects. According to current USEPA (1997a) guidance, the results of such a screening-level ecological analysis can be used to conclude only that one of the following courses of action is appropriate:

  1) There is adequate information to conclude that ecological risks are negligible and therefore there is no need for remediation on the basis of ecological risk;
  2) Available information is not adequate to make a decision on the basis of the screening-level analysis, and the ecological risk assessment process should continue; or
  3) Available information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

  Therefore, the streamlined ecological risk evaluation may indicate that a more detailed ecological assessment is warranted, but it does not demonstrate that a removal action is warranted.

Potential Impacts on Groundwater Quality

- The results of the EE/CA investigation do not demonstrate that migration of contaminants from the Site to ground water has adversely affected (or has the potential to affect) drinking supplies or the Nashua River. Specifically:

  1) As noted in the EE/CA, groundwater underlying the Site does not migrate toward any public or private drinking water wells;

2) Data from soil underlying the sludge disposal areas suggest that sludge constituents have not migrated into the underlying soil at significant concentrations, which is why the EE/CA report does not propose removal action for this underlying soil; and
3) Available groundwater data from the Site, collected by the New Hampshire Department of Environmental Services (NHDES 2001), do not demonstrate that sludge constituents are migrating toward the Nashua River in significant concentrations, as discussed below.

- Groundwater monitoring data obtained by NHDES (2001) indicate that the Site is not having an adverse effect on groundwater quality. (The EE/CA report fails to report these data.) The NHDES report includes groundwater monitoring data from two downgradient wells located between the Nashua River and Areas 1 and 2, where sludge appears to extend into the groundwater table. Data from these two monitoring wells (wells GZ-6 and GZ-9) indicate only low levels of volatile and semi-volatile organic compounds in the groundwater. In fact, none of the organics that are identified in the sludge as chemicals of potential concern (COPCs) warranting removal action were even detected in the groundwater samples from wells GZ-6 and GZ-9. Metals detected in these wells were at concentrations below drinking water standards, except for arsenic. Arsenic concentrations in wells GZ-6 and GZ-9, while above drinking water standards, appear to be unrelated to the sludge at Areas 1 and 2, since sludge characterization data for these areas (Tables 2-1 and 2-4) show that arsenic is present in the sludge only at concentrations that are within the range of natural background levels. Consistent with these data, arsenic was not detected in the TCLP analysis of the sludge samples from either Area 1 or Area 2 (Tables 2-2 and 2-5).

Potential Impact of Flooding Events

- Except for Area 1 (the open lagoon), all other areas have soil covers that are generally several feet thick, are essentially uncontaminated, and are vegetated so that there is no reasonable potential for overland migration of sludge or sludge constituents during normal precipitation events. Even under most flooding events, significant runoff into the Nashua River would not be anticipated because almost the entire Site, with the exception of Area 2, is outside the 100-year floodplain.

- Preventing sludge in Area 1 from entering the Nashua River in the event of a severe flood is an appropriate objective for remedial actions at the Site. However, the EE/CA did not evaluate the effectiveness of the existing berm for achieving this objective or consider measures short of complete sludge removal that might be more appropriate (such as closing the lagoon in place with a soil cover, perhaps after removal of the uppermost portion of the sludge). Reducing the amount of sludge that would need to be removed to achieve this objective would also reduce the amount of material that would need to be transported along local roads, and the potential for odors.

II. Detailed Comments on the Trespasser and Future Residential Scenarios

1. The evaluation of potential exposures of current trespassers to surface materials was based on inappropriate soil and sludge characterization data. The evaluation used data from composite samples that extended to depths where the potential trespasser exposures would not be reasonably expected (i.e., deeper than 2 ft below ground surface [bgs], including many samples deeper than 10 ft bgs), as discussed in Section 2.4.2.1. Instead, the evaluation should have been based on only the characterization data for the overlying soil in each Area (except Area 1 which has no overlying soil), because these data best represent the concentrations to which these receptors would be exposed.

2. The evaluation of potential future residential exposure to soil and sludge at Areas 1 to 7 from depth to 10 ft bgs is unrealistic and used inappropriate exposure point concentrations. First, the assumption that soil from as deep as 10 ft bgs would be brought to the surface and left for residential contact is unrealistic, particularly around Area 1 and Area 2 where the depth to groundwater is relatively shallow (e.g., potentially less than 10 ft bgs at some locations) so that excavation of subsurface soil for construction of residences with basements is unlikely. Second, even if the assumed scenario were to occur, the concentration data used for this evaluation include many samples that extend beyond 10 ft bgs. Third, the construction of residences in the 100-yr floodplain, if this is even realistic, would require about 1 to 2 ft of soil to be added to raise the ground surface above the floodplain, which would essentially eliminate exposure of residents to any surface contamination. Even the EE/CA report acknowledges that soil would have to be placed on top of the sludge in at least Area 1 (see Section 2.4.3.3). However, the exposure point concentrations in Table 2-23.3 do not account for mixing of the sludge with this overlying soil in the unlikely event that sludge were to be excavated from under the soil and left on the ground. Accounting for such mixing would lower the concentrations to which residents may be exposed, resulting in correspondingly lower estimates of risk.

3. If the evaluation of potential exposures of trespasser and future residents to surface materials were instead based on the surface soil data for Area 2 to Area 7, the estimates of site-related cancer and noncancer risks for these Areas likely would not exceed a cancer risk of 10^{-4} or a non-cancer hazard index (HI) of 1, respectively. This can be seen from the comparison of the characterization data for the overlying soil with the screening criteria for identifying COPCs in the EE/CA report, as shown in Table 2-10 and Table 2-16. The comparisons in these tables show that no volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), or pesticides/PCBs were detected in surface soils at concentrations exceeding screening criteria. Although the tables indicate that a few chemicals were detected at concentrations that exceed one or more screening criteria, a closer evaluation demonstrates that these concentrations do not represent significant contamination. Specifically:

   a. The dioxin concentrations, expressed in toxic equivalents (TEQs), are all much lower than the 1,000 nanogram per kilogram (ng/kg) cleanup level proposed by EPA for the Site.

   b. The antimony concentrations are within the range of background concentrations in the eastern U. S. (< 1 milligram per kilogram [mg/kg] to 8.8 mg/kg, Dragun and Chiasson 1991), except at Area 4 where the site-related antimony concentration corresponds to a hazard quotient (HQ) of only approximately 0.4.

   c. Although certain arsenic concentrations are higher than the screening criteria based on the Region 9 preliminary remediation goals (PRGs), these concentrations are all within the range of natural background levels.

   d. Although some of the chromium (Cr^{+3}) concentrations are higher than the NHDES non-risk-based ceiling of 1,000 mg/kg screening criterion, they are all lower than the NHDES S-1 risk-based criterion of 44,300 mg/kg and the Region 9 PRG of 12,000 mg/kg.

   e. The manganese concentration detected at Area 4 is higher than the screening criterion, but corresponds to a HQ of only 0.1.

   f. Although mercury was detected at levels exceeding typical background levels at some locations, all of the mercury concentrations are lower than the risk-based screening criteria.

4. The evaluation for potential exposure of trespassers to sludge at Area 1 is apparently based on a scenario that ignores the fact that the sludge is submerged under approximately 6 inches of water (as shown in the boring logs in Appendix D). Because the sludge is underwater, the degree of trespassers contact with sludge would be minimized by the tendency for the water to wash sediment off a trespasser who might wade into the lagoon. Making the scenario consistent with actual conditions at the lagoon would lead to lower sediment ingestion rates and dermal loading rates, and hence, lower risk estimates.

5. It is at least theoretically possible that a trespasser could be exposed to near-shore, surficial sludge in Area 1. However, the risk evaluation does not explain why it is assumed that the Area 1 sludge data from the boring locations that had to be accessed from a floating platform represent near-shore conditions. It also does not explain why data from the full-depth sludge cores (which extend to depths of 10 to 12 ft bgs) would be representative of the surficial sludge.

6. Even if one were to accept the trespasser exposure scenario for Area 1 as described in the EE/CA report, the risk estimates for such potential exposures were derived incorrectly and in a manner that is inconsistent with current guidance, such as EPA's *Risk Assessment Guidance for Superfund* (RAGS, 2001), as discussed below:

   a. The exposure point concentrations were incorrectly based on what appear to be dry weight concentrations. Instead, the concentrations should have been calculated on a wet weight basis because the soil adherence factors are based on wet weight (EPA 2001). This apparent oversight is significant for the sludge at Area 1, which has an average of only 26% solids according to the EE/CA report. This means the risk estimates presented in Table 2-25.1 are approximately 4-fold too high, for this reason alone.

   b. The sludge-to-skin adherence factor of 231 mg/cm^2 used in the risk evaluation is inappropriately high and the use of this value is inconsistent with the recommendations provided in the EPA (2001) guidance that is cited as the source for this value. According to EPA (2001), the 95th percentile value of 231 mg/cm^2 for the "children-in-mud" scenario, which was used in the EE/CA, should <u>not</u> be used in quantitative risk assessments. Specifically, footnote 5 of Exhibit 3-3 in EPA (2001) states the following:

*Information on the soil adherence values for the children-in-mud scenario is provided to illustrate the range of values for this type of activity. However, the application of these data to the dermal dose equations in this guidance may result in a significant overestimation of dermal risk. Therefore, it is recommended that the 95th percentile AF [adherence factor] values **not** be used in a quantitative dermal risk assessment* [Emphasis added].

EPA (2001) further explains, "*It is **not** recommended that a high-end soil contact activity be used with a high-end weighted AF for that activity, as this use would **not** be consistent with the use of a reasonable maximum exposure (RME) scenario*" [Emphasis added]. Instead the guidance recommends the use of a central tendency weighted adherence factor (e.g., 50th percentile) when a high-end activity is being evaluated.

If the children-in-mud scenario is to be evaluated, the 50th percentile adherence factor of 21 mg/cm^2 should be used, consistent with EPA (2001) recommendations. This means the dermal risk estimates in Table 2-25.1 are 11-fold higher than they should have been for this reason alone. When combined with the incorrect use of dry weights instead of wet weights, the inappropriate use of the 95th percentile adherence factor caused the dermal HI estimates in Table 2-25.1 to be approximately 42 times higher than they should have been. This means that the dermal HI of approximately 42 shown in Table 2-25.1 should have been essentially 1, even assuming that the children-in-mud scenario is a reasonable one in the first place.

c. The dermal absorption factor used in the children-in-mud scenario is also overly-conservative. As explained in EPA (2001), the fraction of chemicals absorbed from soil or sediment into the skin remains constant as soil loading increases to a level at which the skin surface is uniformly covered, and then decreases with increasing loading. Because the sludge in the Area 1 lagoon appears to be relatively fine-grained, the absorption fractions used in the risk evaluation may be as much as 2 to 3 times too high. Correcting for these apparent errors in the dermal calculations would result in an HI that does not exceed 1, even under the highly conservative assumption of a child trespasser playing in mud.

For similar reasons, the dermal cancer risk estimates on Table 2-26.1 should be at least 42 times lower, which would make the cumulative cancer risk estimate for the trespasser scenario no higher than approximately 4×10^{-5}. This means that both the noncancer and cancer risk estimates for this scenario should have been below a HI of 1 and a cumulative cancer risk of 10^{-4}, respectively, which are the EPA thresholds for action.

7. For the reasons discussed above, the soil adherence factor of 0.4 mg/cm^2 used in the risk evaluation for trespasser contact with soil in Areas 2 to 7 is also inappropriately high. This value is a 95th percentile value and should not have been used. For the scenario of children playing in dry soil, the appropriate adherence factor should have been 0.04 mg/cm^2, which is the 50th percentile value recommended in EPA (2001). This means that the dermal HI and cancer risk estimates in Tables 2-25.2a and 2-26.2a are 10-fold higher than they should have been. The noncancer and cancer risk estimates on these tables are already lower than the EPA thresholds for action, so correcting this error would have no material effect on the outcome of the risk evaluation.

8. The adjustment of oral reference dose (RfD) values to account for gastrointestinal (GI) absorption in evaluating ingestion exposures, as discussed in Section 2.4.4.1, appears to be incorrect for both the trespasser and resident scenarios. This adjustment is not necessary because such an adjustment should have been offset by an equal adjustment of the administered dose to an absorbed dose. By adjusting only the RfDs and not making the corresponding adjustments to the ingestion dose estimates, the risk evaluation gave ingestion HQ values that are higher than they should have been. For all cases where this calculation was done incorrectly (where a GI absorption of less than 1 was used), the ingestion HQ estimates can be multiplied by the GI absorption values used in the calculations to obtain corrected HQ estimates. This error is particularly significant for the ingestion HQ estimates in Table 2-25.2b, which are higher than 1 for antimony and cadmium. For antimony, the incorrect HQ of 4 should be multiplied by the GI absorption of 0.15 to obtain the correct HQ of 0.6. For cadmium, the incorrect HQ of 7 should be multiplied by the GI absorption of 0.025 to obtain the correct HQ of 0.2. The HQs on Table 2-25.2b for barium and manganese also require similar corrections, resulting in an ingestion HI of approximately 0.8.

9. In the EE/CA report, the computation of exposure point concentrations used a method that follows outdated EPA guidance for computing 95% upper confidence limit (UCLs) for lognormally distributed data. More recent EPA guidance recognizes that the method used in the EE/CA report for lognormal distributions (see Section 2.4.2.2) tends to produce inappropriately high 95% UCLs that are unreliable for risk assessment (EPA 1997b). As a result of using the outdated method, the calculated 95% UCLs in the EE/CA are usually higher than the maximum detected concentrations, so that maximum concentrations were

used as exposure point concentrations. This use of maximum concentrations in the EE/CA overstated actual exposure point concentrations. Instead, consistent with EPA (1997b) guidance, probabilistic methods such as bootstrap methods should have been used to calculate more reliable 95% UCLs that represent more realistic exposure point concentrations. For example, the exposure point concentrations for 4-methylphenol, antimony, and chromium on Table 2-23.3 would have been significantly lower if calculated using more appropriate nonparametric bootstrap methods. Using the nonparametric bootstrap method known as the BCa (bias-corrected and accelerated) method, the 95% UCLs for these chemicals are as shown below, along with the exposure point concentrations (EPCs) from Table 2-23.3 and the ratio of the two sets of concentrations:

	Bootstrap UCLs	**Table 2-23.3 EPCs**	**Ratio**
4-Methylphenol	430 mg/kg	1,300 mg/kg	0.33
Antimony	100 mg/kg	506 mg/kg	0.20
Chromium	14,400 mg/kg	67,800 mg/kg	0.21

These bootstrap UCLs for the "all soil/sludge" scenario were calculated using all the soil and sludge data provided in the EE/CA report for Areas 1 to 7.

Using the above bootstrap 95% UCLs for 4-methylphenol would reduce the ingestion HQ on Table 2-25.3 from 1.4 to approximately 0.5. For antimony, using the above bootstrap 95% UCL and correcting the GI absorption calculation error (as discussed above) would reduce the ingestion HQ on Table 2-25.3 from 46 to approximately 1. For chromium, using the above bootstrap 95% UCL and correcting the GI absorption calculation error would reduce the ingestion HQ on Table 2-25.3 from 19 to approximately 0.05. With these changes, the only ingestion HQ higher than 1 on Table 2-25.3 is that for manganese, which should be corrected for the GI absorption calculation error so that it would drop from 3.5 to approximately 0.1. This means that there would be no ingestion HQ or dermal HQ values higher than 1 on Table 2-25.3.

10. Data sets that were determined to not follow either a normal or lognormal distribution should not have been assumed to follow a lognormal distribution and 95% UCLs calculated using this assumption. Instead, consistent with EPA (1997b) guidance, the 95% UCLs for these data sets should have been calculated using a nonparametric method, which does not rely on assumptions about the shape of the data distribution. For example, the risk evaluation did not need to use the maximum concentration as the exposure point concentration for dioxin TEQ on Table 2-23.3. The dioxin TEQ data set is neither

normally distributed nor log-normally distributed, so the exposure point concentration should have been calculated using a nonparametric method. Using the nonparametric BCa bootstrap method, the 95% UCL for dioxin TEQ would be approximately 800 ng/kg, which is lower than the proposed PRG of 1,000 ng/kg. Using this 95% UCL instead of the maximum concentration of 2,600 ng/kg would reduce the total cancer risk for dioxin TEQ in Table 2-26.3 from 1.6 x 10^{-4} to approximately 5 x 10^{-5}. This means the cumulative cancer risk estimate for this scenario would not exceed EPA's 10^{-4} risk threshold for action.

11. The EE/CA report says that 95% UCLs were not computed for data sets that consist of 10 samples or less; the maximum concentrations were used as instead (see Section 2.4.2.2). There is no apparent statistical reason for not being able to calculate 95% UCLs for such data sets in general, and the EE/CA provides no technical basis and cites no EPA guidance for this approach. As noted above in Section II.9, the use of maximum concentrations generally overstates actual exposure point concentrations.

12. The soil/sludge ingestion rate for trespassers should have been applied with a fraction ingested (FI) term of less than one, because the trespassers were assumed to be at the Site for only 4 hours/day and the assumed ingestion rates are based on a full day (16 hours) of soil contact. A more appropriate FI value of 0.25 would reduce all the trespasser cancer and noncancer risk estimates for the ingestion route by a factor of 4. The noncancer and cancer risk estimates for this scenario as presented in the EE/CA (see Tables 2-25.2a and 2-26.2a) are already below the EPA thresholds for action, so correcting this assumption would not materially affect the outcome of the risk evaluation.

13. Consistent with EPA guidance, as expressed in RAGS, HI values that exceed 1 should be re-evaluated and segregated according to mechanism of toxicity. This issue becomes increasingly important as the corrections identified above are made and the overall HI values are reduced to values near 1. Cancer and non-cancer risks that are not site-related, such those associated with exposure to "background" levels of arsenic, should also be discussed and segregated from the site-related risk estimates.

14. EPA risk assessment guidance explains that HI estimates (as well as cancer risk estimates) should be expressed with only one significant digit because the assumptions on which these estimates are based (e.g., toxicity values) are not sufficiently precise to warrant the use of more significant digits. The streamlined risk evaluation in the EE/CA should be modified consistent with this convention.

III. Effect of Recommended Changes on the Human Risk Evaluation Results

The following illustrates specific aspects of the risk calculations that led to estimates of unacceptable risk, and pinpoints where the comments presented in Section II apply. One key aspect discussed in Section II that is not specifically noted below is the inappropriate use of subsurface data for assessing surface exposures.

<u>TABLE 2-25.1</u>

The HI of 43 is attributable almost entirely to dermal exposure to 4-methylphenol at a maximum concentration of 1,300 mg/kg dry weight. Adjusting the concentration to wet weight based on 26% solids would reduce the HI to about 10, as discussed above in Section II.6.a.

The other key factor is the soil adherence of 231 mg/cm^2. EPA (2001) recommends use of the 50^{th} percentile instead of 95^{th} percentile. The 50^{th} percentile is about 10-fold lower. Also, the absorption factor should be reduced for such a high loading rate by roughly a factor of 2 to 3, based on the sludge being fine-grained and Exhibit C-4 in EPA (2001), as discussed above in Sections II.6.b and II.6.c. Correcting for these factors would give a HI for this scenario that does not exceed 1.

The arsenic HI for dermal contact is 1.2 but the concentration of 7.6 mg/kg is within background soil levels. Therefore, arsenic should not be seen as contributing any site-related noncancer risk in this scenario.

The GI absorption adjustments to derive dermal RfDs for Sb, Cr, and Mn are consistent with guidance in EPA (2001). For the ingestion route, these adjustments without the corresponding adjustments to the oral dose estimates appear inappropriate, as discussed above in Section II.8. The ingestion HQs should be multiplied by the GI absorption values. Since these ingestion HQs are already less than 1, this revision would not materially affect the outcome of the risk evaluation.

<u>TABLE 2-25.2a</u>

The HI is already less than 1.

TABLE 2-25.2b

The HI of 13 is attributable almost entirely to ingestion exposure to Sb and Cd at maximum concentrations of 44 mg/kg and 17 mg/kg. These HI results are clearly suspect because these maximum concentrations are already lower than the proposed PRGs of 73 mg/kg and 82 mg/kg for these metals.

The problem with the HI estimates for Sb and Cd is the inappropriate GI absorption adjustment to the oral RfD without making the corresponding adjustment to the oral dose estimates, as discussed above in Section II.8. The HI would be less than 1 if the oral RfDs were not adjusted, or if the same adjustments were made to the oral dose estimates.

The HI also includes contributions from metals with exposure point concentrations that are within background levels (e.g., As and Mn). These background contributions to risk estimates should have been eliminated or at least discussed.

TABLE 2-25.3

The HI of 72 is attributable almost entirely to ingestion exposure to Sb, Cr, Mn, 4-methylphenol, and vanadium (in that order). The key issue is the improper GI absorption adjustments for Sb, Cr, Mn, and V. Using nonparametric bootstrap 95% UCLs should bring all the HQs to 1 or lower.

Also, the HQs of greater than 1 for the maximum concentrations of Cr, Mn, and V, as shown on this table, are inconsistent with the fact that these concentrations are already lower than the proposed PRGs for these metals.

TABLE 2-26.1

The cancer risk of 2×10^{-3} is attributable almost entirely to dermal exposure to pentachlorophenol and dioxin (expressed as TEQ). The key issues again are: 1) not using wet weight concentrations, as discussed above in Section II.6.a; and 2) using a soil adherence factor that is too high, as discussed above in Section II.6.b. For pentachlorophenol, the wet weight adjustment alone would reduce the risk to about 5×10^{-5}. As noted above in Section II.6, the cumulative cancer risk estimate for this scenario should be no higher than approximately 4×10^{-5} once these two issues are corrected. This corrected cumulative risk estimate is below EPA's 10^{-4} risk threshold for taking action.

The risk from arsenic is not site-related since the concentration of 7.6 mg/kg is within background levels.

TABLE 2-26.2a

The cumulative cancer risk estimate is already less than 10^{-4}.

TABLE 2-26.2b

The cumulative cancer risk estimate is already less than 10^{-4}.

TABLE 2-26.3

The cancer risk of 2×10^{-4} is attributable almost entirely to ingestion exposure to dioxin TEQ at maximum concentration of 0.0026 mg/kg. The most useful improvement would be to calculate a nonparametric 95% UCL, which should give a value closer to the mean of 0.000512 mg/kg or at least less than the proposed PRG of 0.001 mg/kg.

IV. Conclusions

The "streamlined" evaluations in the EE/CA significantly overstate the potential human health and ecological risks posed by current and anticipated future conditions at the Mohawk Tannery Site. As a result, the EE/CA does not demonstrate that the risks posed by Site conditions warrant removal action under 40 CFR 300.415, or support the need for the large-scale excavation proposed by EPA. In fact, the very real traffic risk created by the need to transport the excavated material along local roads may well offset any theoretical risk reduction offered by the proposed remedy.

To the extent that some action may be warranted at the Site, such as preventing sludge in Area 1 from entering the Nashua River in the event of a severe flood, EPA should consider measures short of complete sludge removal that might be more appropriate (such as closing the Area 1 lagoon in place with a soil cover, perhaps after removal of the uppermost portion of the sludge). Reducing the amount of material removed from the Site would reduce truck traffic and risks, the potential for odors, and the overall cost of the remedy.

V. References

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ATTACHMENT

Resumes for:

Stephen Song
Stephen Washburn

Stephen Song, Ph.D.

Education

1986 Ph.D., Water Resources Engineering, University of California, Los Angeles

1982 M.S., Water Resources Engineering, University of California, Los Angeles

1979 B.S., *cum laude*, Civil Engineering, University of California, Los Angeles

Experience

Dr. Song is a Principal at ENVIRON Corporation. He has 16 years of consulting and industry experience in hazardous waste management, including extensive experience in: the development and application of risk-based approaches to improve site investigation and remediation; regulatory negotiations; RCRA compliance; and regulatory analysis. His project management experience includes major projects under the following regulatory programs:

- RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS);
- RCRA Closure and Post-Closure;
- Superfund Removal Action;
- Superfund Remedial Design (RD) and Remedial Action (RA); and
- Underground Storage Tank (UST) Removal and Corrective Action.

Dr. Song's areas of technical and regulatory expertise include:

- Human health risk assessment;
- Fate and transport modeling;
- Statistical analysis of environmental data; and
- RCRA hazardous waste management.

The following describe some of Dr. Song's work at ENVIRON:

- Directed an RFI baseline risk assessment for a major automotive manufacturing facility in Ohio where potential exposures to workers and neighboring residents from more than a dozen SWMUs, including landfills, surface impoundments, and USTs, were assessed. Dr. Song lead extensive negotiations that succeeded in convincing USEPA Region 5, possibly for the first time in an RFI, to allow future land use to be assessed as industrial, rather than residential, and ground water exposures to be assessed at only existing drinking water wells which were off-site and screened in a lower, rather than the uppermost, aquifer.
- Designed and obtained approval from the Pennsylvania DEP for an RFI/CMS in which the field work and baseline risk assessment were phased with the phase-out of production at a major chemical manufacturing facility in Pennsylvania. Dr. Song directed the

baseline risk assessment which included evaluation of potential exposures to workers and neighboring residents during excavations into shallow, contaminated ground water, and to users of off-site surface water that may be affected by transport of ground water from the facility.

- Directed the development of risk-based soil and ground water criteria for protection of human health at industrial facilities in the People's Republic of China, on behalf of a major US-based multinational automobile manufacturer. Presented the criteria before the China National EPA on two occasions, and successfully negotiated over a two-year period the adoption of the criteria as national guidance. The development work included original research to derive exposure factors (e.g., exposure frequency, exposure duration, skin surface area, and body weight) that were specific to workers in China.

- Served as a subject-matter expert on human health risk assessment for the U. S. Army's Environmental Restoration Independent Technical Review Program, which uses independent subject-matter experts to assist the Army in identifying opportunities for improving the cost-effectiveness of investigations and remediations at Base Realignment and Closure (BRAC) installations and active Army sites.

- Provided technical guidance to Ohio EPA on the use of Monte Carlo techniques in the development of generic risk-based soil and groundwater cleanup standards under the Ohio Voluntary Action Program (a brown fields program), on behalf of an Ohio industry coalition.

- Provided technical guidance to Michigan DEQ on the use of vapor and particulate emission models, air dispersion models, and vapor intrusion models in the development of generic risk-based soil and groundwater cleanup criteria under Michigan's site remediation rules (Part 201 Rules, formerly Act 307 Rules), on behalf of a Michigan industry coalition.

- Developed comments on USEPA's December 1994 draft Soil Screening Guidance for several industrial clients. The comments critiqued the technical basis of the draft risk-based approach, identified technical errors in the USEPA methodologies, and suggested alternate methods to improve the efficiency of the soil screening levels.

- Directed the RD/RA of an operable unit at a major Superfund site in USEPA Region 3. Dr. Song negotiated changes to the $22 million remedy specified in the ROD that saved the PRPs more than $10 million. The RD/RA included segregation and characterization of admixed hazardous wastes that were disposed in a 5,000 yd^3 in-ground vault and design of technologies to treat the wastes to meet RCRA land disposal restrictions treatment standards.

- Developed and successfully negotiated with USEPA Region 4 a risk-based screening methodology for evaluating broad-spectrum (i.e., TCL/TAL) soil characterization data collected at more than 45 sites in six states under a CERCLA 106(a) order. The screening methodology allowed estimates of cumulative excess cancer risk and estimates of noncancer effects to be compared with an acceptable risk of 10^{-4} and a hazard index of 1, respectively.

- Assisted the Michigan Part 201 Program Advisory Group (formerly Act 307 Program Advisory Group) in the development of the technical details for standard default risk-based cleanup standards appropriate to industrial land use under Michigan's Natural Resources and Environmental Protection Act (NREPA, formerly Act 307). The standards, in part, are based on Monte Carlo analysis of multiple, human exposure pathways.

- Developed comments on Ohio EPA's 1993 *Guidance for Reviewing Risk-Based Closure Plans for RCRA Units* and *Closure Plan Review Guidance for RCRA Facilities*, on behalf of a major automotive manufacturer. The comments offered suggestions on technical aspects of Ohio EPA's approach to risk-based clean closures and on streamlining the administrative review of closure plans.

- Directed the development of risk-based screening levels for lead, including soil screening levels appropriate to workers at industrial sites and screening levels appropriate to recreational consumption of fish.

- Developed an expert report that refuted a RCRA Section 7003 "imminent and substantial endangerment" claim against a large inactive land disposal site located on a major river in Illinois.

- Developed an expert report on the historical regulatory framework governing RCRA-related remedial actions and the implementation experience during the 1980s to early 1990s at the federal and state levels.

- Provided expert review of RCRA hazardous waste classification issues and assisted in the development of litigation strategy.

Before joining ENVIRON, Dr. Song served seven years with the General Motors Corporation (GM), Environmental Activities Staff. While at GM, he provided oversight and technical support in RCRA compliance to more than 100 manufacturing facilities. Dr. Song led the development of GM strategies and procedures for managing RCRA-related remedial activities including corrective action, closure/post-closure, UST removal/cleanup, and facility closing/sale. He also conducted legislative and regulatory negotiations and analysis on a variety of RCRA and Superfund issues on behalf of GM. His work at GM included the following:

- Led a coalition of major Michigan industries in successful negotiations with Michigan DEQ and environmental advocacy groups to develop the first workable cleanup standards under Michigan's Superfund law (formerly Act 307). Dr. Song contributed the key concepts to the development of Michigan's three-tier approach to setting risk-based cleanup standards and Michigan's standard default risk-based cleanup standards for industrial land use.

- Provided technical guidance on RCRA closures and post-closures of hazardous waste management units at more than two dozen GM manufacturing facilities. These closures included container management units, tanks, surface impoundments, waste piles, and landfills. As part of these closures, Dr. Song led successful negotiations with the regulatory agencies in Michigan, Ohio, and Missouri to approve the first risk-based RCRA clean closures in those states.

Dr. Song also held the following positions:

Song, S. 1996. Development of Risk-Based Screening Criteria for Industrial Sites in Mexico. Instituto Nacional de Ecologia (INE), Procuraduria Federal de Proteccion al Ambiente (PROFEPA), and Secretaria de Comercio y Fomento Industrial (SECOFI). Mexico City, Mexico. April.

Song, S. and L. Rosolowsky. 1995. Improving EPA's Soil Screening Guidance. Society of Risk Analysis Annual Conference. Honolulu, HI. December.

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Song, S., and L. Marolf. 1993. Michigan's Three-tier Approach to Setting Cleanup Standards for Sites of Environmental Contamination. Water Environmental Federation Specialty Conference on The Development of Soil, Sediment, and Groundwater Cleanup Standards for Contaminated Sites--How Clean Is Clean? Washington, D.C. January.

Stenstrom, M.K. and S. Song. 1991. Effect of oxygen transport limitation on nitrification in the activated sludge process. *Res. J. Water Pollut. Control Fed.*, **63**, 208

Stephen T. Washburn

Education

1982 M.S., Chemical Engineering, Massachusetts Institute of Technology

1980 B.S.E., Chemical Engineering, Princeton University

Experience

Mr. Washburn is a Principal at ENVIRON Corporation. He has a broad background and over 15 years of experience in environmental science and engineering, with specific expertise in risk assessment and risk-based engineering. Specific areas of expertise include contaminant fate and transport, risk-based evaluation and remediation of hazardous waste and industrial sites, hazardous waste management, incineration, and chemical process design. His work at ENVIRON has included the following:

- Performed comprehensive risk assessments for numerous RCRA and Superfund sites, including facilities in Ohio, Illinois, Indiana, Tennessee, New Jersey, Pennsylvania, New York, Oklahoma, and California.

- Developed risk-based remediation strategies for hazardous waste and industrial sites across the U.S. These strategies have been used to successfully negotiate for cost-effective, protective remedies. Examples include the Whitmoyer Superfund Site in Pennsylvania, the DuPont RCRA Site in New Jersey, and the Rocky Mountain Arsenal Superfund Site in Colorado.

- Provided litigation support on toxic tort lawsuits alleging health effects associated with possible historical exposure to chemicals in air and ground water.

- Selected by the U.S. Army Environmental Center to serve as a Subject Matter Expert (SME) on expert peer review panels to evaluate proposed and ongoing remediation efforts at Base Realignment and Closure (BRAC) sites and active Army installations. Participated in the independent technical review of over a dozen active and inactive installations, including Camp Navajo (Arizona), the San Francisco Presidio (California), the Redstone Arsenal (Alabama), Fort Ord (California), the Aberdeen Proving Grounds (Maryland), and the Milan Army Ammunition Plant (Tennessee).

- Selected by U.S. EPA to serve on the external expert peer review panel for the *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*.

- Selected by U.S. EPA to serve on the external expert peer review panel for the multimedia, multipathway, and multiple receptor risk assessment (3MRA) model developed for the Hazardous Waste Identification Rule (HWIR).

- Principal-in-charge and primary agency contact for a multimillion-dollar remedial design project at a complex Superfund site in Pennsylvania. Responsible for developing and implementing site characterization plans, treatability tests and remedial design for soils, lagoons, drummed waste, ground water, and buildings.

- Evaluated the risks associated with polychlorinated biphenyls (PCBs) in various surface water bodies, including the Sheboygan River in Wisconsin and the Kalamazoo River in Michigan.

- Provided litigation support to private parties in cost allocation/cost recovery disputes at several Superfund Sites, including the Helen Kramer Landfill in New Jersey, the Fike Artel Site in West Virginia, the Buzby Landfill in New Jersey, and the Kin-Buc Landfill in New Jersey.

- One of nine scientists selected nationwide by the American Society of Testing Materials (ASTM) to provide training to state regulatory agencies on the ASTM Risk-Based Corrective Action (RBCA) standard (E-1739). Has provided training in over 10 states, including New Jersey, Pennsylvania, Oregon and Michigan.

- Principal-in-charge of human health and ecological risk assessments for the WTI hazardous waste incinerator in East Liverpool, Ohio. These assessments included an evaluation of the potential effect of routine stack emissions, fugitive emissions, and accidental releases on the surrounding community and on ecological receptors.

- Selected by the U.S. Army Environmental Center to provide training to Army personnel on the principles of environmental restoration. Developed course materials on ecological risk assessment and risk management. Conducted training at several installations, including Picatinny (New Jersey), Ravenna (Ohio), and Seneca (New York).

- Retained by the U.S. Department of Justice as an expert to review EPA trial burn plans and risk assessments at the Drake Chemical Superfund Site in Pennsylvania.

- Evaluated disposal alternatives for dioxin-contaminated dredge spoils for a major industrial facility in New Jersey. Supervised bioaccumulation studies involving aquatic organisms to evaluate the potential for dioxin accumulation following ocean disposal.

- Coordinated a technical review of a proposed hazardous waste treatment facility in Ontario, Canada. Evaluated the proposed design and operation, and conducted a detailed, multipathway risk assessment to estimate the facility's potential impacts on human health and the environment. This risk assessment considered not only the emissions released during routine operation, but also those that would be released during facility upsets and transportation accidents. Provided expert testimony on human health and ecological risk assessment before the Ontario Environmental Assessment Board.

- Performed a multipathway exposure evaluation as part of a comparative assessment of the public health risks posed by five remedial alternatives for the McColl Superfund site in California. This assessment included an evaluation of risks to workers and the nearby community. Provided videotaped expert testimony presented to USEPA Region IX.

- Acted as the Principal-in-Charge or project manager on ecological risk assessments at hazardous waste sites, industrial facilities, and incinerators.

- Selected to serve as a member of the Risk Assessment Subcommittee of the Pennsylvania Science Advisory Board. This Subcommittee developed recommendations which were ultimately incorporated into Pennsylvania's Brownfield legislation (Act 2).

- Conducted a Monte Carlo risk assessment of potential chemical releases from buried drums at an operating chemical facility. Calculated probabilistic distributions for chemical concentrations in the environment, human dose through various exposure pathways, and resulting human health risk.

- Evaluated the potential risks posed by a proposed steel mini-mill facility in Pennsylvania. Provided testimony in public hearings before the Pennsylvania Department of Environmental Resources.

- Performed a Monte Carlo risk assessment in Ohio to support risk-based Remedial Action Objectives (RAOs) and Preliminary Remediation Goals (PRGs) at a former refinery site.

- For the City of Bloomington, Indiana, directed a technical evaluation of the Superfund cleanup of six PCB-contaminated sites. Reviewed the design of a 200 ton/day rotary kiln combustor engineered to co-incinerate municipal solid waste (MSW) and PCB-contaminated soils; analyzed the projected performance of the kiln and its associated pollution control equipment during both routine operation and malfunction; and evaluated technical plans for the excavation, transport, and interim storage of contaminated material. Organized and participated in public forums to address human health and environmental risk issues related to the cleanup.

- Performed a peer review of the design and operation for a proposed commercial medical waste incinerator. Determined status of the facility with regard to best available control technology (BACT), and evaluated potential risks posed through indirect food chain pathways. Provided expert testimony on engineering and risk issues.

- Assisted a national public interest group in evaluating the air quality impacts associated with the proposed expansion of a county airport. Regulatory compliance was also assessed.

- Conducted a comparative assessment of the occupational risks posed by two remedial alternatives for the Hardage Superfund hazardous waste disposal site in Oklahoma. The assessment considered both potential exposures of workers to toxic chemicals and injuries associated with the use of heavy equipment.

- Designed and assisted in implementing tests at a paper and pulp mill boiler in Maine to determine the source of elevated dioxin levels in ash.

- Conducted a detailed review of the state-of-the-art for designing, operating, and siting hazardous waste landfills built in the U.S. between 1975 and 1982.

- For the New York City Department of Sanitation, conducted a multipathway risk assessment for retrofitted municipal solid waste incinerator in Southwest Brooklyn.

- Evaluated the technical capabilities of a U.S. contractor involved in the design and construction of hazardous waste incinerators. The study was used by a multinational, European-based corporation to help decide whether to acquire the contractor to enter the U.S. hazardous waste incinerator market.

Stephen T. Washburn

- Conducted Monte Carlo risk assessments at RCRA sites with lead contamination in New Jersey and Pennsylvania. Both projects involved the use of Uptake/Biokinetic (UBK) modeling for evaluating the risks posed by exposures to lead.

- Conducted a multipathway risk assessment for a proposed hazardous waste physical/chemical treatment plant and landfill in Manitoba, Canada.

- Examined the feasibility of irrigating a golf course with treated wastewater; assessed the need for a buffer zone between the irrigated areas and an adjacent housing development to ensure the protection of public health.

- Reviewed state-of-the-art practices for the disposal of chlorinated solvents in the U.S. prior to 1972, and evaluated the extent of public concern regarding industrial chemical pollution of ground water during that period.

- Prepared responses to questions raised by concerned citizens during the siting of a hazardous waste incinerator in Louisiana.

- Provided litigation support to the owner of a large office building by evaluating the risks posed by PCB transformers in the building; reviewed historical data on PCB toxicity and PCB transformer spills and fires.

- Performed an analysis of the impact of leachate from the major New York City-area landfills on adjoining surface water quality.

Prior to joining ENVIRON, Mr. Washburn held the following positions:

- Process Design Engineer, Kesler Engineering. Specialized in the process redesign of petroleum refineries and the development of engineering software. Supervised operations analysis and computer modeling; and oversaw the development of rigorous distillation, equilibrium flash, and two-phase pressure drop simulation software for microcomputers. This software was eventually marketed by Kesler Engineering.

- Materials Analyst, Alfa Laval AB. Analyzed plastics using differential scanning calorimetry, gas chromatography, and thermogravimetric analysis.

- Research Assistant, Massachusetts Institute of Technology. Analyzed polycyclic aromatic hydrocarbon (PAH) levels in diesel soot using high-performance liquid chromatography, and evaluated the extent of PAH desorption in the human gastrointestinal tract.

Publications And Presentations

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ATTACHMENT B

Transcript of August 20, 2002, Public Hearing

UNITED STATES OF AMERICA

ENVIRONMENTAL PROTECTION AGENCY

BOSTON REGION

In the Matter of:

PUBLIC HEARING:

RE: MOHAWK TANNERY SUPERFUND SITE

LOCATED IN NASHUA, NEW HAMPSHIRE

Nashua City Hall
229 Main Street
Nashua, New Hampshire

Tuesday
August 20, 2002

The above entitled matter came on for hearing, pursuant to Notice at 7:00 p.m.

BEFORE: **MICHAEL JASINSKI, Section Chief**
New Hampshire and Rhode Island Superfund section
Environmental Protection Agency
1 Congress Street
Boston, MA 02114

ORIGINAL

I N D E X

P R O C E E D I N G S

(7:00 p.m.)

MR. JASINSKI: I think we'll try to get started this evening. That clock I think is fast. My clock works on the commuter rail in Boston. So, it's right on the clock. We're ready to begin.

Good evening. Welcome to the public hearing for the Mohawk Tannery Superfund site. I did that a little while ago, the Mohawk Tannery Superfund Site, located in Nashua, New Hampshire.

My name is Michael Jasinski. I'm Section Chief, for the New Hampshire and Rhode Island Superfund section, and EPA's New England office in Boston. And I'll be the hearing officer for tonight's presentation and hearing.

The purpose of tonight's hearing is to go over and receive your oral comments on EPA's proposed early cleanup plan for the Mohawk Tannery site. I think most of you probably have received this, or have picked up a copy this evening.

Part of this meeting during the formal presentation, we'll receive your formal comments, we will not be responding to those formal comments, at that moment.

All of your comments will be received this evening for a court stenographer. We will take all those comments and put those into a document, called a responsiveness summary, where we will respond to each and every one of those comments at that point.

That responsiveness summary will be made available in the information repositories that are both in the Nashua Public Library, and in Boston. And it will also become a part of the Ad Action Memorandum, which is what we're trying to come to through this process, which will document our selected remedy for the Mohawk Tannery site, and it will contain your responses.

I have several people from EPA, from Boston's office, and also New Hampshire Department of Environmental Services that I'd like to have introduce themselves right this minute.

MR. REGAN: Sure. My name is John Regan, I'm Supervisor of the State Hazardous Waste Site Section, and I'm with the New Hampshire Department of Environmental Services, Waste Management Division.

MR. HANDLER: My name is Neil Handler, and I'm the EPA Project Manager, for the Mohawk Tannery site. And shortly I'll be giving you hopefully a quick presentation on the results of the EE/CA here.

MS. BOHARRIGO: My name is Angela Boharrigo, from EPA, I'm the Community Involvement Coordinator for the site.

MR. JASINSKI: And in the back row, Eve, please?

MS. VAUDA: I'm Eve Vauda, I'm a lawyer with the

Environmental Protection Agency.

MR. PEASE: I'm Richard Pease with the New Hampshire Department of Environmental Services, Supervisor of the Federal Sect Division.

MR. SPLENDORE: John Splendore, New Hampshire DES.

MR. O'BRIEN: Phil O'Brien, Director, of Division of Waste Management, in New Hampshire DES.

MR. JASINSKI: This evening's presentation will be broken into three-parts. The first part will be basically Neil giving a short and brief presentation hopefully, on the site investigation at the Mohawk Tannery site, as well as a short and brief summary of the early cleanup plan for the Mohawk Tannery site.

He will also give you little details on the public comment period, the process that we're undergoing now. Upon Neil's presentation, I'll ask if there's any clarifying questions on that piece of the presentation, basically on the cleanup approach for the plan and we'll address those at that time.

Then I will begin the formal part of the hearing. Please try to stand up to the microphone here, introduce your name, your affiliation with the site and make your statement.

I'm going to try to keep those to about ten-minutes. So we can keep the meeting going, as well as give everybody an opportunity to make a statement.

If you have a longer talk than that, maybe we can summarize at the end. If you have anything in writing you would like to give the EPA on the proposed cleanup plan, I'd appreciate it if you'll give it to Neil or myself this evening. That will become a part of the record, and we'll go from there.

After all the oral comments have been recorded, I'm going to close the formal hearing, and we will stay around to answer any questions if there's anything that came up that you didn't get answered or otherwise this evening, we'll go from there.

Are there any questions on the purpose of the format right now?

(No response)

I understand Mayor Streeter wants to make a statement before we do the formal presentation. I hope no one has any problem, because he has an engagement he has to attend to right away. Mayor.

MAYOR STREETER: Thank you. Good evening. My name is Bernie Streeter. I'm the Mayor of the great city of Nashua, and I'm here with the President of our Board of Alderman, David Rudivitch, and their Director of Public Works, George Crombie.

From a historical point of view, if you'll just bear with me for two-minutes. Before I became Mayor there was a push by the city to, as you know, to place this project under Superfund. And I think that we all know that the Superfund process can be very cumbersome and there are only a minority of sites in New England that have ever come off the Superfund site.

Many of these sites have been listed for over ten-years, without a lot of cleanup being completed. A full listing under the Superfund Program is a last resort and doesn't guarantee cleanup will happen quickly.

My goals and I hope that they're shared, I know they're shared by many, is too, number one; get the property under city ownership so that the property can be planned out.

There are thirty-acres of prime land on the river.

Number two; is find the fastest way to clean up the site, without having the site be declared a full Superfund site.

Number three; work with the state and the EPA to meet these goals. And if you recall, I know you recall that the EPA went in and did some cleanup last year, and that was under what is called Time Critical Cleanup.

The presentation that you're hearing tonight, deals with non time critical removal action, which could cost between fifteen and twenty-two million dollars to complete, so I guess a rhetorical question that members of the public might ask is what can we do as members of the public, or residents to help with the cleanup process?

My recommendation would be that if you support the recommendations you hear this evening, please let EPA know in writing and let your Congressmen and Senators know. They're key players in this as well.

From my point of view, the best case scenario for the tannery site is, number one; the city gets ownership without a liability. So that they can then work with the community and the neighbors to master plan the property.

Another best case scenario is that funding is made available by EPA this fall so that the cleaning of the lagoons can begin this coming summer.

And further testing of the site reveal's low levels of contamination and the site hopefully can be put back into productive use and it ultimately becomes an asset to both the neighborhood and the city at large.

So, Mr. Chairman and members of both the EPA, and the State DES, whatever we collectively do, I realize there are no guarantees. But I believe that as Mayor, we're taking every available option to attempt to meet the stated goals as I outlined earlier.

I appreciate the fact that you're here. This is the second time and hopefully we'll continue this dialogue and this cooperative relationship that we've established.

If you bear with me one more minute, I'd like to turn it over to George Crombie, our Director of Public Works. And he would like to follow-up on my remarks. Would that be agreeable?

MR. JASINSKI: That would be acceptable, sir.

MAYOR STREETER: Okay. Thank you.

MR. CROMBIE: Thank you, George Crombie, Director of Public Works. The goal as the Mayor's outlined is to try to clean the site up as soon as possible.

FROM THE FLOOR: Would you speak up louder, we can't hear?

MR. CROMBIE: The goal is for the city to clean the site up as soon as possible. We want to thank both the EPA and the state of New Hampshire, all the work they have done to get it to this point.

If you're not familiar with the Superfund process, or not familiar with the cleanup, the amount of time that both EPA and the state of New Hampshire has used to get to this point --

MR. JASINSKI: It's not an amplifying mike, George. It's just for the stenographer. It's just for the stenographer. Turn that to the side, George, please. Yeah. Do it that way, do it and face the audience, George, please?

MR. CROMBIE: Okay. I'll try this. I'm sorry.

The program as the Mayor's outlined, what the city is really trying to do is move the cleanup of the Mohawk Tannery site, as quick as possible.

We want to commend both the EPA, and the Department of Environmental Services for moving to this point as quickly as they have been able to get to this junction. It may seem like a long time to you being residents adjacent to the property, but when you look at the time line that it normally takes to get to this particular point, it's very quick.

The important thing is, we believe that EPA and the Department of Environmental Services have come up with a good plan. The reality is, it's going to take between fifteen to twenty-two million dollars in order to do the cleanup.

So, I think it's very important if we can reach agreement to the so-called cleanup plan. Then we can start the process very quickly, of trying to get the money for the cleanup.

One of the issues I think that's very important is, being listed on the Superfund chart does not mean it's an automatic cleanup, because through that process you still have to go through competition with communities all over the country.

What EPA and the state has tried to do with this is use the up front process of the Superfund process for a non time critical cleanup.

So the goal would be that a decision is made this fall, early this fall, so that we can immediately move for the funding. If the funding was available, cleanup could actually start as early as next summer, is really what we're looking to do here. Thank you.

MR. JASINSKI: Thank you, George. I appreciate the Mayor making a statement. I apologize for everybody else, the Mayor had a previous engagement he has to go to later.

I want to go back to the process. We're going to get formal comments from everyone here this evening. We're here all night, as long as you want to make a statement for the record.

But first I'd like to, some people are new faces, they want to hear a little bit more about the proposed approach before we talk about the comments from the public. So I'll let Neil at this moment, give a short presentation, overview of the history of the site, and EPA's proposed cleanup approach. Neil, if you could.

MR. HANDLER: Thank you. Sorry, if I block you guys for a second.

Thank you very much, all of you, for coming tonight. I know this is sort of the second time in a couple of weeks where we have dragged you, hopefully not dragged you too painfully out of your houses. But it's great to see all of you here and we appreciate your coming. Can you guys hear me in the back?

FROM THE FLOOR: Yeah.

MR. HANDLER: Okay. Thanks.

I'm just curious by a show of hands, how many of you folks were here at the August 7, meeting? Just trying to figure out how many of you are familiar with what we've talked about and just -- okay.

Again, we'll try and go through this pretty quickly, and we'll be trying to focus on the main recommendation EPA's preferred remedy, which we want you folks to comment upon tonight, as well as through the rest of the comment period here.

But certainly, if you have questions about the other alternatives, we can respond to them as soon as I'm done or later tonight. So, hopefully we'll cover that ground, for you folks and answer all your questions.

I don't know how many of you -- the last time we were out here was in February of 2001. At that time we were completing a time-critical removal action that was meant to address the most immediate hazards at the site. Those were the drums, the asbestos, the above ground storage tanks.

At the same time we were finishing that up, we were gearing up for the engineering evaluation and cost analysis. That's a streamlined approach that we use to address the waste disposal areas at the site. That was sort of the area that both the state, EPA, and the city identified as being probably the main concern as well as the community identified as being the main concern to them.

And as part of the EE/CA, we really just looked closer, more closely at the nature of the extent of the contamination at the site. We identified the human health risk as well as we evaluated the cleanup options and then we made a recommendation for a preferred cleanup alternative, which is what we're hoping to get feedback from you folks on.

So the EE/CA pretty much took place, the field activities which were completed by Tetra Tech last August and September, consisted of numerous test pits which were dug in, pretty much, there were seven waste disposal areas at the site.

I know that map is hard to see, just to orient yourself, here's Warsaw Avenue, this is north, Fimble Door is up here, the Nashua River is here, and the seven areas which we investigated as part of the EE/CA were the two major lagoons down here closest to the river, area one and area two. Area one is the lagoon that's open at this point and still has standing water.

In addition, we looked at this smaller disposal area, area three, area four, and then there was another area, area five here which we also investigated, and then area six, and then area seven, which is closest to the main facility.

The main reason why area five is not shown highlighted, this map is really meant to identify the areas where there was contamination detected. Area five was an area where we sampled, but we really didn't encounter any contamination.

So in addition to the test pits and the boring's, we also took numerous samples, over five-hundred environmental samples for various parameters that would help us to better understand the chemical characteristics and we also looked at delineating the wetlands and the floodplain at the site.

Just again, for clarification, a good portion of these two lower areas are in the one-hundred floodplain of Nashua River and that in itself has us concerned if there was ever a significant flood.

The highlights of the EE/CA again, there's a lot here, and obviously we won't go through it tonight. There is a copy available in the local repository.

But just in terms of the highlights, when all these areas, the volume, and is sort of totaled up in these areas, there's approximately sixty-thousands cubic yards of sludge at the site which will have to be dealt with. The predominant contaminant's are chromium, pentachlorophenol, and dioxin.

The good news from the standpoint of how the waste can be dealt with, it's a non hazardous solid waste. That means we can dispose of it as solid waste landfill, rather than a hazardous waste landfill.

There was some confusion the last meeting. That doesn't mean that there aren't hazardous substances and it doesn't mean that there aren't risks posed by that. That just means that the waste doesn't have to go to a hazardous waste landfill and it's really a function of specific tests and the test results.

Again, the material is very odorous, a large amount of sulphide compounds in it. It certainly, a significant portion of the sludge is buried beneath the water table, at least approximately 50 percent of the sludge in these two areas, which really, 90 percent of the sludge overall at the site is in area one and area two. So we have a significant, sort of, materials handling issue in that the material is so wet.

And in terms of the risks posed by the contaminants and the physical conditions of the waste at the site, certainly there's a risk currently with the site in its current condition to trespassers who might come on the site, whether it's children or adults.

And then, in addition, the site is zoned residential and under that scenario, for a future scenario if the site were to be developed residential, there's certainly a potential risk to people who might be living at the site.

So, to address those risks as well as the other issues such as the waste being in the floodplain, we developed remedial removal action objectives. And pretty much they're pretty straight forward, get the waste out of the floodplain and out of the groundwater. Remove the risk posed to either presently under present conditions, or future conditions to the public as well as to the environment. And help bring the site back into a productive use. And that's something that's been loud and clear from the city as well as the public.

Again, that map, I guess we can probably skip that Angela. That's pretty much what I showed you here. Those were the areas that the EE/CA identified as what we would be addressing.

And in terms of when we looked at the removal objectives and we looked at the technologies that are out there, and are available to address the site, and we went through a screening process -- and there were a number of technologies that just wouldn't work, because of the physical characteristics of the waste at the site, as well as its location. We pretty much narrowed down the field of alternatives to these three alternatives.

Alternative one: Which is the preferred alternative which we've identified to the community here consists of excavating the waste from the six disposal areas, transporting it off-site and taking it to a permitted facility off-site.

Alternative two: Which also involves excavation, instead of taking it off-site, the waste would be consolidated, take it out of the floodplain and be placed on a landfill somewhere, a secure landfill at the site.

Alternative three: Is again, excavation and off-site treatment, but the distinction between that and the first alternative is that we looked at treating the waste through incineration and that really is there as part of our statutory requirement we have to look at treatment of the waste.

When these three alternatives -- basically, we further evaluated these criteria's looking at effectiveness, cost, implementability -- sorry Angela -- and pretty much I think those are straightforward effectiveness. Is it protective to human health and environment? Implement ability is how easily can we implement it? Are there landfills available off-site to deal with it? Are there incinerators, their capacities in incinerators off-site to deal with it, and then cost which is pretty straightforward.

When all these criteria were compared, EPA felt that alternative one pretty much addressed most of the removal. It addressed the removal action objectives the best out of all the other alternatives.

We felt this was easiest and the most effective. Certainly it's protective of human health once you get the waste off the site and take them to a disposal, permitted disposal facility off-site.

There won't be any long term risks at the site. And there won't be any future restrictions to the use of the site. And there also won't be any long term operation and maintenance, which there would be for alternative two, if you had a landfill on site.

The estimated cost for this alternative, range from fifteen to twenty-two million, and that range just reflects just some sort of whether or not all the waste could be taken off-site as non-hazardous. The estimated time to complete would be approximately twelve-months from once we get started.

Again, this is EPA's recommended alternative. And again, as I said it would consist of the excavation of the waste from the six disposal areas and taking it off-site.

In terms of the alternative, the preferred alternative that the EPA has identified, there probably -- there may be other issues, but certainly based on the feed back we've gotten from the community, dust and odors are certainly a significant concern.

Obviously, if we're digging up the waste, there may be some potential for odors. To address that we would have an air monitoring program in place which would monitor the level of contaminants at the excavation, based right where we're excavating, as well as along the perimeter of the property to make sure that we weren't releasing anything.

And going along with that also, just monitoring is not obviously going to be enough given the odorous nature of this material. We would have to be -- we're planning and we're aware that we'll have to use engineering controls at the site, such as either lime, to help control the odors.

Also, we have looked into a system where you would basically around the whole excavation area have these nozzles which would -- they would basically shoot out an aerosol which is able to neutralize the odors and it's proven very effective for these types of odors, sulphide and ammonia.

And then in terms of another big issue, obviously that you folks have identified is traffic. To address that concern, we're looking at alternative ways of getting the waste off the site.

Obviously the site is right here on the river. There's a significant residential development right here off Fairmount. We're going to try and we're looking at alternatives to avoid having taking the waste by truck if that's one potential way of taking it off-site.

This way, what we're looking into is possibly taking the waste back here through somewhere around Fimble Door and to Broad Street to avoid impacting the neighborhood here.

Another alternative that we're looking into and again, this has been a partnership working with the city as well as the state, and all those parties have been helping us in terms of trying to identify alternative ways of getting the waste out from the site. We're also looking into using this rail spur here to ship the waste off-site.

So, which brings us again, we're looking for feedback from you folks. You can either submit written comments to EPA, to myself, you can mail it to myself, or if you feel more comfortable just jotting down an email. Again, whatever you're most comfortable with.

And again, tonight, we're encouraging you to get up and make a statement if you feel comfortable in making a statement. And again, you can do a combination of those two things, whatever you're comfortable with.

In terms of sources of additional information, I probably went through this very fast tonight and I'm not sure how much you gleaned from this, but a copy of the engineering evaluation and cost analysis is at the Nashua Public Library, in addition, it's on the EPA web site.

That's the Engineering Evaluation and Cost Analysis is the EE/CA, just that's an acronym obviously for it. But then also, there is a copy of the information that supports the preferred remedy as well as at EPA Boston.

In terms of the next steps, the public comment period will go through August 29. Obviously we're here tonight at the public hearing looking for feed back from you folks. What we'll do after tonight is, we'll take all your comments, evaluate them, and if need be make any modifications to the preferred remedy that we've identified. And all of that will sort of get it rolled up into what Mike mentioned earlier, the Action Memorandum. That's our decision document that documents what the clean up approach is going to be for the site.

We're shooting for September. I think we can do that and basically once that's done we can go back to EPA headquarters for our funding request and we'll just basically then have to compete with other sites that are out there at this point for the funding for next year.

If we get the funding in the near future, then we think basically we can be out there by the summer of 2003, beginning the cleanup and again, as I mentioned earlier, we're estimating a year to complete. So hopefully by summer of 2004, we would be done with the removal of the waste disposal areas.

The one other component that's out there and just briefly touch on, the EE/CA is really focusing on the waste disposal areas at the site.

There may be some other -- certainly, there are other concerns out there that we feel questions need to be answered about, such as, whether there's any contamination in the building? What's the extent of the contamination in the groundwater beneath the site? As well as, what's the extent of contam -- what are the impacts at the site, the waste disposal practice of the site have had on the river?

Those other areas, the groundwater, the building and the river, will be part of the remedial investigation, which the state of New Hampshire is taking the lead on through a cooperative agreement and that is expected to begin hopefully this fall. So with that said, I think I'm through.

MR. JASINSKI: I'd like to ask if there are any clarifying questions on what Neil presented to you tonight? It was short and quick. I'll be giving you comments. So, any questions you may have on this proposed cleanup approach, or any thing in details, I ask you to ask those questions now? Ma'am, please state your name?

MS. CORKERY: My name is Catherine Corkery, I'm sorry, I probably just missed it, but was there any groundwater contamination at the site?

MR. JASINSKI: Neil?

MR. HANDLER: Yeah. As I mentioned, we really haven't focused on that at his point. It's been mostly the sludge.

There's been some preliminary -- there was some data back in some of the earlier investigations and the state recently completed a -- just a preliminary round of sampling. John, would you like to just talk about the groundwater sampling?

In summary, we've just really began to look at that, but maybe you can just --

MR. SPLENDORE: Yeah, there is groundwater contamination above our standards. It's not very, very high above our standards. So, it's of concern to us. Nowhere near the concern of getting the sludge off the site.

We did go out, I actually went out, I forget when it was when we last saw it. And we confirmed the earlier round there were findings. It's there. It's above our standards. It's not by any means one of our worst sites.

MR. HANDLER: And just one thing I'll add. The contamination does seem to be, the groundwater contamination does seem to be pretty low class, at least based on the data we have received so far. It's really around these two main sources, the two largest lagoons, which make sense from the standpoint, that's where most of the waste has been disposed.

MR. JASINSKI: Ma'am, do you have a clarifying question?

FROM THE FLOOR: I did. But I'm sorry --

MR. JASINSKI: I'm sorry. Well, you have one follow-up?

FROM THE FLOOR: Yeah. Just a quick follow-up question. Was there any test done on the river?

MR. JASINSKI: Were there any tests done on the river, John?

MR. SPLENDORE: We, I didn't do any tests recently on the river. We did do -- the state did do tests of the sediment back in ninety-three, and found some levels of chrome and some other contaminants. Not a clear cut -- not clearly attributable to the tannery. We think it probably is, but nothing that jumped right out at us. And surface water samples John, do you recall that? I think that at one time there was some surface water samples.

MR. REGAN: I think there was some surface water samples. Certainly we can check our files for you. Again, the focus that we felt was on the sludge, and there were other things that we needed to look at.

But, no matter what was going on with the groundwater and what was going on in the river, the sludge needed to go, and it needed to go sooner rather than later. So that's the focus of EE/CA.

MR. SPLENDORE: There is more work planned right.

You up front, Ma'am? You got a question?

FROM THE FLOOR: I was going to ask him about the same question, but I'm wondering about the testing of it, how they do test it, the water?

MR. REGAN: The groundwater?

FROM THE FLOOR: The groundwater, water, you know that goes into the ground and that's where it is down there. The bad stuff is way down there. It's sitting way down there and I'd like to know how far down you tested the water, where the -- and leading down there into the ground, beneath the water, and in the soil?

MR. HANDLER: I don't know off hand the exact depth of the wells John, and I don't know if you know it. But I think they were -- I mean, I think they were somewhere twenty, or thirty-feet down below the surface. But other than that John, do you have -- know any --I guess I'm not even sure of the exact depth of the wells --

MR. SPLENDORE: No. That's about right. Generally the wells were about thirty-feet deep, probably close to the bottom of the sludge. So, there are deeper wells planned for the next phase to work.

Again, our feeling is that the source of any groundwater contamination would be the sludge material. So the sooner we get can get it out of there --

FROM THE FLOOR: Well, it's so dirty, it's horrible.

MR. HANDLER: Right. That was our dig.

FROM THE FLOOR: And that's what I'm talking about. I'm looking at both things.

MR. JASINSKI: George do you have a point for question? I saw your hand.

MR. CROMBIE: There's two things that hopefully will help explain what we're trying to do here. The first is -- two things are running parallel with this, hopefully. And it's all predicated on --

One, is to try to get the sludge out of there.

At the same that would be running parallel to that beginning almost as we speak, DES is doing water analysis on the site. If they come out with very little contamination, the site then can go back into a very productive mode as soon as the sludge is removed from the site.

However, if they find a red flag, or a smoking gun on that property, or in the river, then all bets are off. It's a very different project.

MR. JASINSKI: We would be back here probably proposing to you other alternatives to clean it up? If that's the case, but right now we're trying to focus in on sludge waste for tonight's public hearing.

MR. CROMBIE: So the best case scenario is that you remove the sludge over the next year to eighteen months. If the tests that the state is doing comes back negative, or there's not a lot of pollution. So you can take the property and then reuse it again. That's a best case scenario.

The worse case scenario is, not removing the sludge, as well as finding out there's a lot more pollution on the site, which would extrapolate into a lot of time before the site could ever be brought back in a productive manner.

MR. JASINSKI: I do want to get into your public comments so, you really need to ask a clarifying question. We can try to clarify what we're proposing, but if we get into the different tangents I'm going to have to stop this. Ma'am?

FROM THE FLOOR: Well just to go one step further with that, I've asked several times if the wells have been tested, is it safe for us to grow in our gardens and to eat the food that's in our gardens.

So has any bigger testing, you know, it's a tannery site and they've been movies on tannery sites, is there any wider scope that's been investigated.

Maybe we're going to fill a little cav -- maybe we think it's a teeny problem, but maybe it's much bigger than it is.

MR. REGAN: There any residential wells in the neighborhood?

MR. HANDLER: We have tested some and I know the Department of Environmental Services, we know most of the area is on municipal water.

Want me start again?

FROM THE FLOOR: I can't hear a thing.

MR. JASINSKI: Okay. To clarify the purpose of tonight's meeting is to talk about this non-time critical removal action. And the logic of focusing on that is we was told that the sludge is there, is a source of concern for both the groundwater, for the people coming in contact with it in the river.

And we have done some sampling. Earlier meetings, we did take some names down and we did do some residential sampling. We did not find anything that looked to be related to the site, off-site. We are doing more detail review of that. And again, we can talk afterward about if there are people on water.

Our sense is that most of the people are on Nashua Municipal water, but we are looking -- we know we have a problem in front of us, we're trying to focus on that problem, at the same time, look to see if there's other issues out there that could either be big or small.

As John indicated, the initial look at the groundwater from the site, is it's not as bad as what we see at other places. Do we need to address it? Yes.

MR. HANDLER: And we're doing more investigation this fall.

FROM THE FLOOR: Well, the problem is we're looking at development now, we're not thinking about the people that live around the site. The kids have been swimming in the river.

MR. JASINSKI: No.

FROM THE FLOOR: Our kids are swimming in the river.

MR. JASINSKI: No. We're looking at all this Ma'am, because even the state is going to be out this fall doing more studies.

FROM THE FLOOR: No. We want you to -- the people, we're not worried about developing the land, we're worrying about lives.

MR. JASINSKI: One last clarifying question and then I will go to the hearing. I saw a question back there, Ma'am?

MS. GORMAN: Yes. I'm Marie Gorman and I have a question regarding to the application itself. Are we asking the Federal Government the entire amount of fifteen to twenty million dollars, and is there any matching fund associated with it, averted to state or to the city?

MR. HANDLER: We would be asking for the full amount and there aren't any matching funds. This is for removal action. There's no cost sharing involved for the state. So basically it would be 100 percent tax dollars paying for this.

FROM THE FLOOR: Here we go, it's our money?

MR. HANDLER: Yeah. Your money, I said tax dollars.

FROM THE FLOOR: So it's paid by the tax dollars.

MR. HANDLER: Yep. Yep. Yep.

MR. JASINSKI: I'd like to go to the formal part of the hearing, if you could come up, make your statements, we'll be here later, and if you have any other types of technical questions, watering your lawn, whatever.

But I want to try to get your comments on the record this evening, on the proposed clean up plan for the Mohawk Tannery Site. If you could come up to the microphone, and come to this side, it would probably make it easier. And speak into this mic. It does not carry so speak loud.

Please give your name for our court stenographer, your association with the site. I don't usually need a microphone.

And try to limit your comments to ten-minutes. If you have something you want to give out, as far as something in writing, please hand it to Neil this evening.

I have a few requests all ready to make statements. Some of you may have white cards, if you want to make a statement, please, Angela Boharrigo will go around and get your cards.

Put your name on there so I can call you as we go through this. I have four cards already that I have to let them come up first.

And I would please ask Mr. Jeff Rose, Projects Director for Senator Bob Smith's office to step to the podium, please?

MR. ROSE: Good evening. My name is Jeff Rose and I work for Senator Bob Smith, and I'd first and foremost like to start off by thanking the EPA and the DES for having this public hearing. And for making all the information as conveniently available as they do to all of us, so we can get a handle on what the situation is here.

Senator Smith feels very strongly in his work to try to follow what Mayor Streeter indicated in his opening remarks. And that is to get this site cleaned up as quickly as possible and in the best manner in which we can do so.

We have been working quite some time with city officials as well as the state and the EPA, and we feel very confident that things are moving in a very positive direction here.

As ranking member of the Environment and Public Works Committee, we feel very encouraged that this site should be able to be cleaned up, in a very timely manner, and streamlined, and we'll make sure that we use our ability to continue to try to help the City of Nashua in cleaning up sites that have some environmental challenges.

We certainly had some successes with the John's Manville site. And we look forward to continuing to work to make sure that the site is cleaned up. Again, in a timely manner and a manner that works best for the City of Nashua.

So with that, I thank you very much.

MR. JASINSKI: Thank you Jeff. I have a card for a David Gleneck, State Representative, from Ward four, please?

MR. GLENECK: David Gleneck, 34 Tampa Street. I'm a resident in the area, have been a resident for about 45-years and I was part of a group that fought the city and the DES over the clean up and over the odor on this particular tannery.

And at that time, when the treatment was going on, the State DES, says treatment was good and adequate. The tannery closed and now it's a Superfund Site. So my credibility in their statements is a little bit short.

My concerns are this, it's been said tonight, three or four times, we need to put this back into productive use. Is this being accelerated for the single purpose of putting it back into productive use? Is this being done to aid a developer? Do we have a plan for the land, if the grant comes through and we get this cleaned up? Is there other things going on that we're not being told?

MR. CROMBIE: May I cut in?

MR. GLENECK: If you can answer, yes.

MR. JASINSKI: George, George, no, not right now, maybe later. Please, make your statement, sir.

MR. GLENECK: I'm also concerned about how this particular project gets connected to the Broad Street Parkway, because it's been listed as an EPA cleanup site for the Broad Street Parkway, yet it has no physical connection. Nobody has answered that for me in ten-years. And it's been listed for ten-years, and I've asked that question before.

I think that if we cancel this from the Superfund Site and we don't get the money from Senator Smith's office, or from the Federal Government, what happens? Do we go back to ground-zero, and have to reapply?

So I'm concerned about a couple of things that we're not getting information on. It's all nice and rosy if it does come about and we get the money, but if we take it off the Superfund Site and we don't get any money from the Federal Government, then where are we? Thank you.

(Applause.)

MR. JASINSKI: Thank you. I would suggest maybe Mr. Gleneck that maybe you and Mr. Crombie can talk a little bit afterward too. I appreciate your comments for the record, and we will address those in our response summary, as we go through the final. John Regan, Department of New Hampshire EES, please? If you have any white cards, please put your hand up? So, Angela can come around, or just raise your hand and I'll call you as we go around.

MR. REGAN: Good evening again. My name is John Regan and I work for the New Hampshire Department of Environmental Services. I have a few brief comments. The purpose of these comments are twofold, one is to make some comments for the public record, which is why we're here tonight.

And also, second, hopefully convey some information to you about the department's position with respect to this particular project.

I'm going to offer some initial comments about the department's work to date. We will follow that up in writing, but what we want also to do is hear from you folks tonight.

A little bit of how we got here, the department after consulting with the city approached EPA about their involvement, because frankly we weren't able to get a private cleanup. We weren't able to enact a cleanup working with the owner.

Early on in this process, the department recognized that the tannery's waste is a lot of sludge, which we've talked about tonight, which is approximately sixty-thousand cubic yards. It is likely the most significant environmental issue at the site.

As a result we worked to focus on solutions to address the sludge as soon as practical. And that was the purpose of the EPA's Engineering Evaluation, Cost Analysis Study.

The department has worked with the EPA closely during this process, in consultation with the city, and there's been several things we've done. Neil has talked about the characterization of the sludge, which is important to figure out what we do with it, and also to develop remedial alternatives that would be acceptable to the city and the community.

Our department is supportive of the recommended alternative that EPA has made tonight, which is to remove the sludge from the site and dispose of it at an approved off-site landfill.

However, having said that, we are here tonight to listen to the input from the public and we look forward to your comments. Thank you.

MR. JASINSKI: Thank you, John. The next white card is Sandy Belnap. I think I said that right.

MS. BELNAP: That's correct.

MR. JASINSKI: Would you state your affiliation with the site for me?

MS. BELNAP: Sure.

MR. JASINSKI: And if you have something in writing --

MS. BELNAP: I'll send that separate, because I have my handwritten notes all over it, from the discussion tonight.

MR. JASINSKI: Okay. That's fine.

MS. BELNAP: Good evening. My name is Sandra Belnap. I'm the property owner at 40 Fairmount Street. Just over three-years ago, the twenty-year challenge of obtaining Superfund monies to clean up the Mohawk Tannery Site came back into our worlds.

As a neighborhood, we need to look at these conflicting issues and thoughts around the cleanup for the site. In an effort to keep my comments on track this evening, first of all, I've written them down so I cannot divert from my issues.

But I would like to focus on two of my most prominent concerns that many of you have shared with me as I've talked to you through our neighborhoods over the last few weeks.

First of all, how and when do we finally get funding, whether it's city, state, or federal? It sounds like federal funding to clean up the site.

And secondly, what should the cleaned up site be used for? Earlier this month on August 7, the EPA and New Hampshire DES, held a public meeting to explain the three cleanup options that were explained tonight.

The recommended alternative to excavate the sixty-thousand cubic yards of waste to an off-site facility, will cost fifteen to twenty-two million dollars. According to the information shared at that meeting, once Superfund monies are obtained, the cleanup will take approximately twelve-months.

To me, given that this process was stalled for almost seventeen-years, since the time that many of you in this group tonight closed that tannery site, we've made great strides over the last couple years.

Now it's time, we're back on the New Hampshire DES radar screen, the EPA radar screen, and the city radar screen, we need to take action.

I do have a concern that this progress may be compromised by the City of Nashua's recent discussions with Senator Smith. Earlier this summer, prior to the August 7, public meeting that was discussed earlier tonight, the city asked Senator Smith to stop the process of adding the Mohawk Tannery to the national priority list.

I do not understand why the city officials did not share this information with us at a public meeting, on August 7. Especially if the intent was to seek other appropriations that will lead to quicker cleanup of the site.

The EPA, and New Hampshire DES, have both been very forthcoming and open with information discussions. Unfortunately I have concerns that our city officials are not committed to working with our neighborhoods and residents as the other public officials and agencies have been.

I have voiced concerns this week with city officials. That while they feel they are doing the right thing for the city that the perception amongst the neighborhood is that they're working against us, not for us.

As I don't have enough information to make a comment of whether or not the current path of being added to the NPL for Superfund listing, is or is not a better alternative, I'd like to pose a few questions to Representatives from Senator Smith's office. I spoke to Marty Hall in Washington, D.C. last week.

If indeed there's a separate appropriation for seven-million dollars for cleanup, why is this less than half of the amount of the fifteen to twenty-two million dollars that's proposed in alternative one?

Additionally, will obtaining this funding really be faster than the process that we've already been fully engrossed in? If it is, open up your discussions and decision making to the residents of the neighborhood. We want to be involved.

Believe it or not, we could help you through this. There's a lot of passionate people that feel that we need to do something and make this happen.

We don't need individuals or agencies seeking hero status to obtain funding for us. We need to work together as a community to resolve this issue.

Is being listed on the National Priority list really a worse stigma to this city, than having a site continually ignored because it does not fit into a person, or a group's political agenda?

The second issue that continually comes up, regarding the cleanup of this site is, what will happen once it's finally cleaned up?

I've been talking to many of you that are here tonight. Most of the people don't want a development of housing, whether it's low-income, or luxury condos along the riverfront. The desire is for some type of park even though we know that this is probably not desirable for a city seeking tax revenue.

No matter what happens, we don't want the current property owner to be able to continue to profit from the site after the cleanup. There is still business activity at the site today.

This shouldn't be located on our now residentially zoned neighborhood. We have excessive truck traffic traveling at excessive speeds, from various landscaping and other types of businesses all week long, including weekends and evenings.

We shouldn't have to tolerate this.

To the EPA, and New Hampshire DES, thank you for keeping the residents involved in this process over the past three-years, including this hearing tonight.

John Splendore from the New Hampshire DES and Neil Handler have always, every single time returned my phone calls, and have never made me feel like an idiot for calling in and voicing my concerns. And I thank you for that.

You have both spent time to answer my questions and explain the process of every step we've been through, through the past three-years.

To the city, please work with us, the residents, the taxpayers, and the voters. We are in your neighborhoods and you represent us. It's okay to be open and share what's going on.

How about fulfilling past commitments of neighborhood meetings on this topic, or create a neighborhood task force to work with you? When we don't hear anything, your curt response of having the right to confidential discussions, or that your schedules are too busy to have meeting with us, is not acceptable. We all need, and believe it or not, some of us even want to work together as a neighborhood.

The community with our elected officials and public agencies, it should not have taken twenty-years to get to this point and we shouldn't have to wait for another twenty-years. Thank you.

(Applause.)

MR. JASINSKI: Thank you, Sandy. I have a request for a Catherine Corkery? Catherine's with the New Hampshire Sierra Club.

MS. CORKERY: Yeah.

MR. JASINSKI: Did I say that right, Catherine?

MS. CORKERY: Yes, you did. And thank you.

MR. JASINSKI: Anybody else if you have a question or a comment for the record, please raise your hand and put your white card up, or just raise your hand. Catherine?

MS. CORKERY: Thank you. Thank you very much. I only hope I can be as eloquent as you just were. Thank you Neil for having this hearing. And thank you EPA people, it's great to have you here and provide all the information you have. And also the City of Nashua, it's also good to see that you're here, and really involved, and all you citizens.

Ten-years later it's pretty exciting to actually have the hearing and really see this process move. And that's actually what I wanted to talk about.

This is a public hearing. And guaranteed with the Superfund funding and this whole Superfund process, there will be a number of guarantees for you.

There are guarantees that this will be a public process. There are guarantees that you will have input in this process. There is a guarantee that it will be thorough. That they have set priorities as they said, dealing with the sludge, and then, they'll deal with any water contamination, and that's thorough.

We know that it's going to be cleaned up and maybe it will take time, maybe it's not as easy. It's difficult to have these kind of conversations, but we need to have the input and Superfund provides that.

The only problem of course, is what, have we all heard? Funding. Superfund has lost its major backer, which was a tax on these chemicals. And I'm no expert. These guys could definitely give you a better history of Superfund, and the tax. But that Superfund tax, it came together and you guys know, in 1980, and it went on until 1995. And in 1995 this tax was not reinstated in congress.

So our bank account, our Superfund bank account is quickly dwindling and it's relying on our taxpayer dollars now. And so we have to look at our delegation to appropriate taxpayer dollars to clean-up our water, to clean-up our backyards, when the polluter needs to pay for this.

And the Mayor's plan and I'm very interested to learn more about it, but it leaves a lot of questions. And you touched upon a lot of those questions, and I think you had some really great solutions too.

One of the questions is, will the citizens of Nashua be allowed to make public comment and input like we are today?

Does the city have the expertise to clean up something like that? What are the differences between the plan? And why so much money? Why is there such a disparity? We don't know. And the question then becomes, will the Mayor's plan leave pollution there? We don't -- it's a good question that we don't have the answers to yet, and I'm very interested in hearing what the Mayor's plan will be.

But I just wanted to encourage all of you to really think about this and what it means. And I think we are doing that. We have a lot of good questions flying around the room today and hopefully we can catch a lot of those and find the answers that match them.

But overall, what needs to happen is, and this is nothing that obviously we will not get done today, but we do need to reinstate the Superfund tax, so that this responsibility to clean up sites like the Mohawk Tannery here, in Nashua doesn't fall on the taxpayer dollars, or the citizens in New Hampshire and all over the country.

And I just thank you for your time and I certainly hope that I can be of some resource to you. Thank you.

(Applause.)

MR. JASINSKI: I have one other card, Paula Johnson, Alderman at Large.

MS. JOHNSON: Thank you. Good evening my name is Paula Johnson. I'm Alderman at Large here. I'm sorry I wasn't here when this first began this evening, but I've been told -- I would say that almost all of the meetings that have been held for at least the last two-years when I first started on the Board of Education.

My concerns were trucking some of this toxic waste out and the smells around the surrounding schools. Now I'm hearing another plan here. I'm really concerned about this, because I sat through many meetings. I sat with meetings talking about whether or not we were going to put the sludge on trucks and put it to our own landfill. And I'm still concerned, is this going to happen, because I'm looking at the chart here and they're not talking about bringing it up through Fimbel's by the railroad tracks. They're talking about on Broad Street.

Well, my concern if it goes on Broad Street, it's going to go on the highway, then down West Howell Street, to our landfill. We have abutters at the landfill, I think they've had enough.

I know that I live down from the landfill. I've had enough with the smell of the landfill for like the last four-years of this and we don't need any more smells.

When we talk about that we don't want the taxpayers to pay for this and that we should have the company's being paid for -- the polluters, I think we really need to take a look at this whole scenario now.

We don't get the violators to pay for this, whether it's federal dollars, state dollars, or Nashua dollars, it's taxpayer's dollars. And it's about time these violators pay for this and not us anymore. And we have to go -- if it has to be through Washington, send our elected officials down there a message, enough is enough.

These people pollute, they need to pay for it, we should not have to pay for this anymore. And the sad thing is, the owner of this company might walk scot free, and you what? We the people now have paid for this again through our tax dollars.

My other concerns are, how toxic is toxic? It depends on what your scale is and my scale is of toxicity and what's sitting in that groundwater, and what's in the river. These are toxic chemicals. Dioxin we know is very toxic. We know Chromium is toxic. What level of it is safe? I don't think there's any level that's safe.

I feel bad for the people that have lived with this for so long. I remember when I used to take my children to preschool and we used to get off from Exit 5, to Exit 6, and the smell coming across at that area, at that time, it was horrible.

Nobody really knew when I moved into Nashua in the early 80's what was exactly going on, but you knew there was this smell when you got off the highway.

I wanted to thank Angela and Neil. They did come to my house and ask me a lot of questions and I hope I helped them, the EPA and DES, and I've never been a big fan of any government agency. And I'm proud to say that, you know -- I am part of government now, I don't know. But I guess I'm the outsider in government here, as many people on my Board looked at it.

Is quicker the better solution here, to clean it up? Nobody knows, because my concern is are we going to do this quicker and we're not going to clean it the way we need.

Redevelopment, I've heard that there might be a contractor that's interested in that development, in that area. What do you want to put there?

My question, I've sent it to Neil was, I think that any time you cleanup any toxic area, whether it's on the Superfund Site, or not, it should always be posted, and everybody should always know what they're going to live on, what they're going to play on, and what can eventually come out of the ground, because nothing can guarantee me that once you've finished cleaning up that area that you've got every bit of contaminant, every toxic chemical out of that ground.

Remember how many years it's been sitting there? How far down it's gotten? And you can't tell me that you're going to get everything out of that ground, everything out of the water.

But I do want to thank everybody for the hard work they've done. I think community involvement, whether in this, or any other project is the most important thing, because us, as your elected officials, whether at the state, city, or federal level, don't know what you're feeling, unless you tell us. And that's the most important thing.

By you coming out here tonight and making these comments, you're telling me things that I need to know.

And I've gone to as long as I don't have another meeting scheduled, I do my best to come to as many meetings as I can. And thank you all for coming out here tonight.

(Applause.)

MR. JASINSKI: I'd like to emphasize what Paula said. We are very interested in comments, either tonight or before August 29, in writing, by email to Neil, whatever way, shape, form you want to get them to us, we are in a thirty-day public comment period process.

Your comments are important to us. They will shape the final decision on how to clean it up under the time critical removal action.

Does anybody else wish to come and make a statement? Sir, I saw your hand first, and then the lady in back. Would you state your name?

MR. DUFO: My name is Jim Dufo, 6 Huey Street, we have abutted the property for quite a long time. I have to admit that my mother-in-law and my wife are a lot closer to this comings and goings than I am.

But I can say this, it looks like we have a plan in front of us to fix the site. Thank you very much to the EPA and the DES. This has been a long battle. These battles go back.

Not to bore you with the histrionics, but the battles took place in this room, some twenty, twenty-fives years ago when permits were being given to that site, to produce the toxins that we're now trying to take off-site.

The most confusing part of sitting in the audience, it looks like there's a plan B developing here, from the city, which is in the eleventh-hour, contacting our Senator's office saying, we don't want to list the site.

And the majority of us sitting in this audience don't understand that. We have a plan. The plan is comprehensive, it's broad based, it even has on page, if you all have this document, you can flip to page 6, it even talks about residual effects that will be developed and explored. It's complete, and it is comprehensive.

Now in the eleventh-hour, plan B shows up and no one understands it. It looks like an attempt to derail the listing of the site. We just don't understand what that means. It's the sheets being pulled out from under us, and that's probably the biggest concern we have at this point.

You heard earlier, Sandy Belnap speak and she's very eloquent and addressed the points one, after another. If we had a tape of that, we could play it back. I'd like to give the rest of my time so that we could hear it again.

Before I give up the podium here and go sit down, that's the concern. The concern is on the faces of the good people sitting out there is, what is this plan B? This undefined plan that's all of a sudden showing up after all this work's been done. After they've been out there for two-years drilling holes and working on that site, and climbing around in those damn monkey suits and what not.

Now we have this thing documented and it looks like we're going forward. There's a risk of money not being approved for the site? Well, guess what? The money will never be approved for the site if you don't list the site.

Plan B has been brought to us today, or at least mentioned today, and nobody understands it. And it looks like a -- it flies in the face of all the good work that has been done. Thank you.

(Applause.)

MR. JASINSKI: George, I'll let you, after the comment period, you need to address that kind of question, please? But at the formal hearing, no, not right this minute, I'll just give you an opportunity after I close the hearing, because I do have a comment from Mary Gorman. Would you like to make a statement?

MS. GORMAN: Yes, I do. I really do. I'm Mary Gorman. I live at 44 ½ Amherst Street and I'm also a State Representative for Ward 4, and I want to thank everyone for coming. And I believe that the EPA has high standards. I think DE --

FROM THE FLOOR: Can you talk louder?

MS. GORMAN: I believe that EPA has high standards in regard to a complete cleanup of this site. And I am warmed by the fact that the DES, the Department of Environmental Services, in New Hampshire, feels the same way.

And I am very much concerned as a parent, for the toxics that have existed in the area and the effect upon the residents. I agree with the previous speaker that if it is not listed as a Superfund Site, we cannot make application.

I believe we should do this. We have a plan in action. We should go forward. And I believe there is a strong case. And I wish to thank DES, and also the EPA. Thank you, very much.

(Applause.)

MR. JASINSKI: Mr. Crombie wants to make a statement for the record. George, please?

MR. CROMBIE: I think there's a lot of misinformation. As I hear what's being discussed tonight, I think it's important to give the perspective of the city.

Let me begin with -- Superfund to begin with, or the issue of Superfund. Don't take my word, but look at sites around the country and see how fast these sites have been cleaned up and what you will find, is these sites have not been cleaned up for years, and years, and years.

So, the notion that a site is on the Superfund list that you're going to get that site cleaned up and you're going to get the money to do it that just isn't the case.

The second thing is, prior to becoming the Public Works Director, I was an environmental regular, and we tried to do everything in our power to find a way, to get a site cleaned up before it went on the Superfund list.

Now there's been discussions relative to the plan that we talked about. I think there's two important things that I'm not sure got through tonight.

The first is, if a site is under discussion for Superfund listing, EPA, has the ability to come in and do certain work, which is called Time Critical, and Non-Time Critical Work, before it's listed.

And what the city is trying to do is get this work done before it's listed, and there's a good reason for that, because when you look what's happening on a national level, there is a position and a structure, not to fund the Superfund Program.

So one of the goals is to try to get this done as soon as possible, because we view that in the best interest of the City of Nashua.

The other thing that you'll find is when you look at the Superfund Program, a tremendous amount of money goes into Superfund, without really doing any real cleanup and you just have to look at the sites across New England. And this has nothing to do with EPA, or DES. They're very good people, they work very hard, they do everything they can to get the program completed.

The reality is, there isn't the money in the Superfund Program to do the type of clean up that's needed. And what you need to do, is you need to compete for that money. And the faster you have a solution, and the faster you can go to try to get the money, the better position that you're in.

The city is trying to do everything to move this process just as fast as it can. The easy thing to do is say, we're going to list it on the Superfund Program. That doesn't mean the site's going to be cleaned up.

And if you believe that it should be listed, the next question you should ask is when is the money going to come to clean up the site. And I would get a letter and I would get it guaranteed, because just listing doesn't mean you're going to get the money.

So the strategy that the city has been using, in working with DES, in working EPA, is try to get the sludge out of there without listing the site. The notion because they have a remedy now, does not mean that, that site will be cleaned up. Whether you list it, or you don't list it.

FROM THE FLOOR: Is there still a little time to make a rebuttal?

MR. JASINSKI: Do you want to make a statement before the -- Ma'am? Please state your name and your affiliation from the podium?

MS. DUFO: My name is Stephanie Dufo. I live at 6 Huey Street, Nashua, New Hampshire. I've been fighting this for thirty-years. You can't imagine what we've been through. You weren't here. It's been unbelievable. We went to meetings back twenty-five years ago and the alderman put their backs to us.

Now you're talking with the city again, and the city is saying, take us off the list, we're going to do it ourselves. Please don't believe the city. They've never been there for us before. Walk to and through our neighborhood, and then take the road that goes to the grade school. We don't even have sidewalks for our kids.

Do not listen to the city. They're not looking to protect us. They have never been there to protect us. Please listen to the neighbors of the polluter. Please --

whose decision is it? Is it the Mayor's decision? He's been here for a year and a half, or two-years. Where was he? He worked for Memorial Hospital. Warren Keane was on the Board of Directors of Memorial Hospital, when people were getting cancer in the city.

Warren Keane is the owner of the tannery property. He was on the Board and he was the President of the Board of Directors, of Memorial Hospital. Mr. Streeter was associated, he worked -- he was employed by Memorial Hospital.

Now, we have Mr. Streeter here saying, take us off the Superfund list. We have Mr. Warren Keane sitting here watching the whole charade. He can afford his own business. He can afford to pay his taxes on his house. He can afford to take trips. He can afford to pay for his lawyers to protect him. He has rented this property to every Tom, Dick and Harry. The gates are never closed. There's kids swimming in the river. Please do not trust the city.

Please do not -- who is going to make the decision of whether this comes off the Superfund site? Is it Maurice Arella, past Mayor, was just cared about us so much, he just sold our Pennichuck Waterworks. (Laughter.) Don't trust --

MR. JASINSKI: I'm going to --

MS. DUFO: -- this man.

MR. JASINSKI: Ma'am.

MS. DUFO: He is in the same room --

MR. JASINSKI: Ma'am.

MS. DUFO: -- with owner of the property and he's not there for us.

MR. JASINSKI: Thank you.

MS. DUFO: Please think of us.

MR. JASINSKI: Thank you. I'd like to --

(Applause.)

MR. JASINSKI: I know it's difficult to try to make comments on the proposed plan that we have in front of you, but please try to make your comments toward the plan.

MS. DUFO: Please investigate my statements.

MR. JASINSKI: I appreciate your comments. If there is anyone else that would like to make a comment on our proposed approach for Mohawk Tannery, please step forward. If not, I'm going to close the formal hearing and then we can have a discussion if you want, about all of these other issues.

Are there any other formal comments for the hearing? I remind you that you have until August 29. Ma'am, do you want to make a statement on the proposed cleanup approach?

I know there's a lot of issues dealing with Superfund sites, a lot of issues dealing with waste, but I want to try to keep the focus on the proposed approach, please?

MS. YUKNOVITCH: I'm Dora Yuknovitch, 10 Huey Street, Nashua New Hampshire. I've been a resident of the Fairmount Heights from -- I hope you can all hear me? Maybe you hear me better this way?

FROM THE FLOOR: Yes.

MS. YUKNOVITCH: Okay. I just want you to know that we have to take care of ourselves. We cannot, definitely not, I have to repeat what my daughter said. We have to look after ourselves. Our alderman, I tried to have him help me once, he slapped me in the face by saying, we cannot have a four-way stop sign.

Well, I was looking for the children of Nashua, on the summer time. When they're playing in the roads, three-quarters of the year, so they could have joy of playing on the bicycle and everything, he turned around to winter, three-months. Maybe it snows two, or three times very hard that you have to be careful and stop.

So, we lost the stop sign, because he was so generous for the people down the hill, they don't have to stop. That stop is not a straight stop. That is a dead stop, but if he went straight ahead up that street, he would go up into another house. You actually have to move over thirty-feet to turn over, to get up to that street.

MR. JASINSKI: Ma'am, what's the comment on the proposed --

MS. YUKNOVITCH: The thing is, the point is, you cannot trust even your alderman. You have to take care of yourselves. Listen to my daughter and listen to everybody else that spoke here.

MR. JASINSKI: Thank you, very much.

(Applause.)

MR. JASINSKI: We will be here this evening to answer any other clarifying questions. So, I'm going to ask one more time, is there a comment on the record on the proposed plan? Sir, state your name for the record.

MR. PLAMONDON: Mark Plamondon, Alderman, Ward 4. I want to thank all of you for coming out tonight. I apologize for my tardiness this evening. I didn't hear all the comments as I had two other meetings prior to tonight. I also want to thank the EPA, and the DES for all the work that they have done for this project.

This project personally is an abomination. It's been long overdue. I personally want to see us take the fast path to cleaning it up and moving forward.

My personal agenda and personal fight, after the cleanup, is to turn this into city parkland, and annex it to Mines Falls Park. That's my personal fight, and I hope you're behind me in that.

What's been proposed tonight is this so called

Plan B, which after looking at it, speaking with the Mayor, Mr. Crombie and his experience, I do feel this is the right way for the quickest cleanup, and to be done right.

And then, briefly, I just want to address the last speaker's comment's. I sponsored legislation for a four-way stop. It went through the legislative process. The legislative process is what killed it. The other alderman voted against it.

FROM THE FLOOR: (Inaudible comment.)

MR. JASINSKI: Okay. Okay. Please, please. Take your conversation elsewhere.

MR. PLAMONDON: So just so you know that was addressed. It was in the paper.

FROM THE FLOOR: (Inaudible comment.)

MR. JASINSKI: Please let him finish. Please let him finish, Ma'am?

MR. PLAMONDON: It's all in the public record. But anyway, those are my points and I know I'm looking forward to cleaning this up and moving forward, and adding this to a positive chapter in Nashua's history. Thank you.

MR. JASINSKI: I'd like to close this hearing, unless I see one more hand and I don't, so I'd like the form --

Ma'am?

MS. BELNAP: What's Plan B? Nobody has explained what Plan B is.

MR. JASINSKI: Yes. No one's explained Plan B. That's a comment. You want to make it for the record, fine. If you want to talk about it later, we can do that after I close the hearing. Do you want to ask that question of the EPA on their proposed plan, or do you want to ask it of someone else?

MS. BELNAP: The city I guess, because they're proposing Plan B.

MR. JASINSKI: Okay. You want to make that comment for the record. Please, state your name?

MS. BELNAP: Kathy Belnap, on 40 Fairmount Street. Would somebody please explain Plan B to us? I'm not familiar with it, maybe I missed something in the Telegraph. Thank you.

MR. JASINSKI: And I'll let George respond to that, after I close the hearing. Please, George. Phil did you have a comment you want to make for the record?

MR. O'BRIEN: Phil O'Brien, Division of Waste Management, I think in all the discussion that we've had tonight, two things seem very clear.

One, there isn't a great deal of dispute over what the remedy is, or should be. There seems to be a general agreement. Though, there may be in any remedy as there always is, strong parts of it and weaker parts, things that you like better than others. But I think that is the general agreement, or no substantial disagreement.

The second thing that's been talked about is how you get the money and the funds to do the work. There may be a less difference than it seems to be sensed by the audience tonight in that the Superfund Process has been characterized as arduous and slow, not producing results.

But that probably was an adequate characterization some time ago. I think it's been vastly improved with the administrative changes that have actually sped the process up substantially.

So I think, while as George requests, they guaranteed that the money would be available, there will no guarantee and I don't think anyone responsible would suggest that listing is an automatic guarantee that there will be money.

But in the manner in which that program is administered now, I think the odds of getting successful results, that is getting money through Superfund, in my view personally, does suggest that the sight should be listed.

On the other hand, the attempt that the Mayor's Office is trying to make, what may be, your regarding as Plan B, is to find another avenue and another source of the funds through congressional process. And that's why Jeff Rose is here tonight and commented.

Personally, I'm not sure that we should worry a lot about which is successful. If we're successful in either one of the two, we're advantaged. That means the cleanup can go forward.

So, I'm not sure that the sense of the meeting whereby, you have to be on one side of the issue of funding, or on the other side, necessarily serves us all well. I think agreement on the cleanup and how it should be done, and we ought to be, and it's a good thing to do, explore every possibility for funding, because money, it does not fall, you can't shake the money tree and find it that easily.

It is definitely true that federal funding for cleanups is getting more difficult, no question about that. There does not seem to be a congressional will to reauthorize the Superfund tax. So, as the money declines in that account, if you will, it gets more and more competitive to get every last dollar from it.

So, I think exploring every avenue and pressing every advantage that we have, from the congressional staff, through the process itself, is a wise way to go, at least in my view. Thank you, for your time.

(Applause.)

MR. JASINSKI: Thank you. I would like to close the hearing at this time. We will be here to answer any other questions. So, I remind you, I'm going to close the formal part of the hearing this evening.

Other comments are still expected until August 29, that's next Thursday. So you have over a week. Email them, write them down, send them to Neil. Whatever way you want to get them to him.

We'll accept all those comments and we will plan on writing the final decision called an Action Memorandum, by September. That will get the process moving forward.

I thank you for your comments on the record. If anybody wants to ask any other questions, I'm closing the formal hearing now, please do so.

(Whereupon, the hearing was concluded at 9:15 p.m.)

CERTIFICATE OF REPORTER AND TRANSCRIBER

This is to certify that the attached proceedings before: U.S. ENVIRONMENTAL PROTECTION AGENCY

in the Matter of:

RE: MOHAWK TANNERY SUPERFUND SITE

LOCATED IN NASHUA, NEW HAMPSHIRE

Place: Nashua, New Hampshire

Date: August 20, 2002

were held as herein appears, and that this is the true, accurate and complete transcript prepared from the notes and/or recordings taken of the above entitled proceeding.

S. French	08/20/02
Reporter	Date
C. Daniels	09/09/02
Transcriber	Date

ATTACHMENT C

Revised Cancer and Noncancer Risk Summary Tables

TABLE 2-27
SUMMARY OF RECEPTOR RISKS AND HAZARDS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Area	High Lead (1)	Scenario/Receptor	Media CR>1E-04 or HI>1	Total Cancer Risks	Major contributors to cancer risk above 1E-04 (individual cancer risk>1E-06)	Total Noncancer Hazard Index	Major contributors to noncancer Hazard Index (HI>1.0)
Area 1 Surface* sludge	NO	Current/Future Adolescent Trespasser	YES	5E-05	NA	1	NA
Areas 2 through 7 Surface* soil/sludge	YES	Current/Future Adolescent Trespasser	NO	5E-06	NA	5E-02	NA
Areas 2 through 7 Surface* soil/sludge	YES	Future Lifetime Resident	YES	1E-04	NA	1	NA
Areas 1 through 7 "All"* soil/sludge	YES	Future Lifetime Resident	YES	2E-04	Dioxin TEQ, Pentachlorophenol, Arsenic, Benzo(a)pyrene	10	4-Methylphenol, Antimony

Notes:

(1) Maximum Lead > 400mg/kg

* The surface sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs. Since very few samples were collected from only surface materials (0 to 2 feet bgs) in any area and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface datasets include any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs. Similarly, since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

NA Not Applicable

TABLE 2-25.1
NONCANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Average % Solids	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
4-Methylphenol	1300	Max	0.26	*		0.1	1.42E-07	1.39E-05	5.00E-03	1.00E+00	5.00E-03	9.63E-03	9.40E-01	9.50E-01
2-Methylnaphthalene	21	Max	0.26	*		0.13	1.42E-07	1.81E-05	2.00E-02	1.00E+00	2.00E-02	3.89E-05	4.94E-03	4.98E-03
Pentachlorophenol	32	Max	0.26	*		0.25	1.42E-07	3.48E-05	3.00E-02	1.00E+00	3.00E-02	3.95E-05	9.65E-03	9.69E-03
Dioxin TEQ	0.0016	Max	0.26	0.5	6	0.03	7.12E-08	4.17E-06		1.00E+00				
Antimony	4	Max	0.26	*			1.42E-07		4.00E-04	1.50E-01	6.00E-05	3.70E-04		3.70E-04
Arsenic	7.6	Max	0.26	1	7	0.03	1.42E-07	4.17E-06	3.00E-04	1.00E+00	3.00E-04	9.38E-04	2.75E-02	2.84E-02
Chromium	25200	Max	0.26	*			1.42E-07		1.50E+00	1.30E-02	1.95E-02	6.22E-04		6.22E-04
Manganese	13300	Max	0.26	*			1.42E-07		7.00E-02	4.00E-02	2.80E-03	7.04E-03		7.04E-03
														1.00E+00

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time
= (100 mg/d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time
= (4650 cm^2 * 21 mg/cm^2-ev * 1 ev/d * 26 d/y * 10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study
HI = EPC*Average % solids*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

*** The dry weight EPC is multiplied by the average % solids in the final hazard index calculations to yield hazard index estimates based on wet weight concentrations.

TABLE 2-26.1
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Average % Solids	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
4-Methylphenol	1300	Max	0.26	*		0.1	2.04E-08	1.99E-06		1.00E+00				
2-Methylnaphthalene	21	Max	0.26	*		0.13	2.04E-08	2.58E-06		1.00E+00				
Pentachlorophenol	32	Max	0.26	*		0.25	2.04E-08	4.97E-06	1.20E-01	1.00E+00	1.20E-01	2.03E-08	4.96E-06	4.98E-06
Dioxin TEQ	0.0016	Max	0.26	0.5	6	0.03	1.02E-08	5.96E-07	1.50E+05	1.00E+00	1.50E+05	6.35E-07	3.72E-05	3.78E-05
Antimony	4	Max	0.26	*			2.04E-08			1.50E-01				
Arsenic	7.6	Max	0.26	1	7	0.03	2.04E-08	5.96E-07	1.50E+00	1.00E+00	1.50E+00	6.03E-08	1.77E-06	1.83E-06
Chromium	25200	Max	0.26	*			2.04E-08			1.30E-02				
Manganese	13300	Max	0.26	*			2.04E-08			4.00E-02				
														4.46E-05

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time
= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time
= (4650 cm2 * 21 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

*****Cancer Risk** = *EPC*Average % solids*Exposure Factor*CSF*

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.
*** The dry weight EPC is multiplied by the average % solids in the final risk calculations to yield risk estimates based on wet weight concentrations.

TABLE 2-25.2a
NONCANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	RfDinhal mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Inhalation Hazard Index	Total Hazard Index
Aroclor 1242	0.28	Max	*		0.14	1.42E-07	3.71E-07	5.18E-18	2.00E-05	1.00E+00	2.00E-05		1.99E-03	5.19E-03		7.19E-03
Dioxin TEQ	0.0013	Max	0.5	6	0.03	7.12E-08	7.95E-08	5.18E-18		1.00E+00						
Antimony	44.4	Max	*			1.42E-07		5.18E-18	4.00E-04	1.50E-01	6.00E-05		1.58E-02			1.58E-02
Arsenic	15.7	Max	1	7	0.03	1.42E-07	7.95E-08	5.18E-18	3.00E-04	1.00E+00	3.00E-04		7.46E-03	4.16E-03		1.16E-02
Barium	657	Max	*			1.42E-07		5.18E-18	7.00E-02	7.00E-02	4.90E-03	1.40E-04	1.34E-03		2.43E-11	1.34E-03
Cadmium	16.8	Max	*		0.001	1.42E-07	2.65E-09	5.18E-18	5.00E-04	2.50E-02	1.25E-05		4.79E-03	3.56E-03		8.35E-03
Lead	427	Max	*			1.42E-07		5.18E-18								
Manganese	207	Max	*			1.42E-07		5.18E-18	7.00E-02	4.00E-02	2.80E-03	1.40E-05	4.21E-04		7.66E-11	4.21E-04
Mercury	4.5	Max	*			1.42E-07		5.18E-18	3.00E-04	1.00E+00	3.00E-04	8.60E-05	2.14E-03		2.71E-13	2.14E-03
																4.69E-02

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time
= (100 mg/d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time
= (4650 cm^2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y * 10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)
= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 10 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-26.2a
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	CSFinhal mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	2.04E-08	5.30E-08	7.40E-19	2.00E+00	1.00E+00	2.00E+00	2.00E+00	1.14E-08	2.97E-08	4.14E-19	4.11E-08
Dioxin TEQ	0.0013	Max		0.5	6	0.03	1.02E-08	1.14E-08	7.40E-19	1.50E+05	1.00E+00	1.50E+05	1.50E+05	1.98E-06	2.21E-06	1.44E-16	4.20E-06
Antimony	44.4	Max		*			2.04E-08		7.40E-19		1.50E-01						
Arsenic	15.7	Max		1	7	0.03	2.04E-08	1.14E-08	7.40E-19	1.50E+00	1.00E+00	1.50E+00	1.50E+01	4.79E-07	2.67E-07	1.74E-16	7.47E-07
Barium	657	Max		*			2.04E-08		7.40E-19		7.00E-02						
Cadmium	16.8	Max		*		0.001	2.04E-08	3.79E-10	7.40E-19		2.50E-02		6.30E+00			7.83E-17	7.83E-17
Lead	427	Max		*			2.04E-08		7.40E-19								
Manganese	207	Max		*			2.04E-08		7.40E-19		4.00E-02						
Mercury	4.5	Max		*			2.04E-08		7.40E-19		1.00E+00						
																	4.99E-06

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time

= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS_{oral} * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time

= (4650 cm2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS_{dermal} * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)

= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-25.2b
NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE SOIL/SLUDGE AREAS 2-7**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
Aroclor 1242	0.28	Max	*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	7.67E-02	3.01E-02	1.07E-01
Dioxin TEQ	0.0013	Max	0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	44.4	Max	*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	6.08E-01		6.08E-01
Arsenic	15.7	Max	1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	2.87E-01	2.41E-02	3.11E-01
Barium	657	Max	*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	5.14E-02		5.14E-02
Cadmium	16.8	Max	*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	1.84E-01	2.06E-02	2.05E-01
Lead	427	Max	*			5.48E-06							
Manganese	207	Max	*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	1.62E-02		1.62E-02
Mercury	4.5	Max	*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	8.22E-02		8.22E-02
													1.38E+00

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time

= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS $_{oral}$ * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time

= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS $_{dermal}$ * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-26.2b
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-07	1.66E-07	5.40E-07
Dioxin TEQ	0.0013	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	6.53E-05	1.24E-05	7.76E-05
Antimony	44.4	Max		*			6.69E-07			1.50E-01				
Arsenic	15.7	Max		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	1.58E-05	1.49E-06	1.73E-05
Barium	657	Max		*			6.69E-07			7.00E-02				
Cadmium	16.8	Max		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Lead	427	Max		*			6.69E-07							
Manganese	207	Max		*			6.69E-07			4.00E-02				
Mercury	4.5	Max		*			6.69E-07			1.00E+00				
														9.54E-05

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS $_{oral}$ * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS $_{dermal}$ * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.
** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-25.3
NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL SOIL/SLUDGE AREAS 1-7**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
1,4-Dichlorobenzene	1	95%UCL	*		0.1	5.48E-06	1.53E-06	3.00E-02	1.00E+00	3.00E-02	1.83E-04	5.11E-05	2.34E-04
Chlorobenzene	1.7	95%UCL	*		0.1	5.48E-06	1.53E-06	2.00E-02	1.00E+00	2.00E-02	4.66E-04	1.30E-04	5.96E-04
4-Methylphenol	1300	Max	*		0.1	5.48E-06	1.53E-06	5.00E-03	1.00E+00	5.00E-03	1.42E+00	3.99E-01	1.82E+00
Benzo(a)Pyrene	0.66	Max	*		0.13	5.48E-06	1.99E-06		1.00E+00				
2-Methylnaphthalene	21	Max	*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	5.75E-03	2.09E-03	7.85E-03
Naphthalene	61	Max	*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	1.67E-02	6.08E-03	2.28E-02
Pentachlorophenol	120	95%UCL	*		0.25	5.48E-06	3.84E-06	3.00E-02	1.00E+00	3.00E-02	2.19E-02	1.53E-02	3.73E-02
Total Aroclors	0.028	95%UCL	*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	7.67E-03	3.01E-03	1.07E-02
Dioxin TEQ	0.0026	Max	0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	506	95%UCL	*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	6.93E+00		6.93E+00
Arsenic	8.6	95%UCL	1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	1.57E-01	1.32E-02	1.70E-01
Barium	154	95%UCL	*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	1.21E-02		1.21E-02
Cadmium	0.78	95%UCL	*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	8.55E-03	9.57E-04	9.51E-03
Chromium	67800	Max	*			5.48E-06		1.50E+00	1.30E-02	1.95E-02	2.48E-01		2.48E-01
Lead	67.6	95%UCL	*			5.48E-06							
Manganese	1810	95%UCL	*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	1.42E-01		1.42E-01
Mercury	0.76	95%UCL	*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	1.39E-02		1.39E-02
Thallium	0.81	95%UCL	*			5.48E-06		6.60E-05	1.00E+00	6.60E-05	6.72E-02		6.72E-02
Vanadium	32.1	95%UCL	*			5.48E-06		7.00E-03	2.60E-02	1.82E-04	2.51E-02		2.51E-02
													9.52E+00

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time
= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS_{oral} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time
= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS_{dermal} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = (EPC * Exposure Factor)/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSF administered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 2-26.3
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL** SOIL/SLUDGE AREAS 1-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
1,4-Dichlorobenzene	1	95%UCL		*		0.1	6.69E-07	2.11E-07	2.40E-02	1.00E+00	2.40E-02	1.61E-08	5.07E-09	2.11E-08
Chlorobenzene	1.7	95%UCL		*		0.1	6.69E-07	2.11E-07		1.00E+00				
4-Methylphenol	1300	Max		*		0.1	6.69E-07	2.11E-07		1.00E+00				
Benzo(a)Pyrene	0.66	Max		*		0.13	6.69E-07	2.75E-07	7.30E+00	1.00E+00	7.30E+00	3.22E-06	1.32E-06	4.55E-06
2-Methylnaphthalene	21	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Naphthalene	61	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Pentachlorophenol	120	95%UCL		*		0.25	6.69E-07	5.28E-07	1.20E-01	1.00E+00	1.20E-01	9.64E-06	7.61E-06	1.72E-05
Aroclor 1242	0.028	95%UCL		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-08	1.66E-08	5.40E-08
Dioxin TEQ	0.0026	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	1.31E-04	2.47E-05	1.55E-04
Antimony	506	95%UCL		*			6.69E-07			1.50E-01				
Arsenic	8.6	95%UCL		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	8.63E-06	8.18E-07	9.45E-06
Barium	154	95%UCL		*			6.69E-07			7.00E-02				
Cadmium	0.78	95%UCL		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Chromium	67800	Max		*			6.69E-07			1.30E-02				
Lead	67.6	95%UCL		*			6.69E-07							
Manganese	1810	95%UCL		*			6.69E-07			4.00E-02				
Mercury	0.76	95%UCL		*			6.69E-07			1.00E+00				
Thallium	0.81	95%UCL		*			6.69E-07			1.00E+00				
Vanadium	32.1	95%UCL		*			6.69E-07			2.60E-02				
														1.87E-04

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs

APPENDIX D

ADMINISTRATIVE RECORD INDEX

Action Memorandum
Mohawk Tannery Site
Nashua, New Hampshire

Introduction to the Collection

This is the Non-Time-Critical Removal Action (NTCRA) Administrative Record for the Mohawk Tannery Site, released October 29, 2002. It includes the documents contained in the Supplemental Administrative Record File for the Mohawk Tannery Site, Engineering Evaluation/Cost Analysis (EE/CA), released July 30, 2002, and the documents contained in the Mohawk Tannery Site, EE/CA Administrative Record File dated July, 2000. The NTCRA Administrative Record contains site-specific documents and a list of guidance documents used by EPA staff in identifying the proposed response action for the waste disposal areas at the site. The Action Memorandum, which documents the cleanup approach for the proposed NTCRA, was signed by EPA on October 29, 2002.

What is an Administrative Record?

An administrative record is a collection of documents which forms the basis for an agency's decision, in this case to identify the appropriate response action for the waste disposal areas at the Mohawk Tannery Site. Relevant documents that were relied upon in developing the proposed response action, as well as relevant documents that were considered but ultimately rejected, are included. The administrative record also acts as a vehicle for public participation in effecting appropriate response actions.

Under section 113(K) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), the U.S. Environmental Protection Agency (EPA) is required to establish an administrative record for every Superfund removal response and to make a copy of the administrative record available at or near the site. The administrative record must be reasonably available for public review during normal business hours and should be treated as a non-circulating reference document.

The Administrative Record File is available for review at:

EPA New England Superfund Records Center
1 Congress Street, Suite 1100 (HSC)
Boston, MA 02114
(by appointment)
617-918-1440 (phone)
617-918-1223 (fax)

Nashua Public Library
2 Court St.
Nashua, NH 03060
(603) 594-3412

Individuals may copy any documents contained in this Administrative Record File.

Questions concerning the site or documents contained in the Administrative Record File can be directed to either:

Neil Handler
Remedial Project Manager
U.S. EPA, Region 1
1 Congress Street, Suite 1100 (HBO)
Boston, MA 02114-2023
(617) 918-1334
handler.neil@epa.gov

or:

Angela Bonarrigo
Community Involvement Coordinator
U.S. EPA, Region 1
1 Congress Street, Suite 1100 (RAA)
Boston, MA 02114-2023
(617) 918-1034
bonarrigo.angela@epa.gov

MOHAWK TANNERY SITE
NON-TIME-CRITICAL REMOVAL ACTION (NTCRA)
ADMINISTRATIVE RECORD
OCTOBER 29, 2002
(DOC ID ORDER)

VOLUME I

1. REPORT: QUALITY ASSURANCE PROJECT PLAN (QAPP), ENGINEERING EVALUATION/COST ANALYSIS
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 32893 06/01/2001 370 PAGES

2. REPORT: QUALITY ASSURANCE PROJECT PLAN (QAPP), ENGINEERING EVALUATION/COST ANALYSIS [PART 2]
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 32897 06/01/2001 412 PAGES

3. REPORT: REMOVAL PROGRAM AFTER ACTION REPORT FOR SITE FROM OCTOBER 2, 2000 THROUGH JANUARY 26, 2001
   TO: US EPA REGION 1
   AUTHOR: ROY F WESTON INC
   DOC ID: 32900 04/01/2001 58 PAGES

4. REPORT: HEALTH AND SAFETY PLAN, ENGINEERING EVAUATION/COST ANALYSES FOR SITE
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 32914 08/01/2001 279 PAGES

VOLUME II

5. REPORT: PUBLIC HEALTH ASSESSMENT FOR SITE (09/13/01 COVER LETTER IS ATTACHED)
   AUTHOR: AGENCY FOR TOXIC SUBSTANCE AND DISEASE REGISTRY
   DEPARTMENT OF HEALTH AND HUMAN SERVICES
   DOC ID: 32917 08/22/2001 104 PAGES

6. REPORT: PRELIMINARY SLUDGE CHARACTERIZATION INVESTIGATION - TEXT, FIGURES AND APPENDIX A
   TO: US EPA REGION 1
   AUTHOR: GEOSYNTEC CONSULTANTS INC
   DOC ID: 32922 01/01/2001 344 PAGES

7. REPORT: PRELIMINARY SLUDGE CHARACTERIZATION INVESTIGATION - APPENDIX B
   TO: US EPA REGION 1
   AUTHOR: GEOSYNTEC CONSULTANTS INC
   DOC ID: 32924 01/01/2001 318 PAGES

8. REPORT: PRELIMINARY SLUDGE CHARACTERIZATION INVESTIGATION - APPENDIX B CONTINUED AND APPENDIX C
   TO: US EPA REGION 1
   AUTHOR: GEOSYNTEC CONSULTANTS INC
   DOC ID: 32953 01/01/2001 329 PAGES

VOLUME II CONTINUED

9. LETTER: TOPICS FOR DISCUSSION AT PROPOSED MEETING WITH THE CITY, EPA, AND NHDES, DES # 198404002
   TO: ROGER HAWK, NASHUA (NH) CITY OF
   AUTHOR: JOHN REGAN, NH DEPT OF ENVIRONMENTAL SERVICES
   DOC ID: 32957 04/04/2001 3 PAGES

10. LETTER: SITE SLUDGE DISPOSAL AND STATUS OF THE NASHUA FOUR HILLS UNLINED MSW LANDFILL CLOSURE
    TO: RICHARD REINE, NASHUA (NH) CITY OF
    AUTHOR: JOHN REGAN, NH DEPT OF ENVIRONMENTAL SERVICES
    DOC ID: 32958 02/20/2002 2 PAGES

11. MEMO : HAZARDOUS WASTE DETERMINATION FOR SLUDGE AT SITE (TRANSMITTAL LETTER DATED 2/27/01 ATTACHED)
    TO: JOHN REGAN, NH DEPT OF ENVIRONMENTAL SERVICES
    AUTHOR: DAVID C BOWEN, NH DEPT OF ENVIRONMENTAL SERVICES
    DOC ID: 32959 02/20/2001 20 PAGES

12. LETTER: RESPONSE TO EPA LETTER ON THE MANAGEMENT OF EXCAVATED MATERIAL DATED MARCH 20, 2002
    TO: NEIL E HANDLER, US EPA REGION 1
    AUTHOR: DAVID C BOWEN, NH DEPT OF ENVIRONMENTAL SERVICES
    DOC ID: 32960 04/10/2002 2 PAGES

13. LETTER: PROPOSED REGULATORY APPROACH FOR MANAGING EXCAVATED MATERIAL AT SITE
    TO: JOHN L SPLENDORE, NH DEPT OF ENVIRONMENTAL SERVICES
    AUTHOR: NEIL E HANDLER, US EPA REGION 1
    DOC ID: 32961 03/20/2002 5 PAGES

14. LETTER: REQUEST FOR CLARIFICATION OF CORPS OF ENGINEERS JURISDICTION OF WASTE DISPOSAL AREAS AT SITE
    TO: DAVID H KILLOY, ARMY CORPS OF ENGINEERS
    AUTHOR: NEIL E HANDLER, US EPA REGION 1
    DOC ID: 32962 05/30/2002 1 PAGE

15. LETTER: RESPONSE TO REQUEST FOR CLARIFICATION OF CORPS OF ENGINEERS JURISDICTION OF WASTE DISPOSAL AREAS AT SITE
    TO: NEIL E HANDLER, US EPA REGION 1
    AUTHOR: DAVID H KILLOY, ARMY CORPS OF ENGINEERS
    DOC ID: 32963 06/14/2002 2 PAGES

16. PRESS RELEASE: ENVIRONMENTAL NEWS - EPA FORMALLY PROPOSES MOHAWK TANNERY SITE TO SUPERFUND LIST
    AUTHOR: US EPA REGION 1
    DOC ID: 32965 05/11/2000 2 PAGES

17. PRESS RELEASE: ENVIRONMENTAL NEWS - EPA TO BEGIN CLEANUP AT MOHAWK TANNERY SITE
    AUTHOR: US EPA REGION 1
    DOC ID: 32966 09/27/2000 1 PAGE

VOLUME II CONTINUED

18. PRESS RELEASE: EPA REMOVAL UPDATE MOHAWK TANNERY SITE - NO. 1
AUTHOR: US EPA REGION 1
DOC ID: 32968 11/01/2000 2 PAGES

19. REPORT: HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD PACKAGE FOR SITE
AUTHOR: US EPA REGION 1
DOC ID: 32969 05/01/2000 62 PAGES

20. FACT SHEET: MOHAWK TANNERY SITE UPDATE - NO. 2
AUTHOR: US EPA REGION 1
DOC ID: 32970 02/01/2001 3 PAGES

21. PRESS RELEASE: AUGUST ACTIVITIES AT THE MOHAWK TANNERY SITE
AUTHOR: US EPA REGION 1
DOC ID: 32971 08/01/2001 1 PAGE

22. FORM : SUMMARY OF PHONE CONVERSATION WITH COLLIS ADAMS, NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICE, WETLAND DIVISION
AUTHOR: NEIL E HANDLER, US EPA REGION 1
DOC ID: 32972 06/13/2002 1 PAGE

23. FORM : SUMMARY OF PHONE CONVERSATION WITH ELLEN BELLIO, WASTE MANAGEMENT TURNKEY DISPOSAL FACILITY
AUTHOR: NEIL E HANDLER, US EPA REGION 1
DOC ID: 32973 09/14/2001 2 PAGES

24. FORM : SUMMARY OF PHONE CONVERSATION WITH KEN VERHELLE, WASTE MANAGEMENT TURNKEY DISPOSAL FACILITY
AUTHOR: NEIL E HANDLER, US EPA REGION 1
DOC ID: 32974 09/14/2001 1 PAGE

25. FORM : SUMMARY OF PHONE CONVERSATION WITH MIKE MCCLOSKEY, NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
AUTHOR: NEIL E HANDLER, US EPA REGION 1
DOC ID: 32975 09/14/2001 2 PAGES

26. FORM : SUMMARY OF PHONE CONVERSATION WITH BRAD PERKINS, CENTER FOR DISEASE CONTROL (05/17/01 AND 05/16/01 EMAIL CORRESPONDENCE ARE ATTACHED)
AUTHOR: NEIL E HANDLER, US EPA REGION 1
DOC ID: 32976 05/16/2001 4 PAGES

27. FORM : REGARDING PREPARATION OF PUBLIC HEALTH ASSESSMENT FOR SITE (02/01/01 FACT SHEET AND SURVEY ARE ATTACHED)
AUTHOR: PHILIP R TROWBRIDGE, NH DEPT OF HEALTH & HUMAN SERVICES
DOC ID: 32977 02/08/2000 4 PAGES

28. LETTER: HEALTH CONSULTATION EVALUATION OF SLUDGE IN AREAS I AND II
AUTHOR: NH DEPT OF HEALTH & HUMAN SERVICES
DOC ID: 32978 03/13/2001 14 PAGES

MOHAWK TANNERY SITE
NON-TIME-CRITICAL REMOVAL ACTION (NTCRA)
ADMINISTRATIVE RECORD
OCTOBER 29, 2002
(DOC ID ORDER)

VOLUME II CONTINUED

29. LETTER: COMMENTS REGARDING JURISDICTION OF US DEPT OF INTERIOR AND DEPT OF COMMERCE, AND NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) AT SITE AND REQUEST FOR COORDINATION OF CONTINUING INVESTIGATIONS
    TO: ANDREW RADDANT, US DEPT OF THE INTERIOR
    KENNETH FINKELSTEIN, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
    AUTHOR: PATRICIA L MEANEY, US EPA REGION 1
    DOC ID: 32979 04/10/2002 5 PAGES

30. PRESS RELEASE: EPA ENVIRONMENTAL NEWS - EPA AND NH DES TO HOLD INFORMATIONAL MEETING ON MOHAWK TANNERY SITE
    AUTHOR: US EPA REGION 1
    DOC ID: 32980 02/07/2001 2 PAGES

VOLUME III

31. REPORT: ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) - MOHAWK TANNERY
    AUTHOR: TETRA TECH NUS INC
    DOC ID: 32981 07/01/2002 660 PAGES

VOLUME IV

32. MEMO : REVIEW OF PRELIMINARY ECOLOGICAL RISK EVALUATION REPORT AND GENERAL RECOMMENDATIONS FOR SAMPLING AND ANALYSIS TO SUPPORT ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) AND REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)
    TO: NEIL E HANDLER, US EPA REGION 1
    AUTHOR: RICHARD SUGATT, US EPA REGION 1
    DOC ID: 32982 03/26/2001 19 PAGES

33. MEMO : REVIEW: ECOLOGICAL SCREENING OF PRELIMINARY DATA AND RECOMMENDATIONS FOR ADDITIONAL SAMPLING AT SITE
    TO: NEIL E HANDLER, US EPA REGION 1
    AUTHOR: PATTI LYNNE TYLER, US EPA REGION 1
    DOC ID: 32983 04/17/2000 16 PAGES

34. MEMO : CONSULTATION ON DRAFT ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) APPROVAL MEMO FOR SITE
    TO: LARRY REED, US EPA/OFFICE OF EMERGENCY & REMEDIAL RESPONSE
    RAFAEL GONZALEZ, US EPA REGION 1
    AUTHOR: ART JOHNSON, US EPA REGION 1
    DOC ID: 32984 06/22/2000 2 PAGES

35. NEWS CLIPPING: THE TELEGRAPH ONLINE - CITY SITE PROPOSED FOR FEDERAL CLEANUP
    AUTHOR: CORENE DEE BRUCE, NASHUA TELEGRAPH
    DOC ID: 32985 05/12/2000 3 PAGES

VOLUME IV CONTINUED

36. NEWS CLIPPING: THE TELEGRAPH ONLINE - OFFICIALS OUTLINE EFFORT TO ADD SITE TO SUPERFUND
AUTHOR: CORENE DEE BRUCE, NASHUA TELEGRAPH
DOC ID: 32988 05/19/2000 3 PAGES

37. NEWS CLIPPING: THE TELEGRAPH ONLINE - EPA STARTS MOHAWK TANNERY CLEANUP NEXT WEEK
AUTHOR: CORENE DEE BRUCE, NASHUA TELEGRAPH
DOC ID: 32989 10/04/2000 2 PAGES

38. NEWS CLIPPING: THE TELEGRAPH ONLINE - MOHAWK TANNERY NEIGHBORS HEAR STATE'S PLANS FOR ASBESTOS CLEANUP
AUTHOR: ANDREW NELSON, NASHUA TELEGRAPH
DOC ID: 32991 10/06/2000 3 PAGES

39. NEWS CLIPPING: THE TELEGRAPH ONLINE - NASHUA FROM THE INSIDE: MOHAWK MEETING
AUTHOR: ANDREW NELSON, NASHUA TELEGRAPH
CORENE DEE BRUCE, NASHUA TELEGRAPH
DOC ID: 32992 02/17/2001 3 PAGES

40. FACT SHEET: HEALTH CONSULTATION FOR THE MOHAWK TANNERY SITE
AUTHOR: AGENCY FOR TOXIC SUBSTANCE AND DISEASE REGISTRY
US DEPT OF HEALTH AND HUMAN SERVICES
DOC ID: 32993 1 PAGE

41. LETTER: COMMENTS REGARDING STATUS OF OPERATIONS IN THE NASHUA MSW LANDFILL AND THE CITY'S PLANS FOR ONGOING OPERATIONS
TO: MICHAEL A SILLS, NH WATER SUPPLY AND POLLUTION CONTROL COMMISSION
AUTHOR: RICHARD REINE, NASHUA (NH) CITY OF
DOC ID: 32994 02/06/2002 2 PAGES

42. NEWS CLIPPING: THE TELEGRAPH ONLINE - MORE TESTS NEEDED FOR TANNERY
AUTHOR: TOM WEST, NASHUA TELEGRAPH
DOC ID: 32995 02/23/2001 3 PAGES

43. NEWS CLIPPING: THE TELEGRAPH ONLINE - STATE: MOHAWK SITE SAFE
AUTHOR: CORENE DEE BRUCE, NASHUA TELEGRAPH
DOC ID: 32996 04/13/2001 2 PAGES

44. NEWS CLIPPING: THE TELEGRAPH ONLINE - TANNERY NO THREAT TO HEALTH, RESIDENTS TOLD
AUTHOR: TOM WEST, NASHUA TELEGRAPH
DOC ID: 32997 05/03/2001 2 PAGES

45. NEWS CLIPPING: THE TELEGRAPH ONLINE - CITY MAY POSTPONE LANDFILL CLOSING
AUTHOR: CORENE DEE BRUCE, NASHUA TELEGRAPH
DOC ID: 32998 06/14/2001 2 PAGES

VOLUME IV CONTINUED

46. NEWS CLIPPING: THE TELEGRAPH ONLINE - BACK TO FUTURE? AS IDEA OF DUMPING TANNERY SLUDGE IN LANDFILL RESURFACES, PROTESTERS FROM 1981 RENEW OLD QUESTIONS
AUTHOR: CORENE DEE BRUCE, NASHUA TELEGRAPH
DOC ID: 32999 08/18/2001 2 PAGES

47. NEWS CLIPPING: THE TELEGRAPH ONLINE - BEST TO STUDY FULL IMPACT OF TANNERY WASTE TRANSFER
DOC ID: 33000 08/21/2001 1 PAGE

48. NEWS CLIPPING: THE TELEGRAPH ONLINE - NO HEALTH HAZARD FOUND AT TANNERY
AUTHOR: ALBERT MCKEON, NASHUA TELEGRAPH
DOC ID: 33001 08/21/2001 2 PAGES

49. NEWS CLIPPING: THE TELEGRAPH ONLINE - SMITH REQUESTS $12.7M FOR CITY CLEANUP PROJECTS
AUTHOR: ANDREW NELSON, NASHUA TELEGRAPH
DOC ID: 33002 04/11/2002 2 PAGES

50. NEWS CLIPPING: THE TELEGRAPH ONLINE - LOCAL AND REGIONAL NEW BRIEFS - NASHUA: SUNUNU CALLS FOR SUPERFUND LISTING OF DEFUNCT TANNERY
DOC ID: 33003 04/14/2002 3 PAGES

51. NEWS CLIPPING: VALLEY NEWS: SHAHEEN SEES HARM TO TOXIC SITE REPAIR IN BUSH BUDGET PLAN, GOVERNOR ASKS SMITH, BASS, SUNUNU TO ENSURE MONEY FOR SUPERFUND PROGRAM
DOC ID: 33004 03/26/2002 1 PAGE

52. REPORT: STATEMENT OF WORK FOR CONDUCTING ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)
AUTHOR: US EPA REGION 1
DOC ID: 33077 01/26/2001 34 PAGES

53. FACT SHEET: MOHAWK TANNERY SITE UPDATE - NO. 3
AUTHOR: US EPA REGION 1
DOC ID: 33079 12/01/2001 2 PAGES

54. REPORT: DRAFT FINAL WORK PLAN - BASE PERIOD (THROUGH 8/28/01)
AUTHOR: TETRA TECH NUS INC
DOC ID: 33080 05/01/2001 34 PAGES

55. REPORT: DRAFT WORK PLAN - OPTION PERIOD
AUTHOR: TETRA TECH NUS INC
DOC ID: 33081 05/01/2001 37 PAGES

56. REPORT: TIER III DATA VALIDATION - DIOXIN/FURAN: 7 SLUDGE SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: LOUIS MACRI, LOCKHEED ENGINEERING AND SCIENCES CO
MARIA E BACA, LOCKHEED ENGINEERING AND SCIENCES CO
DOC ID: 33082 04/09/2001 73 PAGES

VOLUME IV CONTINUED

57. REPORT: TIER II DATA VALIDATION - AIR TOXICS - VOLATILES/SULFER COMPOUNDS
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: DAN WIELANDT, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33084 10/15/2001 10 PAGES

58. REPORT: TIER II INORGANIC DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: ANN L FRANKE, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33086 11/12/2001 12 PAGES

59. REPORT: TIER II INORGANIC DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: ANN L FRANKE, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33087 11/12/2001 11 PAGES

60. REPORT: TIER II DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: DAN WIELANDT, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33088 11/12/2001 62 PAGES

61. REPORT: TIER II DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: DAN WIELANDT, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33089 11/13/2001 32 PAGES

62. REPORT: TIER II INORGANIC DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: LUCY GUZMAN, TETRA TECH NUS INC
PAULA L DIMATTEI, TETRA TECH NUS INC
DOC ID: 33090 11/15/2001 13 PAGES

63. REPORT: TIER II INORGANIC DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: LUCY GUZMAN, TETRA TECH NUS INC
PAULA L DIMATTEI, TETRA TECH NUS INC
DOC ID: 33091 11/15/2001 11 PAGES

64. REPORT: TIER II INORGANIC DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: ANN L FRANKE, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33092 11/15/2001 8 PAGES

VOLUME IV CONTINUED

65. REPORT: TIER II DATA VALIDATION - SLUDGE SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: DAN WIELANDT, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33093 11/19/2001 36 PAGES

66. REPORT: TIER II DATA VALIDATION - SLUDGE AND SOIL SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33094 11/20/2001 52 PAGES

67. REPORT: TIER II INORGANIC DATA VALIDATION - SLUDGE SAMPLES
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: ANN L FRANKE, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33095 11/26/2001 10 PAGES

68. REPORT: TIER II DATA VALIDATION - AIR TOXICS FROM HEADSPACE AIR GENERATED FROM SLUDGE SAMPLE
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: DAN WIELANDT, TETRA TECH NUS INC
LUCY GUZMAN, TETRA TECH NUS INC
DOC ID: 33096 11/29/2001 11 PAGES

69. REPORT: TIER III DATA VALIDATION - DIOXIN/FURAN
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: STEVEN STODOLA, US EPA REGION 1
DOC ID: 33097 11/28/2001 19 PAGES

70. REPORT: TIER III DATA VALIDATION - DIOXIN/FURAN
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: STEVEN STODOLA, US EPA REGION 1
DOC ID: 33098 12/21/2001 21 PAGES

71. REPORT: TIER III DATA VALIDATION - DIOXIN/FURAN
TO: CHRISTINE CLARK, US EPA REGION 1
AUTHOR: STEVEN STODOLA, US EPA REGION 1
DOC ID: 33099 01/04/2002 21 PAGES

72. MEMO : ANALYSIS DATA ON WATER SAMPLES COLLECTED FOR VOLATILE ORGANIC COMPOUNDS
TO: NEIL E HANDLER, US EPA REGION 1
AUTHOR: DANIEL S GRANZ, US EPA REGION 1
DOC ID: 33100 02/11/2002 14 PAGES

73. REPORT: LABORATORY REPORT - SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS
TO: DANIEL S GRANZ, US EPA REGION 1
AUTHOR: WILLIAM J ANDRADE, US EPA REGION 1
DOC ID: 33101 02/26/2002 9 PAGES

VOLUME IV CONTINUED

74. REPORT: LABORATORY REPORT - PESTICIDES AND PCBS IN WATER
    TO: DANIEL S GRANZ, US EPA REGION 1
    AUTHOR: WILLIAM J ANDRADE, US EPA REGION 1
    DOC ID: 33102 03/04/2002 7 PAGES

75. REPORT: LABORATORY REPORT - DISSOLVED METALS IN WATER BY ICP/MS
    TO: DANIEL S GRANZ, US EPA REGION 1
    AUTHOR: WILLIAM J ANDRADE, US EPA REGION 1
    DOC ID: 33103 03/06/2002 6 PAGES

76. REPORT: LABORATORY REPORT - TOTAL RECOVERABLE METALS IN WATER
    TO: DANIEL S GRANZ, US EPA REGION 1
    AUTHOR: WILLIAM J ANDRADE, US EPA REGION 1
    DOC ID: 33104 03/07/2002 8 PAGES

77. FACT SHEET: MOHAWK TANNERY SITE FACT SHEET - EPA PLANS CLEANUP FOR WASTE DISPOSAL AREAS
    AUTHOR: US EPA REGION 1
    DOC ID: 33212 07/01/2002 9 PAGES

78. REPORT: COMMUNITY RELATIONS PLAN
    AUTHOR: US EPA REGION 1
    DOC ID: 33269 07/26/2002 56 PAGES

79. PRESS RELEASE: ANNOUNCEMENT OF PUBLIC MEETING AND COMMENT PERIOD ON CLEANUP ALTERNATIVE AND ENGINEERING EVALUATION/COST ANALYSIS
    AUTHOR: US EPA REGION 1
    DOC ID: 33270 07/26/2002 1 PAGE

80. PRESS RELEASE: EPA ENVIRONMENTAL NEWS - EPA ANNOUNCES PUBLIC COMMENT PERIOD AND PUBLIC MEETINGS ON PREFERRED CLEANUP OPTION FOR CONTAMINATED WASTE AREAS AT MOHAWK TANNERY SITE
    AUTHOR: US EPA REGION 1
    DOC ID: 33402 07/26/2002 2 PAGES

MOHAWK TANNERY SITE
NON-TIME-CRITICAL REMOVAL ACTION (NTCRA)
ADMINISTRATIVE RECORD
OCTOBER 29, 2002
(DOC ID ORDER)

VOLUME V

1. REPORT: HEALTH CONSULTATION, TECHNICAL ASSISTANCE, PUBLIC HEALTH EVALUATION OF THE ENGINEERING EVALUATION/COST ANALYSIS REPORT (EE/CA)
   [TRANSMITTAL LETTER DATED 09/25/02 IS ATTACHED]
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Appendix B

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ENGINEERING EVALUATION/COST ANALYSIS

MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

RESPONSE ACTION CONTRACT (RAC), REGION I

For
U.S. Environmental Protection Agency

By
Tetra Tech NUS, Inc.

EPA Contract No. 68-W6-0045
EPA Work Assignment No. 118-NSEE-01C7
TtNUS Project No. N4111

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TABLE OF CONTENTS
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

TABLE OF CONTENTS (cont.)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

TABLES

TABLES (cont.)

NUMBER

TABLES (cont.)

NUMBER

FIGURES

NUMBER

FIGURES (cont.)

<u>NUMBER</u>

REFERENCES

APPENDICES

LIST OF ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CDD	Chlorinated Dibenzo-p-dioxins
CDF	Chlorinated Dibenzofurans
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CSF	cancer slope factor
DHHS	Department of Health and Human Services
ECG	electrocardiograph
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
EPC	exposure point concentrations
ERA	ecological risk assessment
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic model
IRIS	Integrated Risk Information System
kg	kilogram
mg	milligram
MSL	mean sea level
NHDES	New Hampshire Department of Environmental Services
NTCRA	non-time critical removal action
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	Preliminary Remediation Goal
PRSC	post-removal site control
ppbv	parts per billion by volume
RAOs	Removal Action Objectives

RfD	reference dose
SERA	screening-level ecological risk assessment
SSAF	Soil-to-skin adherence factor
SVOC	semi-volatile organic compound
TBCs	Criteria and Guidance To Be Considered
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalence Factor
TEQ	Toxicity Equivalent
UCL	Upper Concentration Limit
ug	microgram

E.0 EXECUTIVE SUMMARY

This report presents the findings of the Engineering Evaluation/Cost Analysis (EE/CA) conducted in support of a Non-Time-Critical Removal Action (NTCRA) for the Mohawk Tannery Site. The report was prepared by Tetra Tech NUS, Inc. (TtNUS) for the U.S. Environmental Protection Agency (EPA), Region I, under Work Assignment No. 118-NSEE-01C7, Contract Number 68-W6-0045. The decision to proceed with the EE/CA was documented in the Approval Memorandum signed by EPA on July 12, 2000.

E.1 Site Background

The following presents a description of site features, a summary of the site's operational history, and a brief description of previous investigations that have been performed at the site.

E.1.1 Site Description

The Mohawk Tannery Site is located in the City of Nashua, Hillsborough County, New Hampshire. The site is bordered by the Nashua River to the west, a closed landfill to the north, and residential areas to the east and southeast.

The site is the former location of a leather tannery facility. Several structures used in tannery operations, as well as debris from several demolished structures, remain on site. Remaining structures include the main facility building and a smaller control building attached to the main building. Also remaining on the west side of the site, alongside the Nashua River, is an open lagoon that was part of the facility's wastewater treatment system (the open lagoon is also referred to as Disposal Area 1).

The site slopes steeply toward the Nashua River, with a topographic relief of approximately 70 feet from the eastern boundary of the site to the western boundary along the river. Groundwater was measured between 7 and 14 feet below ground surface in monitoring wells located along the Nashua River, and approximately 70 feet below ground surface in the eastern portion of the site.

The Nashua River flows from north to south along the western border of the site. A former lagoon that has since been covered with soil (Disposal Area 2), is located adjacent to the river, within the river's 100-year floodplain. The Area 1 open lagoon is not located within the 100-year floodplain due to the elevation of the man-made soil berm around its perimeter. If the berm was ever breached during a major flood event, then the contents of the lagoon, which are located below the 100-year flood elevation, could be washed into the river.

E.1.2 Operational History

The Mohawk Tannery, also known as Granite State Leathers, operated at the site from 1924 to 1984. While in operation, the facility used several hazardous substances in the preparation and tanning of animal hides. Substances used included volatile organic compounds (VOCs), inorganic metals, chlorinated phenols, and alkaline and acidic solutions. The facility produced waste streams containing spent chromium, as well as VOCs, chlorinated phenols, proteinaceous solids (e.g. hair and hide scraps), alkaline and acid residuals, mineral solids, and undissolved lime.

Over the course of its operational history, the Mohawk Tannery used the Area 1 and Area 2 lagoons for several functions as part of the treatment process for tannery effluent. Sludge from the lagoons was periodically dredged and disposed of in four disposal areas at the site, referred to as Disposal Areas 3 through 6.

The use of the Area 2 lagoon is believed to have been discontinued at some time during the 1970s. The lagoon was reportedly covered with a layer of 4 to 12 inch diameter logs (which were not encountered during subsurface explorations performed as part of the EE/CA) and a layer of fill. Area 2 has since been allowed to naturally revegetate.

In approximately 1980, materials including hide scraps and other miscellaneous refuse were excavated in preparation for constructing the control building for a new treatment facility. The excavated materials were moved approximately 30 to 125 feet southwest of the building, to an area identified in the EE/CA as Area 7.

During the early 1980s, dried sludge from the facility was placed into a PVC-lined landfill on the adjacent Fimbel Door Company property (Fimbel Landfill). Since 1984, Disposal Areas 3 through 7 have been covered with sand and gravel and allowed to naturally revegetate. The Fimbel Landfill has been capped with a low permeability cover and closed under New Hampshire State Regulations, and was not evaluated as part of the EE/CA.

E.1.3 Previous Investigations and Removal Actions

In April 1985 an initial characterization of subsurface conditions was performed to support future site use subsequent to the closure of Granite State Leathers. Investigative activities included a review of data provided by Granite State Leathers pertaining to tannery processes and waste streams; site plans depicting the locations of treatment facilities; and information on soil, groundwater, and surface water conditions at the site. Subsurface exploration activities included the excavation of 36 test pits, advancement of one soil boring, and collection of one groundwater sample. This report provided information on the operational history of the tannery and a preliminary description of the nature and extent of contamination at the site.

A Phase II hydrogeological study at the site was performed in June 1985 to further characterize site conditions and provide recommendations for containment of tannery sludge/waste. Subsurface investigative activities included the excavation of additional test pits in previously identified sludge disposal areas, advancement of 12 soil borings and installation of 10 monitoring wells, advancement of 2 hand-driven borings within the open lagoon (Area 1), and estimation of hydraulic conductivity through the collection of selected soil samples.

EPA conducted a time-critical removal action at the site beginning in September 2000 and concluding in January of 2001. Actions taken included the removal and disposal of asbestos-containing material from the old tannery building; characterization and disposal of the contents of 42 drums, a large above ground storage tank, and a large clarifier tank on the site; and removal of approximately 110 empty drums and 360 laboratory-type containers and disposal of them at an off-site facility. EPA also repaired a number of gates at the site and posted warning signs about the dangers of trespassing, to better secure the site.

In October 2000, samples of sludge were collected from Areas 1 and 2 (by a consultant for a potential property buyer) in an effort to characterize waste for disposal purposes. Analytical results revealed that none of the sludge samples exhibited a RCRA hazardous waste characteristic. The report concluded that, based on waste characteristic data evaluated during this study, the sludge could be transported to and disposed of at an EPA and NHDES-approved local landfill.

E.2 EE/CA Field Investigation

In August/September 2001, TtNUS performed a field investigation to support the EE/CA. The overall objectives of the field investigation were to collect analytical and field observation data to support a streamlined human health and ecological risk evaluation and the development and evaluation of NTCRA alternatives for the sludge and associated soils in each waste disposal area on the site. In January 2002 EPA conducted limited additional sampling to to support the ecological risk evaluation. The following is a summary of field investigation activities and findings.

E.2.1 Field Investigation Activities

Test pit explorations were conducted in Areas 2 through 7 to better define the horizontal boundaries of the former tannery waste disposal areas, determine the thickness of soil cover over the sludge, and if possible, to determine the sludge thickness at the disposal area boundaries. Test pits were not used to collect sludge/soil samples for laboratory analysis.

Subsequent to the excavation of test pits, several observation borings were advanced using direct-push technique (DPT) drilling in Areas 2, 3, 5, 6, and 7. Observation borings were used to collect further information to delineate the lateral extent of sludge waste, and to aid in the determination of the thickness and volume of sludge and overlying soil in each disposal area. No soil samples were collected for laboratory analysis from observation soil/sludge borings.

Finally, a total of 25 sludge/soil borings were advanced using manual coring techniques and DPT drilling for the purpose of obtaining sludge and soil samples for chemical analysis and determining the thickness of sludge and cover soils in each disposal area. The borings located in Area 1, the open lagoon, were advanced from a floating work platform using manual coring techniques. The borings in the remaining areas were advanced using DPT drilling.

Additional field activities performed by TtNUS in autumn 2001 that were not related to the determination of the nature and extent of sludge/waste included a wetland delineation, endangered/threatened species evaluation, water table measurement collection and inventory of existing wells, and topographic/land survey.

Two surface water samples were collected by EPA in January 2002 from the Area 1 lagoon. The purpose of the sampling was to obtain chemical characterization data for the surface water in the lagoon in support of the streamlined ecological risk evaluation.

E.2.2 Field Investigation Findings

Sludge and soil sample analytical results were compared to EPA Region IX Preliminary Remediation Goals (PRGs) for residential soil, New Hampshire Department of Environmental Services (NHDES) Risk Characterization and Management Policy (RCMP) Method 1 Standards for Category S-1 Soil, and NHDES RCMP background concentrations of metals in soils in order to identify contaminants of potential concern for the EE/CA. Surface water analytical results were compared to water quality criteria from EPA and Oak Ridge National Laboratory to identify contaminants of potential ecological concern.

The screening of analytical data from sludge samples revealed the presence of several contaminants including, but not limited to, carbon disulfide, benzo(a)pyrene, 2-methylnaphthalene, 4-methylphenol, pentachlorophenol, dioxins toxicity equivalents (TEQs), antimony, arsenic, and trivalent chromium at concentrations exceeding screening criteria. Hexavalent chromium was not detected at concentrations exceeding screening criteria.

Overlying soils (e.g. the fill material placed over some of the sludge disposal areas) only exceeded screening criteria for metals. The organic compounds typical of sludge/wastes across the site were detected in overlying soils only sporadically, and at concentrations below screening criteria. Overlying soils exceeded screening criteria for antimony, arsenic, and chromium.

Underlying soils (e.g. the soil beneath observed sludge in the disposal areas) only exceeded screening criteria for arsenic, which may be present due to background conditions. The organic compounds typical of sludge/wastes across the site were detected in site soils only sporadically, and at concentrations below screening criteria. The underlying soils are typically present at depths greater than 10 feet bgs, and therefore are not likely to be accessible for human exposure.

Based on detected levels in two surface water samples from Area 1, surface water exceeded identified screening criteria for several contaminants including carbon disulfide, 4-methylphenol, pyrene, chromium, manganese, and selenium.

The wetland delineation identified two wetland areas on the undeveloped, southern portion of the Mohawk Tannery property. No wetlands were identified on the developed northern parcel.

Federal and State agencies contacted for the endangered and threatened species evaluation did not identify any recorded occurrences of threatened or endangered species in the immediate vicinity of the site, with the exception of "occasional transient bald eagles". However, since many areas of the state have not been surveyed, the lack of positive identification is not definitive proof that no sensitive species are present.

Water table measurements collected in October 2001 indicated that groundwater was encountered between 7 and 14 feet bgs at the western end of the site along the Nashua River. An evaluation of groundwater elevation versus observed sludge depth indicates that sludge is currently located beneath the water table only in Areas 1 and 2. Based on October 2001 conditions, as much as 6 feet of sludge is likely to be submerged in Area 1 and up to 9 feet of sludge in Area 2. More sludge in these areas, as well as sludge in other areas (particularly Area 3) may become submerged as the water table rises. The October 2001 conditions are believed to represent seasonal low groundwater conditions.

E.3 Streamlined Human Health and Ecological Risk Evaluations

Streamlined human health and ecological risk evaluations were conducted to determine whether site contaminants are likely to pose a risk to humans and ecological receptors. Both evaluations concluded that contaminants in site sludge/waste and surface soils pose a potential risk to humans and ecological receptors under current and future exposure scenarios. The following is a summary of the risk evaluation findings.

E.3.1 Streamlined Human Health Risk Evaluation Results

The streamlined human health risk evaluation was performed to identify the risk to humans from soil and sludge at the site. The evaluation was conducted using standard quantitative risk assessment methods, except that it focused only on media of concern for the NTCRA. Other media (groundwater, surface water, air) were not evaluated.

The human health risk evaluation identified potential human health risks above EPA's target non-cancer hazard index (H1) of 1.0 and/or cancer risk level (CR) of 1.0×10^{-4} for the following receptors and exposure scenarios:

- Current or future adolescent trespasser exposed to wet sludge in Area 1: HI of 42.5, CR of 1.86×10^{-3}
- Future lifetime resident exposed to surface soil in Areas 2 through 7: HI of 13.1, CR of 9.54×10^{-5}
- Future lifetime resident exposed to surface and subsurface soil/sludge in Areas 1 through 7: HI of 72.4, CR of 1.87×10^{-4}

The major contributors to excess non-cancer risks are 4-methylphenol, arsenic, antimony, cadmium, and manganese. The major contributors to excess cancer risks are dioxins, pentachlorophenol, arsenic, and benzo(a)pyrene. Benzo(a)pyrene was detected only in a very localized area of the site, in one sample from Area 7. It does not appear to be a site-wide concern.

E.3.2 Streamlined Ecological Risk Evaluation Results

The streamlined ecological risk evaluation is a screening-level evaluation that uses conservative screening values to identify all contaminants that may pose an ecological risk. Contaminant concentrations are compared against screening values to identify contaminants of potential concern (COPCs). COPCs do not necessarily pose a risk to ecological receptors, but rather indicate a potential risk that may warrant further investigation. The degree of potential risk posed by each contaminant is evaluated using hazard quotients (HQs). The HQ is the ratio of the contaminant concentration at the exposure point to its screening value. An HQ of greater than 1.0 indicates that adverse impacts are possible.

The ecological risk evaluation identified potential risks to ecological receptors from exposure to wet sludge (considered sediment in the ecological evaluation) and surface water in Area 1 and surface soil in Areas 2 through 7. The evaluation identified numerous contaminants of potential concern (COPCs) in each media. COPCs for sediment and surface soil included multiple contaminants from each of the following contaminant classes: VOCs, SVOCs, pesticides, dioxins, and metals. COPCs for surface water included only one VOC, two SVOCs, and three metals.

The maximum HQs identified for the Area 1 sediment were 35,000 (4-methyphenol), 30,400 (chromium), and 2,293 (carbon disulfide). The highest HQs for Area 2 through 7 surface soil were 8,823 (mercury), 1741 (aluminum) 528 (chromium), 298 (1,2,3,4,6,7,8-HpCDD dioxin), 200 (iron), and 179 (antimony). The highest HQ for surface water was 42 (manganese) followed by 5.4 (carbon disulfide). Although the ecological HQs were calculated using conservative screening values, the magnitude of the HQs calculated for sediment and surface soil at the site indicates that contaminants at the site pose a real concern for ecological receptors.

E.4 Volume of Sludge/Waste to be Addressed by the EE/CA

The results of the streamlined human health risk evaluations were used to select contaminants of concern (COCs) and preliminary remediation goals (PRGs) for the NTCRA. The PRGs were used to estimate the volume of waste that will be addressed by the EE/CA. The ecological risk evaluation was not used in the selection of COCs and PRGs because it was a screening-level evaluation only and therefore could not be used to definitively identify COCs or determine numerical cleanup standards.

E.4.1 Selection of Contaminants of Concern

The COCs identified for the site are compounds that posed an excess carcinogenic risk greater than 1.0E-6 or an excess non-carcinogenic risk indicated by a hazard index greater than 1 for any exposure scenario. The COCs identified for the site are identified on the table in Section E.4.2.

E.4.2 Identification of Preliminary Removal Goals (PRGs)

PRGs for site sludge/waste and soil were developed using risk-based values calculated from exposure scenarios identified in the streamlined human health risk evaluation; available guidance for addressing dioxin contamination; and the NHDES RCMP background concentrations of metals in soils. For all COCs except dioxins, the proposed PRG was selected from the lower of the risk-based PRGs corresponding to a cancer risk level of 1.0 x 10^{-6} and a hazard index of 1.0, unless this risk-based value was lower than the NH RCMP background concentrations of metals in soil, in which case the background concentration was selected as the proposed PRG. For dioxins, the proposed PRG was selected based on the EPA OSWER Directive Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites (EPA, 1998).

Because the scope of the proposed NTCRA is limited to source control for contaminated soils, sludges, and wastes, PRGs were not developed for groundwater, surface water or river sediments. These media will be evaluated in the RI/FS scheduled to begin later this year.

Contaminants of Concern	Proposed PRG	Units
Benzo(a)Pyrene	145	ug/kg
Pentachlorophenol	6958	ug/kg
4-Methylphenol	712891	ug/kg
Dioxin TEQ	1000	ng/kg
Antimony	73	mg/kg
Arsenic	51	mg/kg
Barium	12780	mg/kg
Cadmium	82	mg/kg
Chromium III	273750	mg/kg
Manganese	12775	mg/kg
Vanadium	1278	mg/kg

E.4.3 Estimated Volume of Sludge/Waste to be Addressed by EE/CA

Sample analytical results were compared with proposed PRGs to estimate the volume of sludge/waste and soil to be addressed under the NTCRA. The following table provides a summary of the estimated volumes of sludge/waste in each disposal area that contain COCs at concentrations exceeding PRGs. No evidence of sludge/waste was observed in Area 5 during field investigation activities and samples collected from Area 5 did not exceed any of the proposed PRGs. As a result, no sludge/waste volume was estimated for this area. Overlying and underlying soil concentrations did not exceed the proposed PRGs, so no sludge/waste volume was assumed for the soils.

Disposal Area	Estimated Volume of Sludge/Waste (CY)
Area 1	25,185
Area 2	29,630
Area 3	370
Area 4	1,000
Area 6	648
Area 7	3,556
TOTAL VOLUME:	60,389

E.5 Removal Action Objectives (RAOs)

RAOs were developed that are protective of human health and the environment and consider potential future use of the site. These removal action objectives are presented below.

- Prevent, to the extent practicable, direct contact with, ingestion of, and inhalation of contaminants in tannery sludge/waste and associated soil at concentrations exceeding PRGs.

- Prevent, to the extent practicable, ecological receptor exposure to contaminants exceeding PRGs in tannery sludge/waste and associated soil.

- Prevent, to the extent practicable, migration of contaminants exceeding PRGs from tannery sludge/waste and associated soil to site groundwater and the Nashua River.

- Address tannery sludge/waste and associated soil with contaminants exceeding PRGs to restore the site to its intended use for residential purposes.

E.6 Development of Removal Action Alternatives

A screening of potential removal technologies and process options was performed to identify treatment, containment, or removal options that could meet the RAOs for the NTCRA. Technology types and process options were screened according to their potential effectiveness and implementability for treating site sludge/soil waste. The evaluation considered site-specific factors such as the nature of contaminated media, moisture content of sludge, contaminants present, location of wastes within the 100-year floodplain, and proximity to residential areas. The following three removal action alternatives were developed from the results of the screening:

- Alternative 1 – Excavation and Off-Site Disposal
- Alternative 2 – Consolidation into On-Site Landfill
- Alternative 3 – Excavation, Off-Site Treatment and Disposal

In April of 2002, the NHDES completed an updated hazardous waste determination for site sludge/waste using data gathered during the EE/CA field investigation. The data and the NHDES determination support the current assumption that sludge/waste from the site would not be considered a RCRA hazardous waste. However, based on the reactive sulfide concentrations found in Area 1 during the EE/CA investigation, it is possible that sludge/waste may be encountered in this area during implementation of the NTCRA that could cause the material to be considered a hazardous waste. As a result, a scenario under which the material from Area 1 would be considered as a RCRA hazardous waste was included in the EE/CA. Although it does not appear likely that the sludge/waste at the site will be classified as RCRA hazardous, a final decision on the regulatory status of the sludge/waste will be made during implementation of the removal action based on the results of the waste characterization samples collected from sludge/waste stockpiles during excavation.

The scenario for considering the Area 1 sludge/waste as a RCRA hazardous waste was included as a sub-option under Alternatives 1 and 2 because the regulatory status of the waste could significantly impact the implementability and cost of these alternatives. The regulatory status of the waste is not expected to impact the implementability or cost of Alternative 3, so the hazardous waste scenario was not evaluated for this alternative. However, the implementability and cost of Alternative 3 could be impacted by the limited number of incinerators within the United States that are able to accept dioxin-containing material. Accordingly, off-site treatment facilities within the United States and in Canada were evaluated as sub-options for Alternative 3.

E.7 Analysis of Removal Action Alternatives

Each of the three removal action alternatives presented above was analyzed individually to assess its effectiveness, implementability, and cost; and compared to the others to identify differences between the alternatives and analyze their comparative benefits and drawbacks. All alternatives offer similar degrees of protection and would achieve all of the removal action objectives established for this NTCRA. For each of the three alternatives, no residual contamination would remain at the site that would pose a risk to human health or the environment once the removal action was completed. Alternatives 1 and 3 would not require post-removal site control (PRSC) operations to maintain the protectiveness of the alternative, except for monitoring of restored vegetation until it is established. Alternative 2, unlike Alternatives 1 and 3, would consolidate and contain contaminated sludge/waste on site rather than remove it from the site and would require more extensive PRSC to monitor the integrity of the on-site landfill and prevent long-term impacts to human health and the environment. In addition, construction of an on-site landfill under Alternative 2 would place additional and permanent restrictions on how that portion of the site could be used thereby limiting the future use and development of the site to a greater extent than Alternatives 1 and 3.

Implementability issues related to excavation and removal of sludge/waste located below the water table would be the same for all three alternatives. On-site activities for Alternatives 1 and 3 would be identical, and both would be more easily implementable than those for Alternative 2 due to difficulties associated with the approval and design/construction of an on-site landfill within a residential area.

Considering implementability issues related to treatment or disposal sludge/waste, Alternative 1 would be the most easily implementable of the three alternatives, regardless of the final regulatory classification of sludge/waste from Area 1. Off-site disposal facilities (RCRA D, RCRA C, or outside the United States) that are willing and able to accept dioxin-containing waste have been identified during the EE/CA. Alternative 3 would be somewhat more difficult to implement because there are a limited number of incineration facilities permitted to accept dioxin-containing waste in both the United States and Canada and this may present some capacity issues. Obtaining the necessary approvals to transport waste to an incinerator is not expected to be difficult. Alternative 2 would be the most difficult to implement because of the anticipated difficulty in obtaining the required approvals to construct an on-site landfill in close proximity to a residential neighborhood and the Nashua River.

Under all cost scenarios considered, Alternative 2 is the lowest cost alternative. If the final waste determination allows for land disposal of the Area 1 sludge (regardless of whether the sludge is classified as non-hazardous or hazardous) Alternative 2 would be less than half the cost of Alternative 1. If the final waste determination concludes that the Area 1 sludge can not be land-disposed (due to the land disposal restrictions for dioxin-containing waste), the difference in cost between Alternatives 1 and 2 would reduce considerably, but Alternative 2 would still be less expensive. Under all regulatory scenarios, Alternative 3 would be the most expensive to implement by a large margin (between 2 and 5 times the cost of Alternative 1 and between 2 and 11 times the cost of Alternative 2). Alternative costs are summarized below.

COST ELEMENT	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
Capital Costs	Alternative 1A: $14,939,000 Alternative 1B: $20,428,000 Alternative 1C: $22,819,000	Alternative 2A: $5,572,000 Alternative 2B: $5,572,000 Alternative 2C: $18,428,000	Alternative 3-US: $69,715,000 Alternative 3-CAN: $50,152,000
Annual PRSC Costs	Years 1-2: $4,000 Years 3-30: $0	Years 1-2: $155,275 Years 3-5: $60,075 Years 6-30: $37,275	Years 1-2: $4,000 Years 3-30: $0
Total Present Worth Costs	Alternative 1A: $14,946,000 Alternative 1B: $20,435,000 Alternative 1C: $22,826,000	Alternative 2A: $6,300,000 Alternative 2B: $6,300,000 Alternative 2C: $19,156,000	Alternative 3-US: $69,722,000 Alternative 3-CAN: $50,160,000

E.8 Recommended Removal Alternative

Based on the comparison of alternatives, Alternative 1 was selected as the recommended removal alternative. All alternatives met the NTCRA removal objectives and were protective of human health and the environment. Alternatives 1 and 3 fully satisfied the removal objective of restoring the site to future residential use; Alternative 2 only partially satisfied this removal objective because Alternative 2 would leave wastes on site in an on-site landfill, thereby restricting how the landfill area could be developed and used in the future. Although Alternatives

1 and 3 constituted a more permanent measure due to fewer PRSC requirements, all alternatives may be considered permanent and would be effective in the long term, provided that the on-site landfill (in Alternative 2) is properly operated and maintained and land use restrictions are enforced. Only Alternative 3 would satisfy the statutory preference for treatment.

The primary differences among the three alternatives lie in their implementability. Alternative 1 would be the most easily implemented. Several off-site landfill facilities in reasonably close proximity to the site are available to accept the volume of sludge/waste that is expected to be generated during the removal action. In addition, obtaining the necessary approvals for the off-site landfill disposal alternative is expected to present the fewest challenges from an administrative feasibility standpoint.

Alternative 2 would be much more challenging to implement than Alternative 1 due to the size of the on-site landfill that would be required to accommodate the volume of contaminated sludge/waste at the site and the potential for public opposition to an on-site landfill. Design and construction of a landfill that would be adequate to encapsulate 66,000 cubic yards of material would place considerably more constraints on how the site could be used and developed in the future and require more long-term efforts associated with PRSC. As a result, obtaining concurrence and acceptance from the State and public to construct an on-site landfill may be difficult.

Alternative 3 would be more difficult to implement than Alternative 1 because of the limited number of off-site treatment facilities within the U.S. and Canada that are permitted to receive dioxin-containing waste. Alternative 3 would be easier to implement than Alternative 2 because locating treatment facilities able to accept the waste and obtaining the necessary approvals for off-site incineration would present fewer challenges than obtaining concurrence and acceptance from the State and public to construct an on-site landfill.

Although Alternative 1 is only slightly more implementable than Alternative 3, it was selected as the preferred alternative because it would be considerably less costly. Off-site treatment at a Canadian incinerator (Alternative 3-CAN) would be the less expensive of the incineration options, but it would still cost over three times more than off-site disposal if Area 1 sludge were classified as non-hazardous waste; and more than two times more than off-site disposal if Area 1 sludge were classified as hazardous waste. For this reason, Alternative 1 (A, B, or C) is selected as the preferred removal action alternative, pending final waste determination and/or characterization results.

1.0 INTRODUCTION

This report presents the Engineering Evaluation/Cost Analysis (EE/CA) conducted for the Mohawk Tannery Site in Nashua, New Hampshire (the site). The U.S. Environmental Protection Agency (EPA) determined that an EE/CA was needed to evaluate potential threats to humans and the environment posed by tannery sludge/wastes in seven former lagoons and disposal areas at the site and to develop and evaluate potential non-time-critical removal-action (NTCRA) alternatives for the site. The work was conducted by TtNUS for EPA Region I, under Contract No. 68-W6-0045, Work Assignment 118-NSEE-01C7.

The EE/CA was prepared consistent with the requirements of all applicable laws, regulations, and guidance, including: the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR 300; and the Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA (EPA, 1993).

1.1 Purpose and Organization of Report

The purpose of this report is to present the results of the EE/CA process in order to provide EPA with sufficient information to justify the need for a NTCRA and select the preferred NTCRA alternative for the site. The report also presents the methods and results of the field investigation conducted to collect the data necessary to prepare the EE/CA.

Section 1.0 presents the introduction, provides a site description and historical information, and summarizes the field activities performed for the EE/CA. Section 2.0 summarizes the findings of the site investigations and the streamlined human health and ecological risk evaluations. Section 3.0 identifies contaminants of concern (COCs), selects preliminary remediation goals (PRGs), identifies the site conditions that justify a removal action, establishes the scope and objectives of the NTCRA, identifies regulatory considerations (ARARs), and presents a proposed schedule for NTCRA implementation. Section 4.0 documents the development of removal action alternatives and provides descriptions of the potential alternatives. Section 5.0 presents the detailed evaluation of removal action alternatives.

1.2 Site Background

This section presents the site description and operations history and describes previous removal actions that have been conducted at the site.

1.2.1 Site Description

The Mohawk Tannery site is located at the intersection of Fairmont Street and Warsaw Avenue in the City of Nashua, Hillsborough County, New Hampshire (Figure 1-1). The site is the former location of a leather tannery facility. The site consists of two contiguous properties: an approximately 15-acre developed parcel to the north, and an approximately 15-acre undeveloped parcel to the south. The site is bordered by the Nashua River to the west, a closed landfill to the north, and residential areas to the east and southeast. A chain link fence borders the developed portion of the site, except along the Nashua River side (Figure 1-2).

The inactive tannery facility is situated on the northern parcel. Several structures used in tannery operations, as well as debris from several demolished structures, remain on site. Remaining structures include the main facility building; a smaller control building attached to the main building; and portions of the former wastewater treatment system including a wood frame building housing a 60 foot long, 20 foot wide, 6 foot deep clarifier tank. Also remaining on the west side of the site, alongside the Nashua River, is an open lagoon that was part of the wastewater treatment system (TtNUS, 2001).

The site topography slopes steeply toward the Nashua River, with a topographic relief of approximately 70 feet from the eastern boundary of the site at Warsaw Avenue to the western boundary along the river. Groundwater was measured between 7 and 14 feet below ground surface in monitoring wells located in the vicinity of Areas 1 and 2, and approximately 70 feet below ground surface in the eastern portion of the site adjacent to Warsaw Avenue (GZA, 1985b).

Where it borders the site to the west, the Nashua River flows from north to south. The floodplain elevation along the Nashua River was determined to be 131 feet above mean sea level (MSL), referenced to North American Vertical Datum (NAVD) 1988. A large portion of Area 2 is located within the river's 100-year floodplain (Figure 1-2). The Area 1 Lagoon is not located within the 100-year floodplain due to the elevation of the berm that has been constructed around its perimeter. If the berm was ever breached during a 100-year flood event, then the contents of the lagoon, which are located below the 100-year flood elevation, could be released into the river during such a flood event.

1.2.2 Site History

The site history information presented in this section was obtained from the following documents: *Phase I Hydrogeologic Study, Granite State Leathers, Inc. Facility, Nashua, New Hampshire*, April 1985, prepared by Goldberg, Zoino and Associates (GZA) Inc. for Fairmont Height Associates; *Phase II Hydrogeologic Study and Conceptual Closeout Plan, Granite State Leathers, Inc. Facility, Nashua, New Hampshire*, October 1985, prepared by GZA for Fairmont Height Associates; and the Mohawk Tannery Site Approval Memorandum to perform an Engineering Evaluation/Cost Analysis for a Non-Time Critical Removal Action, USEPA, July 2000 (Appendix A; USEPA, 2000b).

The Mohawk Tannery, also known as Granite State Leathers, operated at the site from 1924 to 1984. While in operation the facility used numerous hazardous substances in the preparation and tanning of animal hides. Substances used included volatile organic compounds (VOCs), inorganic metals, chlorinated phenols, and alkaline and acidic solutions. The facility produced waste streams containing spent chromium, as well as VOCs, chlorinated phenols, proteinaceous solids (e.g. hair and hide scraps), alkaline and acid residuals, mineral solids, and undissolved lime.

Little is known about the tannery's effluent treatment practices prior to the 1960s. In general, industry practice prior to that time did not require treatment of wastes prior to discharge into nearby waterways. In the 1960s the facility began providing some treatment of waste prior to its discharge into the Nashua River. Two unlined lagoons were constructed along the western side of the site approximately 30 feet from the Nashua River and within its 100-year floodplain. Treatment in the lagoons (which are identified as Areas 1 and 2 on Figure 1-2) consisted of combining the acid and alkaline waste streams and allowing the solids to settle out before the liquid fraction was discharged to the river.

A separate treatment process for the alkaline and acid waste streams was put into use from around 1971 to 1981. The alkaline effluent was pumped sequentially into the Area 2 and Area 1 lagoons before being discharged to the river. The acid waste stream passed through a series of settling basins before being discharged to the river. The sludge from the lagoons and settling basins was periodically dredged and disposed of in four disposal areas at the site, identified as Areas 3 through 6 on Figure 1-2.

Between 1971 and 1981 a new treatment facility was constructed consisting of a control building, screen house, equalization tank, sulfide oxidation tank, primary clarifier, sludge dewatering unit with belt filter press, aerated lagoon (Area 1 lagoon), and a secondary clarifier. During construction, it was reported that sludge located in the general vicinity of the new primary clarifier (Area 6 on Figure 1-2) was transferred to Areas 3 through 5.

The use of the Area 2 lagoon was discontinued prior to completion of the new treatment system and the lagoon was reportedly covered with a layer of 4- to 12-inch diameter logs (which were not encountered during subsurface explorations performed as part of this EE/CA) and a layer of fill. Area 2 has since been allowed to naturally revegetate and is now covered with primarily herbaceous (non-woody) vegetation such as common reed.

In approximately 1980, materials including hide scraps and other miscellaneous refuse were excavated in preparation for constructing the control building for the new treatment facility. The excavated materials were moved approximately 30 to 125 feet southwest of the building, to the area identified as Area 7 on Figure 1-2.

From 1981 until the tannery closed in 1984, dried sludge from the facility was placed in a PVC lined landfill on the adjacent Fimbel Door Company property (Fimbel Landfill, identified on Figure 1-2). Since 1984, disposal Areas 3 through 7 have been covered with sand and gravel and allowed to naturally revegetate. In addition to granular fill, Area 5 was reportedly covered with a base layer of 6- to 12-inch diameter logs, similar to the reported cover on Area 2. These logs were not encountered during subsurface explorations performed during this EE/CA. The Fimbel Landfill has been capped with a low permeability cover and closed under New Hampshire State Regulations and was not included as part of the EE/CA.

In 1987, a release of aqueous material from the berm of the Area 1 lagoon was observed by the New Hampshire Department of Environmental Services (NHDES) during an inspection of the property. The property owner was ordered to determine the source of the release and conduct a study to characterize contamination at the site. No remediation of the site was conducted by the property owner (USEPA, 2000b).

1.2.3 Previous Removal Actions

EPA conducted a time-critical removal action at the site beginning in September 2000 and concluding in January of 2001. Actions taken included removing and disposing of asbestos-containing material from the old tannery building; characterizing and disposing of the contents of 42 drums, a large above ground storage tank, and a large clarifier tank on the site; and removing approximately 110 empty drums and 360 laboratory-type containers and disposing of them at an off-site facility. EPA also repaired a number of gates at the site and posted warning signs about the dangers of trespassing, to better secure the site.

1.3 Previous Investigations

This section provides brief descriptions of previous environmental investigations prepared for the site. EPA has determined that the data from these earlier investigations will not be used in the streamlined risk evaluations conducted as part of this EE/CA due to differences in the data quality objectives. However, the data will be used where appropriate in evaluating the nature and extent of sludge/waste at the site.

Phase I Hydrogeologic Study, Granite State Leathers, Inc. Facility, Nashua, New Hampshire, April 1985, prepared by Goldberg, Zoino, and Associates (GZA) Inc. for Fairmont Height Associates. GZA performed an initial characterization of subsurface conditions at the site in April 1985 in order to support future site use subsequent to the closure of Granite State Leathers. Investigative activities included a review of data provided by Granite State Leathers pertaining to tannery processes and waste streams; site plans depicting the locations of treatment facilities; and information on soil, groundwater, and surface water conditions at the site. Subsurface exploration activities performed in 1985 included the excavation of 36 test pits, advancement of one soil boring (which was converted to monitoring well GZ-1), and collection of one groundwater sample. TtNUS used this report as a source of information concerning the operational history of the site, waste handling and sludge disposal practices, geological conditions, and preliminary nature and extent of tannery sludge/waste.

Phase II Hydrogeologic Study and Conceptual Closeout Plan, Granite State Leathers, Inc. Facility, Nashua, New Hampshire, October 1985, prepared by GZA for Fairmont Height Associates. GZA performed a Phase II hydrogeological study at the site in June 1985 to further characterize hydrogeological conditions; further define the nature and extent of tannery sludge; define the nature and extent of overburden groundwater contamination; assess the potential impact of tannery sludge/waste on the Nashua River; and provide recommendations for containment of tannery sludge/waste. Subsurface investigative activities included the excavation of additional test pits in previously identified sludge disposal areas, advancement of 12 soil borings and installation of 10 monitoring wells, advancement of two hand-driven borings within the open lagoon (Area 1), and estimation of hydraulic conductivity through the collection of selected soil samples. Results of these investigations are summarized in the report submitted in October 1985. TtNUS used this report as an additional source of information pertaining to the nature and extent of tannery sludge/waste, as a preliminary source of groundwater elevation data, and as an initial source of information concerning the chemical nature of sludge/waste at the site.

Preliminary Sludge Characterization Investigation, Mohawk Tannery, 11 Warsaw Avenue, Nashua, New Hampshire, January 2001, prepared by GeoSyntec Consultants for Environmental Reclamation, Inc.: GeoSyntec collected samples of sludge from Areas 1 and 2 in an effort to characterize waste for disposal purposes. It was assumed that sludge from these areas is representative of waste located in Areas 3 through 7. Analytical results revealed that none of the sludge samples exhibited a RCRA hazardous waste characteristic. The report concluded that, based on waste characteristic data evaluated during this study, the sludge could be transported to and disposed of at an EPA- and NHDES-approved local landfill. TtNUS used data from this report to assist in characterizing the nature and extent of the tannery waste in Areas 1 and 2.

1.4 EE/CA Field Investigation Activities Summary

This section provides a summary of field investigation activities that were conducted by TtNUS in 2001 to support the EE/CA. A more detailed discussion of field investigation methods and objectives is presented in the Quality Assurance Project Plan (QAPP) (TtNUS, June 2001). The overall objectives of the field investigation were to collect analytical and field observation data to support a streamlined human health and ecological risk evaluation and the development and evaluation of NTCRA alternatives for the sludge and associated soils in each waste disposal area on the site. The specific goals of the field investigation were to:

- determine the nature, extent, and volume of sludge/waste and associated soils impacted by past waste disposal practices that may require removal;
- identify any on-site wetlands and endangered/threatened species that could be affected by actions taken at the site;
- collect topographic/land survey information needed to fully characterize the site and evaluate field data.

To meet the project objectives, the following field investigation activities were performed: test pit explorations; observation sludge/soil borings; sludge/soil borings for sampling and analysis; sludge sampling for air-headspace analysis; wetland delineation; endangered/threatened species evaluation; water table measurements and inventory of existing wells; and topographic/land surveying. These activities are described in the balance of this section. Field investigation results are presented in Section 2.

1.4.1 Test Pit Explorations

Test pit explorations were conducted to better define the horizontal boundaries of the former tannery waste disposal areas, determine the thickness of soil cover over the sludge, and if possible, determine the sludge thickness at the disposal area boundaries. Test pits were not used to collect sludge/soil samples for laboratory analysis.

The test pit investigation focused on Areas 2 through 7, the six sludge disposal areas that have been covered with soil. The horizontal limits of disposal Area 1, the open lagoon, were considered to be obvious and therefore did not require any further excavation. A total of 65 test pits were excavated at the site: fifteen in Area 2, ten in Area 3, nine in Area 4, ten in Area 5, ten in Area 6, and eleven in Area 7. Soils observed in each test pit were described on log sheets using the Unified Soil Classification System. All pertinent observations (depths and descriptions of sludge and soil, estimated grain size, dry vs. wet, etc.) were recorded, and photographs were taken. All test pit locations are depicted on Figure 1-3. Test pit locations for individual disposal areas are depicted on Figures 1-4 through 1-6. Test Pit Log sheets are contained in Appendix B.

1.4.2 Observation Borings

Subsequent to the excavation of test pits, several non-sampling (NS) observation borings were advanced using direct-push technique (DPT) drilling in Areas 2, 3, 5, 6, and 7. Observation borings were used to collect further information to delineate the lateral extent of sludge waste, and to aid in the determination of the thickness and volume of sludge and overlying soil in each disposal area. No soil samples were collected for laboratory analysis from observation soil/sludge borings.

A total of 19 observation borings were advanced at the site: four in Area 2, seven in Area 3, two in Area 5, four in Area 6, and two in Area 7. At each observation boring location, continuous samples were collected (using 4-foot length samplers) beginning at the ground surface and continuing to approximately 2 feet beyond the vertical limit of sludge (if encountered). Soil/sludge recovered from each sampler was described on boring logs using the Unified Soil Classification System. All pertinent observations (depths and descriptions of visually contaminated materials, grain size, moisture content, etc.) were recorded. Observation boring locations are depicted on Figures 1-3 through 1-6. Boring Log forms prepared during advancement of observation borings are contained in Appendix C.

1.4.3 Sludge/Soil Borings for Soil Sampling and Analysis

A total of 25 sludge/soil borings were advanced using manual coring techniques and DPT drilling for the purpose of obtaining sludge and soil samples for chemical analysis and determining the thickness of sludge and cover soils in each disposal area. The borings located in Area 1, the open lagoon, were advanced using manual coring techniques. The borings in the remaining areas were advanced using DPT drilling.

The general approach for locating borings for sampling and analysis was to divide each of the seven onsite disposal/lagoon areas into quadrants and advance one boring in the approximate center of each quadrant. This sampling approach was designed to yield representative sludge and soil samples from each area and to provide adequate spatial distribution to estimate sludge and soil volumes with an acceptable degree of accuracy for use in the EE/CA. Boring locations were adjusted in the field based on access considerations, field observations, and the estimated size of the disposal areas determined by test pitting activities and observation borings. The following is a summary of sludge/soil boring advancement and sample collection activities that were performed at each disposal area. Boring locations are depicted on Figures 1-3 through 1-6. Boring Log forms are contained in Appendix D. Analytical methods used are presented on Table 1-1. Sample analytical results are discussed in Section 2.1.

1.4.3.1 Area 1

Four borings were advanced in Area 1 (the open lagoon) from a floating work platform, using manual coring techniques (see Figure 1-4 for locations). Borings were advanced to refusal at each of the four sampling locations, and no underlying soil was recovered. Because of the challenges of obtaining samples from the open lagoon and the inherent limitations of manual coring, reaching refusal in these borings does not necessarily signify that bedrock was encountered. Based on the observed elevations of bedrock in nearby (non-manual) borings, it is unlikely that the manual borings in Area 1 reached bedrock.

Sludge recovered from each sampler was described on boring logs using the Unified Soil Classification System. All pertinent observations (depths and descriptions of visually contaminated materials, grain size, moisture content, etc.) were recorded.

One boring-composite sludge sample consisting of sludge from the entire length of the boring was collected from each boring. Each boring-composite sludge sample was shipped for laboratory analysis for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, and total sulfides. Additionally, one area-composite sludge sample (made up of sludge from all four Area 1 borings) was collected and shipped for laboratory analysis for RCRA hazardous waste characteristics for TCLP SVOCs, TCLP pesticides, TCLP metals, corrosivity, and reactivity. One paint filter test sample was collected from boring SL-104 based on observations of high moisture content of sludge. The paint filter test is used to determine the presence or absence of free liquids in a waste. The presence of free liquids in the sludge/waste would have an impact on materials handling and disposal options because wastes with free liquids can not be land-disposed without pre-treatment to dry or remove the liquids.

1.4.3.2 Area 2

Five sludge/soil borings were advanced in Area 2 due to the large area of sludge identified during the excavation of test pits and advancement of observation borings (see Figure 1-4). At each of the five boring locations, continuous sludge/soil samples were collected (using 4-foot length samplers) beginning at the ground surface and continuing through the entire thickness of the sludge and approximately 2 feet into the soils (or to refusal) beneath the sludge. At each boring, soils and sludge recovered from each sampler were described on boring logs using the Unified Soil Classification System. All pertinent observations (depths and descriptions of visually contaminated materials, grain size, moisture content, etc.) were recorded.

Sludge and soil samples for chemical analysis were collected from each of the five borings advanced in Area 2. Media that were sampled from these borings included tannery sludge, the cover soil above the sludge, and the bottom soil underlying the sludge. One boring-composite sample of sludge (from the entire sludge thickness) was collected from each of the five borings advanced in Area 2. Each of these samples was shipped for laboratory analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, and total sulfides. One paint filter test sample was collected from boring SL-205 based on observations of high sludge moisture. Additionally, one area-composite sludge sample (made up of sludge from each of the five borings) was collected and shipped for laboratory analysis for RCRA hazardous waste characteristics for TCLP SVOCs, TCLP pesticides, TCLP metals, corrosivity, and reactivity.

Samples were collected from soil both overlying and underlying the tannery sludge layer. One area-composite cover soil sample (made up of cover soil from all of the borings advanced in Area 2), and one area-composite underlying soil sample (made up of approximately 2 feet of soil underlying the sludge from borings SL-202, SL-204, and SL-205) were collected. Borings SL-201 and SL-203 met refusal prior to encountering underlying soils. Area-composite samples of overlying and underlying soil were shipped for laboratory analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, and total sulfides.

1.4.3.3 Areas 3 through 6

Three borings were advanced in each of these disposal areas (See Figures 1-4, 1-5, and 1-6). At each of the boring locations, continuous sludge/soil samples were collected (using 4-foot length samplers) beginning at the ground surface and continuing through the entire thickness of the sludge and approximately 2 feet into the soils beneath the sludge. At each boring, soils and sludge recovered from each sampler were described on boring logs using the Unified Soil Classification System. All pertinent observations (depths and descriptions of visually contaminated materials, grain size, moisture content, etc.) were recorded.

Sludge and soil samples for chemical analysis were collected from each boring. Media that were sampled from these borings included tannery sludge, the cover soil above the sludge, and the bottom soil underlying the sludge. One boring-composite sample of sludge was collected from each boring and shipped for laboratory analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, total sulfides, TCLP VOCs (grab sample), TCLP SVOCs, TCLP pesticides, TCLP metals, corrosivity, reactivity, and ignitability. The grab samples for TCLP VOC analysis were selected from the most contaminated sample interval within each boring, as determined by VOC headspace screening and/or visual observations. As proposed in the QAPP, one paint filter test sample (SL-402) was collected from these disposal areas based on observation of high sludge moisture content.

Sampling procedures in Areas 3 through 6 were adjusted in the field to accommodate the subsurface conditions encountered during the test pit explorations and advancement of observation borings. In Area 3, area-composite samples of overlying and underlying soil from all borings were collected and shipped for laboratory analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, and total sulfides. In Area 4, sampling procedures for overlying and underlying soils were the same as for Area 3, except that underlying soil was not collected from boring SL-401 due to boring refusal prior to encountering the vertical limit of sludge. In Area 5, due to the absence of an obvious sludge layer, no overlying or underlying soil samples were collected. All samples collected from Area 5 were identified as sludge samples for the purposes of data evaluation only. In Area 6, overlying and underlying soil area-composite samples were collected and shipped for analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, and total sulfides. The area-composite samples for Area 6 included soil from all borings, except soil from boring SL-603 was not included in the area-composite of overlying soil due to an ambiguous interface between overlying soils and tannery sludge/waste. An obvious layer of sludge was observed at a depth of 6 feet bgs in boring SL-603; however, traces of animal hides were observed in soils in this boring beginning at the ground surface.

1.4.3.4 Area 7

Four soil/sludge borings were advanced in Area 7 (see Figure 1-6). At each boring location, continuous sludge/soil samples were collected (using 4-foot length samplers) beginning at the ground surface and continuing through the entire thickness of the sludge and approximately 2 feet into the soils beneath the sludge. Soils and sludge recovered from each sampler were described on boring logs using the Unified Soil Classification System. All pertinent observations (depths and descriptions of visually contaminated materials, grain size, moisture content, etc.) were recorded.

Sludge and soil samples for chemical analysis were collected from each boring. Media that were sampled from these borings included tannery sludge, the cover soil above the sludge, and the bottom soil underlying the sludge. One boring-composite sample of sludge was collected from each boring and shipped for laboratory analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, total sulfides, TCLP VOCs (grab sample), TCLP SVOCs, TCLP pesticides, TCLP metals, corrosivity, reactivity, and ignitability.

Samples were collected from soil both overlying and underlying the tannery sludge layer in Area 7. One area-composite cover soil sample (made up of overlying soil from borings SL-701, SL-703, and SL-704), and one area-composite underlying soil sample (made up of underlying soil from all borings) were collected. The overlying soil composite for Area 7 did not include soil from boring SL-702 because signs of potential tannery waste and debris were observed beginning at the ground surface at this location. Area-composite samples of overlying and underlying soil were shipped for laboratory analyses for VOCs, SVOCs, pesticides/PCBs, metals, dioxins, hexavalent chromium, and total sulfides.

1.4.4 Sludge Sampling for Air-Headspace Analysis

Sludge/soil borings were also used to collect sludge samples for air-headspace analysis. The purpose of these samples was to evaluate potential air emissions that may result from excavation of the sludge during the NTCRA. The air data will be used in the EE/CA to identify and evaluate potential odor control technologies to address the expected air emissions that would be generated by excavation and handling of site sludge. Odor control is expected to be an important component of any removal action involving excavation of sludge because the sludge has a strong sulfide odor that could potentially impact residential properties in the site vicinity.

During the drilling/sampling program, grab sludge samples from distinct intervals in four borings were collected and shipped to a laboratory for headspace analysis for VOCs and odorous sulfides. Air headspace sample locations were selected in the field based on field observations and screening that indicated a potential for significant air emissions during excavation (e.g. strong odors and visual evidence of contamination). The sample interval was selected based on jar headspace screening results (the highest in a boring), or if the headspace screening was inconclusive, field observations of odors and/or visual evidence of contamination. In general, the grab samples for headspace analysis were collected from the same general vicinity as the VOC and TCLP VOC samples. Air headspace samples were collected from sludge in borings SL-104 (Area 1), SL-205 (Area 2), SL-403 (Area 4), and SL-704 (Area 7).

1.4.5 Wetland Delineation

The objective of the wetland delineation was to identify the current wetland boundaries and map the areal extent of the on site wetlands. The wetland delineation used the three parameter approach based on vegetation, soils, and hydrology described in the Corps of Engineers Wetlands Delineation Manual (COE Manual, Environmental Laboratory, 1987). The wetland delineation methods and results are presented in Section 2.1.4 of this report.

1.4.6 Endangered/Threatened Species Evaluation

The objective of the endangered/threatened species evaluation was to identify any rare or endangered species that may be present at the site. The evaluation was conducted through communications with federal and state agencies and through on-site observations. The endangered/threatened species evaluation results are presented in Section 2.1.5 of this report.

1.4.7 Water Table Measurements and Inventory of Existing Wells

TtNUS performed an inventory of existing groundwater monitoring wells to determine whether the wells would be useable for groundwater level measurements and possible future sampling. The inventory focused primarily on wells in the vicinity of the seven waste disposal areas and lagoons. Water table measurements were taken in all wells determined to be in adequate condition. Data from the water table measurements will be used to determine the elevation of the water table in the vicinity of the disposal areas. This information will be used in the planning and evaluation of removal alternatives to address the site sludge.

Monitoring wells GZ-1, GZ-4, GZ-6, GZ-9, GZ-10, and GZ-11 were determined to be in adequate condition and groundwater depths were recorded. Monitoring well GZ-12 was found to be destroyed and monitoring well GZ-13 was not functional due to an obstruction. Monitoring well GZ-7 and observation wells TP-1, TP2, TP-4, and TP-6 could not be located. All other monitoring wells and observation wells located on site were not part of the well inventory because they are outside the general vicinity of the disposal areas and are not of immediate concern for the purposes of the EE/CA. Results of the well inventory are summarized in Section 2.1.6 and detailed on the Well Inspection and Groundwater Level Measurement Sheets contained in Appendix E. Monitoring well locations are shown on Figure 1-3.

1.4.8 Topographic/Land Surveying

A topographic/land survey was conducted to verify the locations of important site features, spot-check the topographic contours, and identify selected sampling locations. Surveyed features were added to the digital-format site base map obtained from the City of Nashua, to provide an accurate depiction of the site for use in removal action evaluation and planning. The base map obtained from the city, entitled "Topographic Map of the City of Nashua, Hillsborough County, New Hampshire" was prepared by Chas. H. Sells, Inc. of Charlton, MA based on aerial photography dated April 13, 1998. The base map, with all boring and test pit locations, is presented as Figure 1-3.

1.5 Lagoon Surface Water Sampling by EPA

EPA personnel collected two surface water samples for chemical analysis from the Area 1 lagoon on January 30, 2002. The water samples were analyzed by the EPA New England Regional Laboratory for VOCs, SVOCs, pesticides/PCBs, total metals, and dissolved metals. The purpose of the sampling and analysis was to obtain chemical characterization data for the surface water in the lagoon for use in the streamlined ecological risk evaluation. Analytical results for the surface water samples are provided in Appendix F and discussed in Section 2.5.5.

2.0 DATA EVALUATION AND SITE CHARACTERIZATION

This section presents the results of site characterization efforts and the streamlined human health and ecological risk evaluations.

2.1 EE/CA Field Investigation Results

This section presents the results of the field investigation activities described in Section 1.0. In Sections 2.1.1 and 2.1.2, sludge, soil (overlying and underlying), and air headspace laboratory analytical results are presented in tabular form and compared to federal and state environmental standards and criteria. In Section 2.1.3, the analytical data and test pit logs, observation boring logs, and sample boring logs are interpreted to estimate the lateral extent and volume of waste present. Sections 2.1.4 and 2.1.5 document the results of the wetland and endangered species evaluations, respectively. In Section 2.1.6, water table measurements are used to estimate the volume of sludge located below the water table. Field results are presented by disposal area in the following sections.

2.1.1 Analytical Data Evaluation

Analytical data from sludge, soil, and air headspace samples were compared to project screening criteria selected from appropriate federal and state policies and regulations.

Screening criteria used to evaluate sludge and soil data are the EPA Region IX Preliminary Remediation Goals (PRGs) for residential soil and the New Hampshire Department of Environmental Services (NHDES) Risk Characterization and Management Policy (RCMP) Method 1 Standards for Category S-1 Soil. The S-1 soil category applies to soils with the highest potential for exposure. This includes accessible (surficial) soils in locations where children are present and may be exposed on a high frequency-high or low intensity basis, or a low frequency-high intensity basis, or where adults may be exposed on a high frequency-high or low-intensity basis. It also includes potentially accessible soil (2-15 feet below ground surface or shallower, if paved) where children may be exposed on a high frequency-high intensity basis. These criteria are considered appropriate for the site because it is zoned as residential property and abuts a residential neighborhood.

The Region IX PRGs are human health risk based criteria. Region IX PRGs for carcinogens are based on cancer risk levels of 1.0E-6. Region IX PRGs for non-carcinogens are based on a Hazard Index of 1.0. For consistency with the streamlined human health risk evaluation (which uses Region IX PRGs to identify contaminants of concern), the Region IX PRGs for non-carcinogens were adjusted to correspond to a hazard index of 0.1 (see Section 3.3 for details on the rationale for this adjustment). These adjusted values are presented in the data summary tables and used in evaluating the site data. The NHDES RCMP S-1 soil standards are derived to be protective of human health and of groundwater. The standards are the lower of the risk-based or leaching to groundwater-based criteria for each chemical.

In addition to the criteria identified above, soil samples were compared to NHDES RCMP background concentrations of metals in soils. Published RCRA criteria were used as screening criteria for TCLP analyses. NHDES 24-hour ambient air limits (AALs) were used as screening criteria for the air headspace analysis results.

Summaries of detected compounds in sludge, soil, and air samples collected at the site, and a comparison of analytical results to project screening criteria are presented on Tables 2-1 through 2-17. Analytical data results are contained in Appendix G.

In the following sections, contaminants that exceeded one or more screening criteria are identified. These exceedances are highlighted on Tables 2-1 through 2-17 along with the specific screening criteria that were exceeded. Table 2-18 provides a summary of percent solids results from sludge and soil samples collected from each of the disposal areas. Table 2-19 provides a summary of contaminants detected in each disposal area above project screening criteria. Figures 1-4 through 1-6 provide a visual depiction of test pit and soil boring locations.

2.1.1.1 Sludge/Waste Data Evaluation

This section presents the evaluation of sludge characterization data from each disposal area. The evaluation focuses on contaminants detected in sludge/waste, RCRA characterization analyses of sludge, and air-headspace analysis of sludge samples. The analytical results are summarized on Tables 2-1 through 2-15. Analytical data results are contained in Appendix G.

Area 1

Sludge samples collected from borings advanced in Area 1 contained several VOCs, SVOCs, pesticides, dioxins, and metals above laboratory detection limits. TCLP SVOCs, TCLP metals, and reactive sulfides were also detected in Area 1 sludge. A summary of contaminants detected in sludge samples collected from Area 1 is provided on Tables 2-1 and 2-2.

Contaminants detected in sludge samples at concentrations exceeding screening criteria included 2-butanone, carbon disulfide, 2-methylnaphthalene, 4-methylphenol, pentachlorophenol, 2,3,7,8-TCDD, dioxins as toxicity equivalents (TEQs), antimony, arsenic, chromium, and manganese. Hexavalent chromium was not detected in any of the sludge samples collected from Area 1. A sludge sample collected from SL-104 passed the paint filter test.

The area-composite sludge sample from Area 1 did not exceed TCLP criteria for SVOCs or metals; however, the sample contained reactive sulfides at concentrations that may indicate a potential reactivity concern. There are currently no federal numerical standards to determine exceedance of the RCRA reactivity characteristic. In the absence of a current standard, interim levels contained in a July 1985 guidance, but withdrawn in April 1998 (USEPA, 1998b), were used to identify potential reactivity concerns. Reactive sulfide concentrations in the Area 1 composite sludge sample and its duplicate (694 mg/kg and 663 mg/kg, respectively) were slightly higher than the withdrawn regulatory guidance level of 500 mg/kg.

It was noted that the reactive sulfide concentrations for the Area 1 composite sample and its duplicate were higher than the total sulfide concentrations for the individual Area 1 samples from which the composite sample was taken. These seemingly anomalous results are likely due to the heterogenous distribution of the sulfides within the sludge matrix. Because the sulfides are insoluble, they tend to be unevenly distributed within the solid matrix. As a result there can be significant variability in results from different parts of the same sample or across an area. A more detailed analysis of reactive sulfide versus total sulfide results follows.

The total sulfides result includes the total concentration of acid soluble and acid insoluble sulfides in a sample. The analytical procedure involves adding hydrochloric acid to the sample to liberate the sulfides as hydrogen sulfide gas that is collected in a scrubber. The concentration of total sulfides is expressed in terms of milligrams (mg) hydrogen sulfide generated per kilogram (kg) of sample. The reactive sulfides analysis determines the rate of hydrogen sulfide released from a sample under the specific conditions of the test method. The procedure involves adding sulfuric acid to the sample to liberate the sulfides as hydrogen sulfide gas that is then collected in a scrubber. The concentration of reactive sulfides is also expressed in terms of mg hydrogen sulfide released per kg of sample.

Ideally, for a homogeneous sample, the reactive sulfides result for a sample should not exceed the total sulfides result. However, the less-than-ideal nature of environmental sampling and differences in the two analytical methods explain why in some instances the reactive sulfides results exceed the total sulfides results for the same sample or area. The first factor, and likely the most significant, is sample heterogeneity. Most of the sulfides are present in the solid matrix as insoluble salts. These insoluble sulfides are unevenly distributed within the solid matrix. As a result, two samples collected from the same location may contain significantly different sulfide concentrations. Additionally, since only a fraction of the field sample is used in the laboratory method, even two analyses conducted on different portions of material from the same sample jar could have very different concentrations depending on where the sulfide "granules" were located within the sample.

Another factor that may contribute to the difference in the results is the difference in the two analytical methods. The two methods use different sample mass (50 g for total sulfides, 10 g for reactive sulfide), different acids, and different reaction temperature and time. The difference in sample mass, in particular, may increase the potential for inconsistent results due to heterogeneity issues discussed above. If the sulfides "granules" are unevenly distributed in the sample matrix, the sulfide concentrations in a 10 g and a 50 g sample of the same material could differ considerably solely due to chance. The effect of heterogeneity in the sludge at the site is illustrated by the total sulfides results for sample SL-103 (15.8 UJ) and its duplicate, SL-DUP-06 (230 J). Although the two samples were collected from the same boring, the results are significantly different. These results indicate the possibility for significant differences within the same sample and using the same analytical method. The potential for differences between the Area 1 samples is compounded by the fact that a composite sample from several locations (analyzed for reactive sulfide) is being compared to several individual samples from the area, analyzed by a different method (for total sulfides).

TCLP VOC analysis was not performed on samples from Area 1; however, previous TCLP analyses (GeoSyntec, 2001) did not detect VOCs in excess of RCRA TCLP criteria and the low concentrations of VOCs detected in sludge (Table 2-1) are well below concentrations that could result in exceedance of TCLP VOC criteria.

A headspace air sample collected from boring SL-104 contained several VOCs and sulfur compounds above laboratory detection limits. Concentrations of benzene, carbon disulfide, and methyl mercaptan detected in headspace air samples exceeded screening criteria for headspace air. Headspace results will be used to predict the types and maximum concentrations of odorous sulfides and VOCs likely to be released during excavation of sludge/waste. These results are assumed to represent the concentration of contaminants generated under worst-case, closed conditions (with approximately 1 volume of soil to 2 volumes of air). Concentrations of contaminants in ambient air under actual conditions during excavation would be lower due to dilution of contaminants in a larger volume of air and dispersion of contaminants by air currents. A summary of compounds detected in headspace air samples collected at the site is provided on Table 2-3.

The solids content in sludge samples collected from Area 1 ranged from 13.1 to 35 percent and averaged 25.7 percent solids (Table 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

Area 2

Sludge samples collected from borings advanced in Area 2 contained concentrations of several VOCs, SVOCs, pesticides, dioxins, and metals above laboratory detection limits. TCLP SVOCs and TCLP metals were also detected. A summary of contaminants detected in sludge samples collected from Area 2 is provided on Tables 2-4 and 2-5.

Contaminants detected at concentrations exceeding screening criteria in sludge samples collected from borings SL-201, SL-203, and SL-204 in Area 2 included the following: carbon disulfide, naphthalene, pentachloropheneol, 2,3,7,8-TCDD, dioxins TEQs, antimony, arsenic, and chromium. Sludge samples collected from boring SL-202 exceeded screening criteria for those compounds (except chromium) as well as 4-methylphenol, phenol, aldrin, and heptachlor epoxide. The sludge sample collected from boring SL-205 only exceeded screening criteria for arsenic. Hexavalent chromium was not detected in sludge samples collected from Area 2. A sludge sample collected from boring SL-205 passed the paint filter test.

The area-composite sludge sample from Area 2 did not exceed TCLP criteria for SVOCs or metals and did not contain detectable levels of reactive cyanide or reactive sulfide.

TCLP VOC analysis was not performed on samples from Area 2; however, previous TCLP analyses (GeoSyntec, 2001) did not detect VOCs in excess of RCRA TCLP criteria and the low concentrations of VOCs detected in sludge (Table 2-4) are well below concentrations that could result in exceedence of TCLP VOC criteria.

A headspace air sample collected from boring SL-205 contained detectable concentrations of chlorobenzene, methylene chloride, trichlorofluoromethane, carbon disulfide, and carbonyl sulfide. Detected concentrations did not exceed screening criteria. A summary of compounds detected in headspace air samples collected at the site is provided on Table 2-3.

The solids content of Area 2 sludge samples ranged from 54 to 94.2 percent and averaged 73.3 percent solids (Table 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

<u>Area 3</u>

Sludge samples collected from borings advanced in Area 3 contained detectable concentrations of a few VOCs, a few SVOCs, a few pesticides, Aroclor 1254, and several dioxins. Metals were detected in sludge samples collected from all three borings advanced in Area 3. A summary of contaminants detected in sludge samples collected from Area 3 is contained in Tables 2-6 and 2-7.

Concentrations of naphthalene and pentachlorophenol detected in a sludge sample collected from SL-303 exceeded screening criteria. The concentration of 2,3,7,8-TCDD in a sludge sample collected from SL-301 exceeded the screening criteria of 3.9 ng/kg. The concentrations of arsenic exceeded screening criteria in all three sludge samples. Antimony also exceeded screening criteria in the samples collected from borings SL-301 and SL-303 and chromium exceeded screening criteria in the sample from boring SL-301. Hexavalent chromium was not detected in sludge samples collected from Area 3.

TCLP VOC, TCLP SVOC, and TCLP metals analyses on sludge samples collected from Area 3 revealed very low concentrations of contaminants, none exceeding RCRA TCLP criteria. Reactive cyanide was not detected and reactive sulfide was detected only at low concentrations in one sample.

The solids content of Area 3 sludge samples ranged from 83 to 94 percent and averaged 90.7 percent solids (Table 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

Area 4

Sludge samples collected from borings advanced in Area 4 contained concentrations of VOCs, SVOCs, pesticides, PCBs, dioxins, metals, and reactive sulfide above laboratory detection limits. TCLP VOCs, TCLP SVOCs, and TCLP metals were also detected. A summary of contaminants detected in sludge samples collected from Area 4 is contained in Tables 2-8 and 2-9.

Carbon disulfide and 4-methylphenol were detected at concentrations exceeding screening criteria. Antimony, arsenic, chromium, manganese, and thallium were also detected at concentrations exceeding screening criteria. Hexavalent chromium was not detected in sludge samples collected from Area 4.

A sludge sample collected from boring SL-402 failed the paint filter test, indicating the presence of free liquid in the sample. This result does not seem to be consistent with percent solids values. The sludge sample from Area 4 contained 50 percent solids, which is nearly four times higher than the percent solids content (13.1) of the Area 1 sample that passed the paint filter test (Appendix G). A possible explanation for this result is that the sludge sample from Area 1 has greater water-holding capacity than the sample from Area 4. The paint filter test measures the free liquid that drains from a sample when placed in the test apparatus, not the total amount of water in the material. Therefore, a material with a higher moisture content but greater water-binding capacity (such as clay) may pass the paint filter test while a material with a lower moisture content but less ability to hold water (such as sand) may fail. Additional testing will be required to confirm the presence of free liquids in Area 4 sludge and to determine what actions may be needed to dewater the sludge.

No contaminants were detected in Area 4 sludge samples at concentrations exceeding RCRA hazardous waste criteria.

A headspace air sample collected from boring SL-403 contained detectable concentrations of several VOCs and sulfur compounds. The concentrations of chlorobenzene, toluene, and carbon disulfide exceeded screening criteria established for the assessment of air sampling results. A summary of compounds detected in headspace air samples collected at the site is provided on Table 2-3.

The solids content of Area 4 sludge samples ranged from 36.4 to 79.9 percent and averaged 57.5 percent solids (Table 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

<u>Area 5</u>

Tannery waste material was not identified in Disposal Area 5 through field observations. Thin lenses of possible staining were observed, but obvious visual and olfactory evidence of tannery waste/sludge was not observed in any of the test pits or DPT borings advanced in Area 5. Therefore, the samples from this area consisted of soil from the ground surface to the end of the boring. No overlying or underlying soil samples were collected from these borings. For purposes of chemical analysis the samples were classified as sludge/waste (they were analyzed for the same parameters as other sludge samples). However, because the samples actually consisted of only soil, the results were compared with NH RCMP background soil concentrations as well as the EPA Region IX and NH S-1 screening criteria.

Samples collected from the borings advanced in Area 5 contained one SVOC, one PCB, several dioxins, and several metals above laboratory detection limits. TCLP SVOCs, TCLP metals, and reactive cyanide were also detected. A summary of contaminants detected in samples collected from Area 5 is contained in Tables 2-10 and 2-11.

Only concentrations of antimony and arsenic exceeded screening criteria (the EPA Region IX PRGs). The arsenic concentrations did not exceed NH RCMP background soil concentrations. The antimony concentration in the sample from boring SL-503 exceeded the NH RCMP background soil concentration but did not exceed the NH S-1 screening criteria. A low concentration of hexavalent chromium, below screening criteria, was detected in the sample from boring SL-502. No contaminants were detected in Area 5 samples at concentrations exceeding RCRA hazardous waste criteria.

The solids content of the samples collected from Area 5 ranged from 84.6 to 99 percent and averaged 95.4 percent solids (Tables 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

Area 6

Sludge samples collected from borings advanced in Area 6 contained concentrations of VOCs, SVOCs, pesticides, dioxins, and metals above laboratory detection limits. TCLP VOCs, TCLP SVOCs, TCLP metals, and reactive sulfide were also detected. A summary of contaminants detected in sludge samples collected from Area 6 is contained in Tables 2-12 and 2-13.

Concentrations of 1,2-dichlorobenzene, 1,4-dichlorobenzene, chlorobenzene, naphthalene, pentachlorophenol, 2,3,7,8-TCDD, and dioxins TEQs detected in sludge samples from borings SL-601 and SL-602 exceeded screening criteria. No VOCs, SVOCs, or pesticides/PCBs were detected in SL-603 at concentrations exceeding screening criteria. However, 2,3,7,8-TCDD, antimony, and arsenic were detected in SL-603 at concentrations exceeding criteria. Concentrations of several metals exceeding screening criteria were detected in all three Area 6 borings. Concentrations of antimony, arsenic, barium, chromium, thallium, and vanadium exceeding screening criteria were detected. Hexavalent chromium was not detected in sludge samples collected from Area 6.

No contaminants were detected in Area 6 sludge samples at concentrations exceeding RCRA hazardous waste criteria.

The solids content of sludge samples from Area 6 ranged from 27.3 to 91.3 percent and averaged 51.6 percent solids (Table 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

Area 7

Sludge samples collected from borings advanced in Area 7 contained concentrations of VOCs, SVOCs, pesticides, PCBs, dioxins, and metals above laboratory detection limits. TCLP VOCs, TCLP SVOCs, and TCLP metals were also detected. A summary of contaminants detected in sludge samples collected from Area 7 is contained in Tables 2-14 and 2-15.

Concentrations of 4-methylphenol, benzo(a)pyrene, pentachlorophenol, Aroclor-1242, 2, 3, 7, 8-TCCD, and dioxins TEQs in sludge samples collected from Area 7 exceeded screening criteria. Benzo(a)pyrene and Aroclor-1242 were each only detected at one location. Concentrations of several metals that exceeded screening criteria were detected in sludge samples collected from Area 7 borings, including antimony, arsenic, barium, cadmium, chromium, lead, manganese, mercury, and thallium. Hexavalent chromium was not detected in sludge samples collected from Area 7.

No contaminants were detected in Area 7 sludge samples at concentrations exceeding RCRA hazardous waste criteria.

A headspace air sample collected from boring SL-704 (including a field duplicate sample) contained detectable concentrations of xylenes, toluene, and several sulfur compounds. The concentrations of toluene and methyl mercaptan exceeded project screening criteria established for the assessment of air sampling results. A summary of compounds detected in headspace air samples collected at the site is provided on Table 2-3.

The solids content of sludge samples from Area 7 ranged from 30 to 89.4 percent and averaged 62.1 percent solids (Table 2-18). A detailed tabulation of the solids content in individual samples is provided in Appendix G.

2.1.1.2 Overlying Soil Data Evaluation

This section presents the evaluation of overlying soil data for each disposal area. Composite samples of overlying soil were collected from each disposal area, with the exception of Area 1 (the open lagoon) and Area 5 (where no obvious sludge/tannery waste layer was present). Overlying soils were collected from the ground surface to immediately above the first visually identified tannery sludge/waste layer in each boring. The overlying soil samples from the individual borings within each disposal area were then composited into one area-composite sample for each disposal area. Table 2-16 presents the overlying soils data.

Area 2

The composite sample of overlying soil collected from borings advanced in Area 2 contained three VOCs, two pesticides, several dioxins, and metals above laboratory detection limits (see Table 2-16). Concentrations of 2,3,7,8-TCDD, antimony, arsenic, and chromium exceeded screening criteria. The arsenic concentration did not exceed NH RCMP background soil concentrations. Mercury exceeded NH RCMP background soil concentrations only. Hexavalent chromium was not detected in this soil sample.

Area 3

A composite sample of overlying soil collected from borings advanced in Area 3 contained concentrations of metals and several dioxins above laboratory detection limits (see Table 2-16). The arsenic concentration in this sample exceeded the EPA Region IX screening criterion but did not exceed NH RCMP background soil concentrations. Antimony and chromium exceeded background soil concentrations only. Hexavalent chromium was not detected in this sample.

Area 4

A composite sample of overlying soil collected from soil borings advanced in Area 4 contained concentrations of VOCs, pesticides, PCBs, dioxins, and metals above laboratory detection limits (see Table 2-16). Concentrations of antimony, arsenic, chromium, and manganese exceeded screening criteria. Arsenic and manganese concentrations did not exceed NH RCMP background soil concentrations. Hexavalent chromium was not detected in overlying soil in Area 4.

Area 6

A composite sample of overlying soil collected from borings advanced in Area 6 contained concentrations of chlorobenzene, several dioxins, and several metals above laboratory detection limits (see Table 2-16). The concentration of 2,3,7,8-TCDD exceeded screening criteria, but the dioxins TEQ concentration did not exceed criteria. The arsenic concentration in this sample exceeded the EPA Region IX screening criteria but did not exceed NHDES S-1 or background soil concentrations. The antimony concentration exceeded the EPA Region IX screening criterion and the NH RCMP background soil concentrations. The chromium concentration exceeded the NHDES S-1 and NH RCMP background soil criteria. The concentration of hexavalent chromium detected in overlying soil from Area 6 was slightly below its EPA Region IX PRG (30 mg/kg).

Area 7

A composite sample of overlying soil collected from borings advanced in Area 7 contained concentrations of pesticides, PCBs, several dioxins, and several metals above laboratory detection limits (see Table 2-16). Concentrations of antimony, arsenic, chromium, and mercury exceeded screening criteria. Hexavalent chromium was not detected in samples of overlying soil collected from Area 7.

2.1.1.3 Underlying Soil Data Evaluation

This section presents the evaluation of underlying soil data for each disposal area. Composite samples of underlying soil were collected from each disposal area, with the exception of Area 1 (where refusal was reached before underlying soils were encountered) and Area 5 (where no obvious sludge/tannery waste layer was present). Underlying soils were collected from approximately the 2 feet of soil immediately beneath visually identified tannery sludge/waste in each boring. The underlying soil samples from the individual borings within each disposal area were then composited into one area-composite sample for each disposal area. Table 2-17 presents the underlying soils data.

Area 2

The composite sample of underlying soil collected from borings advanced in Area 2 contained one VOC (chloroform), one SVOC (pentachlorophenol), several dioxins, and several metals above laboratory detection limits (see Table 2-17). Only arsenic was detected at a concentration exceeding screening criteria. The arsenic concentration in this sample also slightly exceeded the NH RCMP background soils concentration. Hexavalent chromium was not detected in this soil sample.

Area 3

A composite sample of underlying soil collected from borings advanced in Area 3 contained concentrations of pentachlorophenol, several dioxins, and several metals above laboratory detection limits (see Table 2-17). The arsenic concentration in this sample exceeded the EPA Region IX screening criterion but did not exceed NH RCMP background soil concentrations. No other analytes exceeded screening criteria. Hexavalent chromium was not detected in this sample.

Area 4

A composite sample of underlying soil collected from borings advanced in Area 4 contained concentrations of 4-methylphenol, several dioxins, and several metals above laboratory detection limits (see Table 2-17). The arsenic concentration in this sample exceeded the EPA Region IX screening criterion but did not exceed NH RCMP background soil concentrations. No other analytes exceeded screening criteria. Hexavalent chromium was not detected in underlying soil in Area 4.

Area 6

A composite sample of underlying soil collected from borings advanced in Area 6 contained concentrations of several dioxins and several metals above laboratory detection limits (see Table 2-17). The arsenic concentration in this sample exceeded the EPA Region IX screening criterion but did not exceed NHDES S-1 or background soil concentrations. The concentration of chromium in this sample exceeded only NH RCMP background soil concentrations. Hexavalent chromium was not detected in underlying soil in Area 6.

Area 7

A composite sample of underlying soil collected from borings advanced in Area 7 contained concentrations of VOCs, SVOCs, dioxins, and metals above laboratory detection limits (see Table 2-17). The concentrations of arsenic and chromium detected in this sample exceeded screening criteria or NH RCMP background soil concentrations. Hexavalent chromium was not detected in underlying soil in Area 7.

2.1.2 Summary of Data Evaluation

This section presents a summary of analytical data for site sludge/waste, overlying soil, and underlying soil.

2.1.2.1 Sludge/Waste

This section presents a summary of the sludge/waste data, focusing on compounds exceeding screening criteria. Table 2-19 presents a summary of compounds exceeding screening criteria in each disposal area.

Sludge/waste samples from all seven disposal areas contained contaminants exceeding project screening criteria. Area 5 samples only exceeded screening concentrations for metals. All other areas exceeded criteria for organic compounds and metals. Areas 1 and 4 also exceeded screening criteria for RCRA disposal analyses. The following text summarizes the exceedences, by analyte group.

VOCs

Four VOCs were detected in site sludge/waste at concentrations exceeding screening criteria. These VOC exceedences occurred in sludge from Areas 1, 2, 4, and 6. Carbon disulfide was the most prevalent, exceeding screening criteria in Areas 1, 2, and 4. The other compounds were detected above screening criteria in one area each: 2-butanone in Area 1; and 1,2-dichlorobenzene, 1,4-dichlorobenzene and chlorobenzene in Area 6.

SVOCs

Three polynuclear aromatic hydrocarbons (PAHs) and three phenols were detected in site sludge/waste at concentrations exceeding screening criteria. These SVOC exceedences occurred in sludge from all disposal areas except Area 5. The most prevalent compounds exceeding screening criteria were pentachlorophenol (Areas 1, 2, 3, 6, 7); 4-methylphenol (Areas 1, 2, 4, 7); and naphthalene (Areas 2, 3, 6). In addition, 2-methylnapthalene, phenol, and benzo(a)pyrene each exceeded criteria in one area (Areas 1, 2, and 7, respectively).

Pesticides/PCBs

Two pesticides and one PCB were detected in site sludge/waste at concentrations exceeding screening criteria. The two pesticide exceedances (aldrin and heptachlor epoxide) occurred in Area 2. The PCB exceedance (Aroclor-1242) occurred in Area 7.

Dioxins

The EPA Region IX PRG for 2,3,7,8-TCDD dioxins is 3.9 ng/kg. This value is used in the screening of contaminants of concern for human health risk assessments. However, current EPA policy recommends the use of 1 ppb (1000 ng/kg) as a cleanup goal for residential settings (USEPA, 1998a). Therefore, to provide a better indication of the extent of dioxins that may have to be addressed in a removal action, the policy-based cleanup goal of 1000 ng/kg was used for screening of dioxin TEQs. The EPA Region IX PRG was used only for screening of the individual dioxin compound 2,3,7,8-TCDD.

The screening criteria for dioxins TEQs was exceeded in sludge/waste samples from Areas 1, 2, 6, and 7. The screening criteria for 2,3,7,8-TCDD was exceeded in Areas 1, 2, 3, 6, and 7.

Metals

Sludge/waste samples from all disposal areas exceeded screening criteria for antimony, arsenic, and chromium (except in Area 5). In addition, manganese concentrations exceeded screening criteria in Areas 1, 4, and 7; thallium exceeded screening criteria in Areas 4, 6, and 7; barium exceeded screening criteria in Areas 6 and 7; vanadium exceeded screening criteria in Area 6; and cadmium, lead, and mercury exceeded screening criteria in Area 7. Hexavalent chromium was not detected at concentrations exceeding screening criteria in any sample from the site.

RCRA Parameters

TCLP criteria for VOCs, SVOCs and metals were not exceeded in any of the sludge/waste samples collected at the site during this or previous site investigations. However, a composite sludge sample and its field duplicate from Area 1 contained reactive sulfides at concentrations that may indicate the potential for classification as a RCRA hazardous waste. There are currently no federal numerical standards to determine exceedance of the RCRA reactivity characteristic. In the absence of a current standard, the interim level (500 mg/kg) contained in a July 1985 guidance withdrawn in April 1998 (USEPA, 1998b), was used to identify potential reactivity concerns. Reactive sulfide concentrations in the Area 1 sludge samples were 694 mg/kg and 663 mg/kg, indicating a potential reactivity concem.

One sludge sample from the site (from Area 4) failed the paint filter test, indicating the presence of free liquids in the sample and the potential need for dewatering or addition of bulking agents prior to final disposal. Additional paint filter testing would be conducted during the characterization of sludge/waste to make a final determination of the need for dewatering measures, but for the purposes of the EE/CA it is assumed that sludge/waste from Area 4 (and possibly from other Areas) may require dewatering prior to transportation and final disposal.

2.1.2.2 Overlying Soil

This section presents a summary of the overlying soil data, focusing on compounds exceeding screening criteria. Table 2-16 presents the overlying soils data.

Composite samples of overlying soil were collected from soil borings in each disposal area, with the exception of Area 1 (the open lagoon) and Area 5 (because no obvious sludge/tannery waste layer was present). No VOCs, SVOCs, pesticides, or PCBs were detected at levels exceeding screening criteria in overlying soil samples.

Relatively low concentrations of dioxins were detected in overlying soil from all disposal areas. Concentrations of 2,3,7,8-TCDD exceeded the Region IX PRG in the samples from Areas 2 and 6, but dioxin TEQ concentrations did not exceed the EPA guidance level of 1000 ng/kg (1 ppb) in any of the overlying soil samples collected from the site.

Several metals were detected in overlying soil samples at concentrations exceeding screening criteria. Concentrations of antimony and arsenic exceeded screening criteria in most samples of overlying soil. However, concentrations of arsenic did not exceed either the NH S-1 or the NH RCMP background soil concentrations. Based on the widespread detection of these metals at similar, relatively low levels in soil throughout the site, and the relatively low screening criteria concentrations, these metals may be attributed to background concentrations present throughout the area.

Concentrations of chromium (a typical tannery contaminant) exceeded NH S-1 screening criteria in overlying soil samples collected from Areas 2 and 4. Chromium concentrations in samples from the other disposal areas exceeded only NH RCMP background soil concentrations. Hexavalent chromium was detected only in the overlying soil sample collected from Area 6, and at a concentration lower than the screening criteria.

Overlying soil samples were collected from various depths depending on observations made during the advancement of sample borings. In Area 2, overlying soil samples were generally collected from the upper 4 feet of soil; in Area 3, samples were generally collected from the upper 2 to 4 feet of soil; in Area 4, from the upper 3 feet of soil; in Area 6, from the upper 5 feet of soil; and in Area 7, from the upper 2 feet of soil.

2.1.2.3 Underlying Soil

This section presents a summary of the underlying soil data, focusing on compounds exceeding screening criteria. Table 2-17 presents the underlying soils data.

Composite samples of underlying soil were collected from borings in each disposal area, with the exception of Area 1 (because refusal was reached before underlying soils were encountered) and Area 5 (because no obvious sludge/tannery waste layer was present). Underlying soils were collected from approximately the 2 feet of soil immediately beneath visually identified tannery sludge/waste in each boring. No VOCs, SVOCs, pesticides, PCBs, or dioxins were detected in underlying soil samples above screening criteria.

Arsenic was detected in all the underlying soil samples exceeding screening criteria. However, concentrations of arsenic were lower than NH S-1 standard and the NH RCMP background soil concentrations in all samples except the one from Area 2, which was slightly higher than the background screening concentration. Based on the widespread detection of arsenic at similar, relatively low levels, and the relatively low screening concentrations, the presence of arsenic may be attributed to background concentrations present throughout the area. Chromium exceeded the NH RCMP background soil concentration in Areas 6 and 7; however it did not exceed the EPA Region IX PRG or NH S-1 criteria for chromium.

2.1.3 Disposal Area Extent and Waste/Soil Volume

Qualitative analysis of test pit logs, observation boring logs, and a historical aerial photograph of the site were used in conjunction with a comparison of laboratory analytical data with screening criteria to estimate the horizontal and vertical extent of tannery waste and overlying soil in each disposal area. This approximation was used to formulate order-of-magnitude volume estimates of tannery sludge/waste and overlying soil that may require removal/treatment consideration in the EE/CA. Sections 2.1.3.1 and 2.1.3.2 present the volume estimation process and results for tannery sludge/waste and overlying soils, respectively. Section 2.1.3.3 explains why volume estimates were not made for underlying soils.

2.1.3.1 Tannery Sludge/Waste

The following sections provide a description of the estimated limits of tannery sludge/waste and preliminary volume estimates for each disposal area. Visual depictions of the estimated horizontal extent of waste are presented on Figures 2-1 through 2-3. A summary of estimated sludge/waste areas, thicknesses, and volumes is presented on Table 2-20.

Area 1

Observations made during advancement of borings in Area 1 indicate that the thickness of sludge in the lagoon is at least 10 to 12 feet. Manual borings advanced in this area reached refusal (probable till or bedrock) at depths of 10 to 12 feet, with no underlying soils recovered. In evaluating methods to estimate the depth of sludge in Area 1, nearby borings in Area 2 (former site of a second open lagoon) and information on depth to till and/or bedrock in nearby borings and monitoring wells were evaluated. It was determined that since reported bedrock depths in the immediate area vary considerably, it would be difficult to accurately project bedrock depths underlying Area 1, and to use this projected depth to estimate the bottom of sludge.

Therefore, in order to provide an estimated maximum sludge thickness in Area 1, it was assumed that the bottom elevations of the two lagoons (Areas 1 and 2) may have been similar, and the estimated bottom elevations of sludge in Area 2 borings were used to estimate the depth of sludge in the Area 1 lagoon. Borings advanced in Area 2 encountered underlying soil or bedrock at approximately 16 to 19 feet below ground surface (bgs) (elevation 109 to 113 feet above mean sea level [MSL]). Instrument survey data and field observations of water depth indicate that the elevation of the top of sludge in the Area 1 lagoon is approximately 128 feet above MSL (Figure 2-1). Based on this information, it is estimated that the average sludge thickness in Area 1 is approximately 17 feet.

The lateral extent of Area 1 sludge/waste was estimated based on field observations, boring logs, and a historical aerial photograph of the site taken while the facility was in operation (see photo in Appendix H, date unknown). The aerial photograph shows the footprint of the Area 1 lagoon to be considerably larger than the current footprint. The photo indicates that the lagoon extended farther east into the western side of Area 3. Borings and test pits in Area 3 confirm that sludge is present beneath the current eastern berm of Area 1 and indicate that the top of sludge beneath the berm is at approximately the same elevation as the top of sludge in Area 1. Based on these observations, it is assumed that the areal extent of sludge in Area 1 includes the sludge beneath the current eastern berm. The lateral extent of Area 1, including the westernmost portion of Area 3 (see Figure 2-1), is estimated to be 40,000 square feet (SF). Assuming an average sludge thickness of 17 feet, it is estimated that a volume of approximately 680,000 cubic feet (CF) of sludge is present in Area 1.

Area 2

The lateral extent of Area 2 sludge/waste was estimated based on boring and test pit logs and a historical aerial photograph of the site (Appendix H). The south and east limits of sludge in Area 2 were approximated using observations recorded during the excavation of TP-2-03, TP-2-12, TP-2-14, and TP-2-15, which indicated that tannery sludge was not present in these areas. The northeastern and western limits of Area 2 were estimated based on the aerial photograph and test pit and boring observations. The areal extent of sludge/waste in Area 2 is estimated to be 80,000 SF.

Test pit and boring logs indicate that sludge/waste thicknesses in Area 2 generally range from 6 to 13 feet. It is estimated that the average thickness of sludge in Area 2 is 10 feet. Based on these estimates, the estimated volume of sludge/waste in Area 2 is 800,000 CF.

Area 3

The lateral extent of Area 3 was estimated based on boring and test pit logs and a historical aerial photograph of the site (Appendix H). Field observations made during the excavation of test pits and advancement of observation borings in Area 3 delineated the approximate southern, northern, and eastern limits of sludge/waste. Test pits and soil borings advanced in the western part of Area 3 confirm that sludge/waste is present beneath the berm separating Area 3 from the Area 1 lagoon and the top of sludge beneath the berm is at approximately the same elevation as the top of sludge in Area 1. These observations and the historical aerial photo indicate that the sludge present beneath the berm is a continuation of the sludge in Area 1. Therefore the sludge/waste volume estimated for Area 3 excludes the sludge beneath the berm.

Based on these observations, the areal extent of sludge/waste in Area 3 is estimated to be 2,000 SF. Boring and test pit logs indicate that sludge/waste thicknesses in Area 3 range from 1 to 6 feet. Based on an assumed average thickness of 5 feet, it is estimated that 10,000 CF of sludge/waste is present in Area 3.

Area 4

Observations made during the excavation of test pits delineated the approximate limits of sludge in Area 4. The southern and western limits were delineated by test pits TP-4-1, TP-4-2, TP-4-5, TP-4-6, and TP-4-7. The horizontal extent of sludge is assumed to approach the base of the slope to the north and east of Area 4. The estimated areal extent of sludge in Area 4 is 3,000 SF.

Boring and test pit logs indicate that sludge/waste thicknesses in Area 4 range from approximately 5 to 9 feet. Based on an assumed average thickness of 9 feet, it is estimated that 27,000 CF of sludge is present in Area 4.

Area 5

No visual or olfactory evidence of tannery sludge was observed during the excavation of test pits or advancement of borings in Area 5. Possible indications of waste—consisting of black streaks, lenses of dark sand, and potentially stained soil—were observed within a matrix of poorly-graded fine sand.

Analytical data from samples collected from borings advanced in Area 5 reveal that only concentrations of antimony and arsenic exceeded screening criteria. Several contaminants that were typically detected in sludge samples at the site (sulfides, phenols, and PAHs) were not present above detection limits in Area 5 samples.

Although antimony and arsenic were detected in Area 5 at concentrations above screening criteria, the concentrations found were below the preliminary remediation goals developed for the site and discussed further in Section 3.3. As a result of the lack of visual and chemical confirmation of sludge/waste, no waste volume was included for Area 5.

Area 6

Observations made during the excavation of test pits and advancement of borings revealed that obvious evidence of tannery sludge is present at TP-6-03, TP-6-04, TP-6-05, TP-6-06, SL-601, and SL-602. Most other test pits and borings in Area 6 contained fill and/or waste layers consisting of small clusters of hair and hide, but no obvious sludge. Test pits TP-6-02 and TP-6-10 did not contain evidence of tannery waste. The estimated areal extent of sludge in Area 6 is 3,500 SF.

Boring and test pit logs indicate that sludge/waste thicknesses in Area 6 generally range from 4 to 7 feet. Based on an assumed average thickness of 5 feet, it is estimated that 17,500 CF of sludge/waste is present in Area 6.

Area 7

Observations made during the excavation of test pits and advancement of borings in Area 7 delineated the approximate northern and southern limits of sludge/waste. The eastern limit of the sludge/waste is assumed to approach the concrete retaining wall and base of hill southwest of the main facility building. The western limit of the sludge/waste is assumed to approach the top of the slope at the edge of Area 7. The areal extent of sludge/waste in Area 7 is estimated to be 8,000 SF.

Observations during test pit and soil boring advancement indicate that the presence and appearance of sludge/waste in Area 7 is not uniform across the area and is different than that observed in other areas. Observed wastes included scraps of hide, clumps of hair, black sludge, purple-black sludge, and purple cellulose-like material. At some borings sludge was present; however, many borings and test pits contained only miscellaneous waste and fill materials.

Boring and test pit logs indicate that sludge/waste thicknesses in Area 7 generally range from 5 to 13 feet. Based on an assumed thickness of 12 feet, it is estimated that 96,000 CF of sludge/waste is present in Area 7.

2.1.3.2 Overlying Soils

As presented in Section 2.1.2.2, overlying soils only exceeded screening criteria for metals. The organic compounds typical of sludge/wastes across the site were detected in overlying soils only sporadically, and at concentrations below screening criteria. Overlying soils exceeded screening criteria for antimony, arsenic, and chromium. With the exception of chromium, the presence of these metals may be attributed to background conditions. Although several metals were present at concentrations above screening criteria, the concentrations were below the preliminary remediation goals developed for the site and discussed further in Section 3.3. As a result of the lack of visual and chemical confirmation of sludge/waste, no waste volume was included for the overlying soil.

Regardless of whether the overlying soil will have to be addressed as waste, it would have to be removed to access the underlying sludge/waste. If the soil does not require removal and treatment or disposal as waste, it would be desirable to segregate the overlying soil from the sludge/waste during excavation to avoid the costs of disposing or treating these soils along with the sludge/waste. Therefore, the volume of overlying soil that could be practically segregated from the sludge/waste during excavation was estimated. Due to the limitations of standard excavation equipment, it was assumed that 1 foot of soil should remain as a buffer above the sludge/waste to ensure that the sludge/waste is not excavated and mixed into the overlying soils. Additionally, it was assumed that it was not practical to segregate overlying soils that were less than 2 feet thick.

To estimate the volume of overlying soil that could be practically segregated during excavation, the test pit and boring logs for each disposal area were evaluated and the average overlying soil thicknesses were estimated for each area. A 1-foot thickness was then subtracted from the averages to estimate the practical thickness for segregation. These thicknesses were then multiplied by the estimated area of sludge/waste in each disposal area, discussed above in Section 2.1.3.1. The following bullets summarize the overlying soil thickness evaluation.

- The thickness of overlying soils in Area 2 ranged from 3 to 6 feet and averaged approximately 4 feet. The practical thickness for segregation was therefore assumed to be 3 feet.

- The thickness of overlying soils in Area 3 ranged from 2 to 7 feet and averaged approximately 3 feet. The practical thickness for segregation was assumed to be 2 feet.

- The thickness of overlying soils in Area 4 ranged from 1 to 5 feet and averaged approximately 3 feet. The practical thickness for segregation was assumed to be 2 feet.

- The thickness of overlying soils in Area 6 ranged from 0 to 6 feet and averaged approximately 3 feet. The practical thickness for segregation was assumed to be 2 feet.

- The thickness of overlying soils in Area 7 ranged from 0 to 5 feet; however, in most locations the thickness was less than 2 feet. Because of the limitations of standard excavation equipment, it was concluded that it would not be practical to segregate the thin and discontinuous layer of overlying soils in this area.

Based on these thicknesses and the areas discussed in Section 2.1.3.1, the total volume of overlying soil at the site that can be practically segregated during excavation is estimated to be approximately 9,500 cubic yards. The results of the evaluation are presented on Table 2-20.

2.1.3.3 Underlying Soils

As presented in Section 2.1.2.3, underlying soils only exceeded screening criteria for arsenic, which may be present due to background conditions. The organic compounds typical of sludge/wastes across the site were detected in underlying soils only sporadically, and at concentrations below screening criteria. Additionally, the underlying soils are typically present at depths greater than 10 feet bgs, and therefore are not likely to be accessible for human exposure. As a result, these soils will likely not warrant treatment as waste during an NTCRA.

Because the underlying soils are unlikely to be considered as waste to be addressed during the NTCRA and they would not require excavation to access the sludge/waste present, no waste-soil volumes were estimated for the underlying soils.

2.1.4 Wetland Delineation

The wetland delineation performed at the site used the three parameter approach based on vegetation, soils, and hydrology described in the Corps of Engineers Wetlands Delineation Manual (COE Manual, Environmental Laboratory, 1987). This section presents the general approach and results of the wetland delineation survey.

2.1.4.1 Wetland Delineation Background

Except for certain "problem area" situations and other specific exceptions identified in the COE Manual, any area delineated as a wetland according to the COE Manual must display positive evidence of three characteristics:

- Hydrophytic vegetation
- Hydric soils
- Wetland hydrology

Hydrophytic Vegetation

Hydrophytic vegetation is defined in the COE Manual as the sum total of macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. Most common plant species in the United States have been assigned an indicator status based on empirical observation of their relative occurrence in wetlands and uplands. These include:

OBL (Obligate Wetland)	Plant species that occur almost always (estimated probability greater than 99 percent) in wetlands under natural conditions; however they may occur rarely (estimated probability less than 1 percent) in nonwetlands.
FACW (Facultative Wetland)	Plant species that occur usually (estimated probability 67 to 99 percent) in wetlands, but also occur (estimated probability 1 to 33 percent) in nonwetlands.
FAC (Facultative)	Plant species with a similar likelihood (estimated probability 33 to 67 percent) of occurring in both wetlands and nonwetlands.
FACU (Facultative Upland)	Plant species that occur sometimes (estimated probability 1 to 33 percent) in wetlands, but occur more often (estimated probability 67 to 99 percent) in nonwetlands.
UPL (Upland)	Plant species that occur rarely (estimated probability less than 1 percent) in wetlands, but occur almost always (estimated probability greater than 99 percent) in nonwetlands under natural conditions.

For some plant species, the indicator status is modified by adding a "+" or "-". A "+" means that the plant species is slightly more likely to occur in wetlands than suggested by its indicator status alone. A "-" means that the plant species is slightly less likely to occur in wetlands than suggested by its indicator status alone.

To document that an area supports hydrophytic vegetation according to the COE Manual, more than 50 percent of the dominant plant species in each vegetational stratum must have an indicator status of OBL, FACW or FAC (excluding FAC-). The COE Manual suggests the use of four strata: trees, saplings and shrubs, herbs, and woody vines. However, the COE has approved the use of a 5-stratum approach developed in another wetland delineation manual (FICWD, 1989). Under this alternative approach, used for the Mohawk Tannery site, the following five strata are recognized:

Trees	Woody plants greater than 5 inches in diameter at chest height.
Saplings	Woody plants less than 5 inches in diameter at chest height and greater than 20 feet in height.
Shrubs	Woody plants greater than 3 feet in height and less than 20 feet in height.
Herbs	Plants less than 3 feet in height.
Woody Vines	Woody vines climbing on trees in a forested area.

Vegetation in wetlands may display one or more morphological adaptations that assist in survival under saturated soil conditions. The COE Manual lists several such morphological adaptations, including buttressed (swollen) tree trunks, unusually shallow root systems, adventitious roots, and others. The hydrophytic vegetation parameter may be met if two or more dominant species display one or more of these adaptations, even if the vegetation is composed primarily of FACU or UPL species.

Hydric Soils

Hydric soil is defined in the COE Manual as soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. The National Technical Committee for Hydric Soils (NTCHS) has developed a list of soil series (soils having similar profile characteristics) that meet the definition of hydric soil (NTCHS, 1991). If soil profile data collected in a specific area can be matched to a recognized soil series, then its status as hydric can be determined by checking the NTCHS list.

Otherwise, a determination can be made based on the presence of one or more field indicators of hydric soil listed in the COE Manual. The most readily observable indicator is soil color. Soil colors are expressed in terms of hue, value, and chroma using a Munsell Soil Color Chart. Typically, soil colors with a chroma of 1 (regardless of hue and value) are indicative of hydric soils. Soils with a chroma of 2 that are also mottled (spotted) are generally hydric as well. Other readily observable indicators of hydric soils include a predominantly organic soil profile (histosols or mineral soils with histic epipedons), sulfidic material (rotten egg smell), or iron and manganese concretions (black or dark brown specks).

The New England Division of the US Army Corps of Engineers recognizes a number of additional field indicators of hydric soils specific to the New England region, which includes New Hampshire (NEIWPCC, 1998). These regional field indicators of hydric soil were considered as part of the wetland delineation of the Mohawk Tannery site wetlands.

Wetland Hydrology

Wetland hydrology is defined in the COE Manual as the sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation. Areas generally must be inundated or saturated for at least 5 percent of the growing season (in some cases 12.5 percent) during typical rainfall years for wetland hydrology, as defined in the COE Manual, to be present. The presence of wetland hydrology is usually determined through direct or indirect evidence of seasonal saturation or inundation. The COE Manual lists several other indicators of wetland hydrology that indirectly suggest that an area has wetland hydrology even though it may be dry at the time of observation. These include the presence of:

Watermarks	Lines on trees or other upright structures that represent the maximum static water level reached during an inundation event.
Drift Lines	Accumulations of debris along a contour that represents the height of an inundation event.
Sediment Deposits	Thin layers of mud or fine debris coating vegetation or the soil surface.
Drainage Patterns	Deposited debris or scoured leaf litter indicative of water flow patterns.

Other indicators of wetland hydrology are commonly recognized by wetland scientists even though they are not formally stated in the COE Manual. These include blackened leaf litter on the soil surface and the presence of oxidized rhizospheres (thin rust colored soil zones surrounding living plant roots). Although the presence of these indicators cannot be used as the sole basis for determining wetland hydrology, their presence can be noted as supplementary supporting information.

Field indicators of wetland hydrology, especially observation of inundation or saturation, must be viewed in the context of recent rainfall occurrences and seasonal water table fluctuations. For example, the presence of saturation during a seasonally wet time period or immediately following heavy rainfall cannot be used to conclude that wetland hydrology is present, and the absence of saturation during a seasonally dry period or following a drought cannot be used to conclude that wetland hydrology is absent.

2.1.4.2 Field Protocol

Preliminary reconnaissance of the Mohawk Tannery site revealed that the on-site wetlands cover less than 5 acres. Therefore, representative locations were selected on the upland and wetland sides of the suspected wetland boundary (in perpendicular transects) to confirm its accuracy, as outlined in Part IV, Section D, Subsection 2 of the COE Manual.

Observations at each selected representative location were documented using a data form developed by the New England Division of the US Army Corps of Engineers (Appendix I). Dominant plant species were recorded for lands surrounding each location (roughly a 30-foot radius circle, but not crossing the wetland boundary), together with their Indicator Status for Region I (which includes New Hampshire) according to Reed, 1988. Then a hole was dug with a soil auger and the soil profile (including the different textures, colors, and consistencies of the soil and the depths at which they occurred) were noted to a depth of approximately 15 to 20 inches (or auger refusal due to compacted or highly saturated soils). Any hydrologic indicators present in the area were noted.

The wetland/upland boundary was traversed and flagged with surveyor's flagging. The coordinates of each boundary flag were surveyed to submeter accuracy by using Global Positioning System (GPS) equipment (Trimble Navigation Pathfinder ProXR). The GPS results were used to create a wetland delineation drawing at a scale of 1 inch equals 60 feet (Figure 1-3, map pocket).

2.1.4.3 Wetland Delineation Results

The site consists of two contiguous properties: an approximately 15-acre developed parcel to the north and an approximately 15-acre undeveloped parcel to the south.

Northern Parcel

Background information and a site walkover indicated that any wetlands that may have been present in the developed area of the site would have been significantly disturbed during the tannery's operations. It could not be determined if "natural" wetlands were present prior to site disturbances from tannery operations. Most of the developed area along the Nashua River had been excavated to form settling ponds for tannery waste operations.

The Area 1 lagoon (Figure 1-3) was constructed in the 1960s and remains open, but has not been used or maintained as a settling pond since the Mohawk Tannery ceased operations in 1984. The lagoon is approximately 60 feet from the Nashua River at its closest point. Due to the standing water and vegetation present, the Area 1 lagoon was evaluated to determine whether it would be considered a jurisdictional wetland. After consultation with the COE and NHDES, it was determined that the lagoon is not considered a wetland, based primarily on the fact that the lagoon was part of a permitted treatment unit under the clean water act. (Field data forms and additional documentation [COE, 2002; NHDES, 2002] of the non-wetland determination for Area 1 are presented in Appendix I.)

Disposal Area 2 (the former lagoon that has been covered with soil fill) was evaluated and determined not to be a jurisdictional wetland. Several observation plots conducted in the area confirmed this conclusion, even though FACW vegetation (*Phragmites communis*) is present. Phragmites often colonize disturbed non-wetland areas. Hydric soils and wetland hydrology criteria were not met in Area 2. An approximate average of 4 feet of fill material has been placed over tannery sludge wastes in this area. A field data form for an example plot completed in Area 2 (Area 2 X (1-3)) and a figure showing observation plot locations are presented in Appendix I; .

<u>Southern Parcel</u>

Two wetland areas were delineated in the southern undeveloped parcel of land at the site. These wetlands are shown as Wetlands A and B on Figure 1-3. These wetlands were formed in alluvial deposits in slightly concave areas of the floodplains bordering the Nashua River. Wetland A was disturbed during the installation of a sewer line in the 1970s. These activities may have isolated Wetland B from a more extensive wetland system located to the southeast of this parcel. Field Data Forms and a figure showing wetland transect locations are presented in Appendix I.

2.1.5 Endangered/Threatened Species Evaluation

The United States Fish and Wildlife Service (FWS) and State of New Hampshire Department of Resources and Economic Development (Division of Forests and Lands) were contacted for the endangered/threatened species evaluation conducted for the site. The FWS did not identify any recorded occurrences of threatened or endangered species in the immediate vicinity of the site, with the exception of "occasional transient bald eagles". The FWS indicated that a biological assessment or any other further action under Section 7 of the Endangered Species Act would not be necessary, but the determination may be reconsidered if additional information were to become available (FWS, 2002).

The State of New Hampshire Division of Forests and Lands performed a search of the Natural Heritage Inventory (NHI) database and did not identify any recorded occurrences of sensitive species or natural communities in the immediate vicinity of the site. NHI noted, however, that since many areas of the state have not been surveyed, a negative result should not be interpreted as proof that no sensitive species are present (NHI, 2001).

2.1.6 Water Table Measurements and Inventory of Existing Wells

The table below provides a summary of monitoring well elevations and groundwater measurements collected during the topographic survey and existing well inventory, respectively (well locations are shown on Figure 1-3).

GROUNDWATER ELEVATION SUMMARY, OCTOBER 2001			
Monitoring Well Number	Elevation of Top of PVC Casing (feet above MSL)	Groundwater Depth[1] (feet below PVC)	Groundwater Elevation[2] (feet above MSL)
MW-GZ-1	190.41	69.61	120.80
MW-GZ-4	128.35	12.36	115.99
MW-GZ-6	130.90	14.20	116.70
MW-GZ-9	130.89	14.35	116.54
MW-GZ-10	125.57	7.75	117.82
MW-GZ-11	125.09	7.62	117.47

1. Groundwater depths measured from top of PVC casing
2. Elevations referenced to North American Vertical Datum (NAVD) 1988.
   MSL = Mean Sea Level PVC = Polyvinyl Chloride

Water table elevations, ground elevations, and sludge depths observed in site borings were used to estimate the volume of tannery sludge that is located below the water table. This information will be considered during the evaluation of excavation as an alternative for sludge removal. The evaluation indicates that sludge is currently located beneath the water table only in Areas 1 and 2. In these areas the groundwater elevation was estimated to range between 117 and 118 feet above MSL at the time of the monitoring well survey in October 2001. The estimated elevation of the bottom of sludge in Area 1 is 112 feet and the estimated elevation of the bottom of sludge in Area 2 ranges from 109 to 118 feet MSL. Therefore, based on October 2001 conditions, as much as 6 feet of sludge is estimated to be submerged in Area 1 and up to 9 feet of sludge in Area 2.

As the water table rises, additional (shallower) sludge in these areas, as well as sludge in other areas (particularly Area 3, where the bottom of sludge is estimated to be approximately 118 feet

MSL) will become submerged. The October 2001 conditions are believed to represent approximate seasonal low groundwater conditions.

2.1.7 Topographic/Land Surveying

As discussed in section 1.4.8, a topographic/land survey was conducted to verify the locations of important site features, spot-check the topographic contours, and identify selected sampling locations. The surveyed features are presented on Figure 1-2 and subsequent site figures. The results of the survey were compared with the base map provided by the City of Nashua, to verify site features and elevations. In general, the base map correlates well with the surveyed points. There are minor differences in elevation at some individual points, but overall the features and topographic contours on the base map appear to be a reasonable depiction of the features and topography of the site.

2.2 Site Geology, Hydrogeology, and Hydrology

This section presents a general characterization of site geology, hydrogeology, and hydrology.

2.2.1 Site Geology and Hydrogeology

This section presents a general description of the geologic and hydrogeologic features of the site. The discussion presented here is based on data and interpretations presented by GZA in their 1985 hydrogeological study and on data collected by TtNUS during field investigations performed in 2001.

Bedrock

Bedrock at the site is mapped as part of the Merrimack group of Silurian and Ordovician age, locally referred to as Merrimack schist (Billings, 1966). Observations made from bedrock cores collected at the site revealed it to be moderately to slightly weathered and moderately to highly fractured. GZA provided an interpretation of bedrock topography based on test borings and test pits performed in 1985. Bedrock elevations at the site were generally observed to decrease in a southerly direction along a ridge spanning from Area 4 to south of Area 2 (GZA, 1985).

In reference to ground surface, bedrock was encountered at approximately 8 feet bgs in test boring GZ-4, approximately 30 feet bgs in test boring GZ-6, approximately 40 feet bgs in test boring GZ-7, approximately 31 feet bgs in test boring GZ-9, and at approximately 37 feet bgs in test boring GZ-12 (refer to Figure 1-3 for boring/well locations) (GZA, 1985). TtNUS encountered bedrock in Area 2 at approximately 18 feet bgs during advancement of boring SL-201 and at approximately 22 feet bgs during advancement of boring SL-203 (TtNUS, 2002).

Overburden Geology

Three major types of natural overburden deposits are present at the site—lacustrine delta deposits, glacial till, and alluvial terrace deposits. Present soil conditions result primarily from the modification of topography by glacial action and river erosion and subsequent deposition. Site development activities, including the excavation of soil and placement of fill comprised of tannery wastes or granular soil, have altered surface and subsurface conditions throughout the site (GZA, 1985).

Most of the thickness of overburden material at the site consists of Pleistocene epoch stratified, sandy, lacustrine delta deposits. The thickness of this deposit ranges from 0 feet (absent) near the Nashua River to approximately 80 feet at GZ-1 on the east border of the site. Lacustrine delta deposits generally consisted of medium dense, silty fine sand and fine to medium sand.

Boring logs compiled by GZA in 1985 indicate that till was generally encountered directly above bedrock in the western portion of the site along the Nashua River (Areas 1 and 2). Observed thickness of till was between 1 and 13 feet.

Alluvial deposits of the Holocene epoch were observed overlying glacial till, delta deposits, or bedrock along the western portion of the site. Alluvial deposits generally consisted of stratified, fine to medium sand with varying amounts of silt. Alluvial deposits were encountered primarily below the groundwater table.

Hydrogeology

As discussed in Section 2.1.6, groundwater depths ranged between 7 and 14 feet bgs in monitoring wells located in the vicinity of Areas 1 and 2, and approximately 70 feet bgs in the eastern portion of the site adjacent to Warsaw Avenue during the TtNUS field investigation in September 2001 (TtNUS, 2002). GZA collected groundwater depth measurements subsequent to the installation of monitoring wells in 1985 and observed similar depths to groundwater. GZA inferred from groundwater elevations that the direction of groundwater flow on the site was generally towards the west or southwest (GZA, 1985). Groundwater level measurements collected by TtNUS generally supported this conclusion.

GZA estimated the hydraulic conductivity of subsurface material at the site using in-situ field testing methods. Hydraulic conductivity was estimated by evacuating water from, or introducing water into, a well and monitoring the rate at which groundwater levels returned to their original level. Using this conductivity data, hydraulic gradients estimated from groundwater level measurements, and an estimate of soil porosity, GZA estimated the groundwater flow velocity through overburden material to be between 1 and 125 feet/year (GZA, 1985).

Groundwater beneath the site is not used as drinking water. According to the EPA Approval Memorandum (Appendix A), residents in the vicinity of the site are supplied with municipal water by the Pennichuck Water Company. The majority of residents within 4 miles of the site obtain their drinking water from municipal water supplies located greater than 4 miles from the site. Two residential wells approximately 30 feet deep are reported to be located approximately one half mile southeast of the site. These wells were sampled by NHDES for volatile organic compounds and metals in October 1994. No evidence of contamination related to the site was identified.

2.2.2 Floodplain

The 100-year flood elevation of the Nashua River in the area of the site was determined to be 131.7 feet MSL based on the National Geodetic Vertical Datum (NGVD) 1929. This flood elevation was determined based on Flood Insurance Rate Map panel number 5 of 10, community panel number 330097-0005B, with an effective date of June 15, 1979. This elevation was converted to North American Vertical Datum (NAVD) 1988 for consistency with the site base map. The 100-year flood elevation in the vicinity of the site was determined to be 131 feet MSL based on NAVD 1988.

Topographic surveying conducted in October 2001 confirmed that the majority of Area 2 and most of the southern parcel is located within the 100-year floodplain of the Nashua River (Figure 1-3). The Area 1 Lagoon was determined not to be within the 100-year floodplain due to the elevation of the berm that has been constructed around its perimeter. The top elevation of the berm is approximately 136.5 feet MSL. If the berm was ever breached during a major flood event, then the contents of the lagoon, which are located below the 100-year flood elevation (at approximately 130 feet MSL), could be affected.

2.2.3 Nashua River

The Nashua River flows from north to south along the western border of the site. Two dams in the vicinity of the site, the Mines Falls Dam upstream and Jackson Falls Dam downstream, control the stream discharge past the site (GZA, 1985b). The confluence of the Nashua and Merrimack Rivers is located approximately 3.5 miles downstream of the site. Both rivers are contiguous to wetlands and are characterized as fisheries.

2.3 Contaminant Fate and Transport

As described in Section 2.1, a variety of contaminants including VOCs, SVOCs, pesticides, PCBs, dioxins, and metals were detected in tannery sludge/waste in all disposal areas except Area 5, where no evidence of sludge was detected. Additionally, relatively low concentrations of dioxins and metals were detected in surface soils in Areas 2 through 7. This section describes the major mechanisms of contaminant transport in environmental media at the site.

Potential Migration of Contaminated Sludge in Areas 1 and 2 in Event of Flooding

Most of Area 2 is situated within the 100-year floodplain of the Nashua River. In the event of a flood, the area would be submerged under flood waters and the cover soils may be eroded exposing highly contaminated sludge to the flood waters. Contaminants in the soils and sludge would be subject to erosion and transport into the Nashua River. Contaminants would likely deposit in the river sediments near the site or be transported further downstream.

The Area 1 Lagoon was determined not to be within the 100-year floodplain because the berm around its perimeter is higher than the 100-year flood elevation. However, if the berm was ever breached, then the contents of the lagoon would be subject to erosion and transport into the Nashua River during a major flood event.

Migration of Contaminants in Surface Soils by Erosion

Contaminants located at the surface of Areas 3 through 7 are subject to erosion through precipitation and surface runoff. Areas 3 through 7 are situated on a hillside, that slopes down to the floodplain of the Nashua River. Areas 1 and 2 and a wetland (at the border of the northern and southern parcels of the site) are situated on the nearly level land at the bottom of the hillside. Contaminants in surficial materials in Areas 3 through 7 may migrate through precipitation runoff overland to the floodplain and wetland, and ultimately to the river.

Contaminant Leaching to Groundwater

The results of groundwater sampling conducted by NHDES in May of 2001 indicate the presence of several contaminants in groundwater that were also detected in the tannery sludge/waste. Because the sludge/waste at the site is subjected to precipitation and portions are buried beneath the water table, organic chemicals and metals are likely being leached from the waste/sludge into the underlying groundwater. Although there is limited information regarding the hydrogeology of the site, groundwater is interpreted to flow generally west or southwest across the site and discharge to the Nashua River. Therefore, contaminants that leach from the sludge/waste may ultimately discharge to the Nashua River through the groundwater.

2.4 Streamlined Human Health Risk Evaluation

A streamlined human health risk evaluation was performed to identify the risk to humans from soil and sludge at the site. The assessment is focused on the soil and sludge to support selection of removal actions under the NTCRA. The purpose of a streamlined risk evaluation is to evaluate the exposure scenarios associated with the media of concern that could pose the greatest potential risks. Other media (surface water, groundwater, air, etc.) that may have been impacted by past operations and waste disposal practices at the tannery will be evaluated during the remedial investigation of the site. A full Human Health Risk Assessment, which is typically performed as a part of a remedial investigation, would evaluate risk to all receptors interacting with all site media. Section 2.4.1 provides an overview of the site. Section 2.4.2 contains a discussion of the selection of contaminants of potential concern (COPCs) and exposure point concentrations (EPCs). Section 2.4.3 contains information on the potential receptors considered and the routes by which they might be exposed. Section 2.4.4 contains a discussion of toxicity factors used and the potential adverse effects of site contaminants. Section 2.4.5 contains the numerical results of the risk characterization. Finally, Section 2.4.6 presents uncertainties associated with this risk evaluation.

2.4.1 Overview of the Exposure Areas

The site encompasses seven disposal areas within the developed portion of the formerly industrial site. Around the time of the tannery's closure the property was re-zoned as residential to help facilitate future development of the site. A detailed description of the site is provided in Section 1.2 of this EE/CA. A characterization of the contamination detected within the disposal areas at the site is discussed in Section 2.1.

Table 2-21 presents the potential exposure points included in this human health risk evaluation and the receptors and exposure pathways considered. The two most likely risk receptor populations for the site based on its current abandoned condition and potential future development are adolescent trespassers and residents. These groups were evaluated for exposure to soil and sludge from on-site disposal areas. Three different exposure areas were defined based on physical features of the site, the data available from disposal areas, and the persons expected to access them. These exposure areas included surface sludge from Area 1 (an open lagoon), surface soil and sludge from Areas 2 through 7, and soil and sludge from 0 to 10 feet below ground surface (bgs) from Areas 1 through 7.

2.4.2 Data Evaluation

Data evaluation is an exposure area-specific task that uses a variety of information to determine which of the detected chemicals in a dataset are most likely to present a risk to potential receptors. The end result of this qualitative selection process is a list of contaminants of potential concern (COPCs) and representative exposure point concentrations for each dataset.

2.4.2.1 Selection of Contaminants of Potential Concern

Tables 2-22.1 through 2-22.3 present summaries of the COPC selection process for quantitative risk evaluation for Area 1 surface sludge, Areas 2 through 7 surface soil and sludge, and Areas 1 through 7 soil and sludge from depths of 0 to 10 feet bgs, respectively. All validated analytical data collected during the EE/CA field investigation were used to identify COPCs. Site data were divided into three datasets based on the identified exposure areas and scenarios. The datasets are described in the following bullets. Appendix J presents listings of sample locations included in each dataset.

- The Surface Sludge Area 1 dataset represents samples taken from the surface of the sludge in the open lagoon down to a depth of 10 to 12 feet bgs (where refusal was encountered). All samples in this dataset are composite samples extending from the surface of the lagoon to the bottom of the sludge recovered in an individual boring.

- The Surface Soil and Sludge Areas 2 through 7 dataset includes all soil and sludge samples from these areas which originate at the surface of the disposal area. The samples in this dataset represent the range of conditions found in Areas 2 through 7, including area-composite samples of a distinct soil fill layer above the sludge, such as that found in the overlying soil composite samples from Areas 2, 3, 4, 6, and 7; composite samples of soil, sludge, and debris all intermixed as found in samples from two borings in Areas 6 and 7; and composite samples of soil beginning at the surface and extending deeper than 12 feet bgs from borings in Area 5, where no visible or chemical evidence of sludge/waste was found. Most samples in this dataset are composite samples that extend below 2 feet bgs with one sample extending to 20 feet bgs.
- The All Soil and Sludge Areas 1 through 7 ("all soil") dataset is the most inclusive. This dataset includes all samples obtained from Areas 1 through 7 that begin at a depth between 0 and 10 feet bgs. Accordingly, this dataset includes all samples from both of the previous (surface) datasets as well as any additional samples from Areas 1 through 7 that began below the surface, but at a depth of less than 10 feet bgs. Many of the samples in this dataset are composites that extend to depths greater than 10 feet bgs.

The site is zoned for residential land-use; therefore, COPCs were identified by comparison of Site data to screening criteria based on EPA Region IX PRGs for residential soil exposures. These values were developed using the current EPA Region IX PRG Table (USEPA, 2000d), which identifies concentrations of potential concern for nearly 600 chemicals in various media (air, drinking water, and soil) using certain reasonable maximum exposure default assumptions. Region IX PRGs for carcinogens were taken directly from the Region IX PRG table. These PRGs are based on cancer risk levels of 1.0E-06. Region IX PRGs for non-carcinogens are based on a hazard quotient (HQ) of 1.0. The HQ is the ratio of an estimated dose to an established "safe" dose (the Reference Dose). In a risk assessment, HQs from multiple contaminants are added together to produce the total site hazard index (HI). Two or more contaminants present at or slightly below concentrations corresponding to their reference dose could yield a total site HI greater than the target HI of 1.0. If these contaminants act on the same target organ, adverse effects may occur. By setting the screening criteria at a concentration that would result in a dose that is one-tenth of the "safe" reference dose, the COPC selection protects against overlooking the presence of multiple contaminants that may produce additive effects. For this reason, Region IX non-carcinogenic PRGs were adjusted to COPC screening levels based on a target HQ of 0.1, which is one-tenth of the suggested cumulative target noncarcinogenic risk for a potential receptor. Screening values for non-carcinogenic contaminants whose Region IX PRGs are based on ceilings or soil saturation limits are adjusted to one tenth of the risk-based PRG developed prior to the application of ceiling or saturation limits.

The following chemicals were identified as COPCs based on a comparison of maximum site concentrations to risk-based COPC screening levels for residential land use:

- Semi-Volatile Organics (SVOCs): 1,4-dichlorobenzene, 4-methylphenol, and pentachlorophenol;

- Polynuclear Aromatic Hydrocarbons (PAHs): benzo(a)pyrene, 2-methylnaphthalene, and naphthalene;

- Polychlorinated Biphenyls (PCBs): Aroclor 1242;

- Metals: antimony, arsenic, barium, cadmium, chromium, lead, manganese, mercury, thallium, and vanadium;

- Dioxins.

Data evaluation and subsequent risk estimates for dioxins were evaluated through use of dioxin toxicity equivalents (TEQs). The Toxicity Equivalent Factors (TEFs), presented in Appendix J, were used to convert concentrations of individual dioxin and furan congeners to TEQs of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Concentrations of individual dioxins and furans were multiplied by their TEFs to yield 2,3,7,8-TCDD equivalent concentrations. These values were then totaled to yield total dioxin TEQs for each sample. These concentrations could then be compared to the screening toxicity value for 2,3,7,8-TCDD in the COPC selection step. *In computing the dioxin TEQs for each sample, non-detected values were treated as one-half of* the detection limit for those specific dioxin congeners that were positively detected in one or more samples within a data subset. One-half of the detection limit for non-detected dioxin results were included along with positive results in the TEQ summation for each sample.

Aluminum, cobalt, copper, and iron were not identified as COPCs because EPA Region I does not advocate quantitative risk assessment of the health effects of these metals because of the lack of adequate toxicity criteria.

Essential nutrients, including calcium, magnesium, potassium, and sodium, were not selected as COPCs.

Samples were analyzed both for total chromium and hexavalent chromium (chromium VI). Chromium VI was not detected in any sludge samples and in the two instances where it was detected at low concentrations in soil at the site (in Areas 5 and 6) the results were below chromium VI screening criteria. As a result, total chromium concentrations detected at the site were screened against trivalent chromium (chromium III) criteria. Chromium III was identified as a COPC based on comparison of maximum total chromium concentrations to chromium III screening values. Evaluation of risks from exposure to chromium were performed using chromium III toxicity values.

In general, similar contaminants were selected in each exposure area; however, the list of COPCs selected for Areas 1 through 7 "all soil" to a depth of 10 feet bgs was most inclusive.

2.4.2.2 Exposure Point Concentrations

Tables 2-23.1 through 2-23.3 present EPCs for quantitative risk evaluation for Area 1 surface sludge, Areas 2 through 7 surface soil and sludge, and Areas 1 through 7 soil and sludge from depths of 0 to 10 feet bgs, respectively. Current EPA risk assessment guidance (USEPA, 1992 and 1994b) was used to identify appropriate EPCs. When a sufficient number of samples were available, 95 percent upper concentration limits (UCLs) of the arithmetic mean were used as EPCs in estimating chemical intakes.

The methodology used for estimating the 95 percent UCL depends on the distribution of the sample set. For this risk evaluation, the distribution was determined using the Shapiro-Wilk W-Test (Gilbert, 1987). When the results of the test were inconclusive and the distribution was regarded as undefined, the distribution was assumed to be log normal and the 95 percent UCL for log-normally distributed data sets was selected as the EPC.

For normally distributed data, the calculation of the UCL is a two-step process. First the standard deviation of the sample set must be determined, as follows:

$$S = \left[\frac{\Sigma(X_i - \bar{X})^2}{(n-1)}\right]^{1/2}$$

where:

S	=	standard deviation
X_i	=	individual sample value
n	=	number of samples
$\bar{X}$	=	mean sample value

The one-sided UCL on the mean is then calculated as follows:

$$UCL = \bar{X} + t\left(\frac{S}{n^{1/2}}\right)$$

where:

UCL	=	95 percent Upper confidence limit of the mean
$\bar{X}$	=	Arithmetic average
t	=	One-sided t distribution factor ($t_{0.95}$)
S	=	standard deviation
n	=	number of samples

For log-normally distributed data sets, the UCL is calculated using the following equation:

$$UCL = \exp\left(\bar{X} + 0.5s^2 + \frac{Hs}{(n-1)^{1/2}}\right)$$

where:

UCL	=	95 percent UCL of the mean
exp	=	Constant (base of the natural log, e)
$\bar{X}$	=	Mean of the transformed data
S	=	Standard deviation of the transformed data
H	=	H-statistic (from Gilbert, 1987; $H_{0.95}$)
n	=	Number of samples

This equation uses individual sample results that have been transformed by taking the natural logarithm of the results.

In data sets with 10 samples or less and data sets in which the calculated 95 percent UCL exceeded the maximum detected concentration, the maximum detected concentration was used as the EPC. EPCs used in the risk assessment are presented in Tables 2-23.1 through 2-23.3 and appear to the left in risk summary tables, Tables 2-25.1 through 2-25.3 and 2-26.1 through 2-26.3.

2.4.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the site and identifies the exposure input parameters used to estimate exposure intakes and risks. A summary of the potentially significant exposures identified for quantitative evaluation for the site is provided in Table 2-21. Tables 2-24.1 through 2-24.3 present exposure parameters and exposure factor equations that incorporate exposure parameters into a single factor for use in determining chemical intake. These exposure factor equations and parameters also appear at the bottom of Tables 2-25.1 through 2-25.3 and Tables 2-26.1 through 2-26.3. The various assumptions used as input parameters to determine chemical intakes for each potential receptor and exposure route are discussed below.

The exposure assessment is based on the assumption that chemical compositions for environmental media are identical under current and future site conditions. Under current/future conditions, potential human receptors (adolescent trespassers) are assumed to be exposed to surface soil/sludge. As stated previously, the surface dataset includes any sample with a top depth of 0 feet bgs. Under future conditions, potential human receptors (residents) are assumed to be exposed to soil/sludge from a depth of 0 to 10 feet bgs ("all soil"). The "all soil" dataset includes any sample with a top depth of less than 10 feet bgs.

2.4.3.1 Potential Receptors

This evaluation quantifies risks to adolescent trespassers and to hypothetical future residents as identified in Table 2-21.

2.4.3.2 Adolescent Trespassers

Possible exposures of adolescent trespassers to site-related contaminants would be through recreational activities, such as walking, dirt biking, or exploring the edges of the open lagoon. Adolescent trespassers are evaluated for exposure to surficial soil/sludge at each of two exposure points, under current and future land use. Adolescent trespassers at Area 1 are assumed to contact surface sludge from the open lagoon while exploring the edge of the lagoon. Trespassers walking and dirt biking in drier areas of the site are expected to contact surface soil/sludge from Areas 2 through 7.

The trespasser is identified as an adolescent aged 9 through 18 years. The trespasser is exposed to site media primarily through incidental ingestion and dermal contact with soil and sludge. Exposure parameters including skin surface areas, body weights, and soil-to-skin adherence factors are shown on Tables 2-24.1 and 2-24.2 and in the exposure factor equations on the risk summary tables, Tables 2-25.1 and 2-25.2a and Tables 2-26.1 and 2-26.2a. Trespassers are assumed to be exposed to site media 26 days/year, corresponding to 1 day/week for 6 months of the year from May to October. These receptors are assumed to ingest an average of 100 mg/day. Feet, hands, forearms, and lower legs are expected to be available for dermal contact with soil/sludge. The soil-to-skin adherence value for trespassers in Area 1 was selected based on the 95th percentile for children playing in mud. The soil-to-skin adherence value for trespassers in Areas 2 through 7 was selected based on the 95th percentile for children playing in dry soil.

For trespassers exposed to soil/sludge from Areas 2 through 7, inhalation of fugitive dust during dirt biking activity was considered as a potential pathway. Inhalation pathway assumptions and equations are shown on Table 2-24.2. The inhalation rate for adolescents was set at 1.2 m^3/hr, occurring over 4 hours/day of exposure. The default particulate emission factor of 1.32E+9 m^3/kg was selected.

2.4.3.3 Residents

Possible exposures of hypothetical future residents to site-related contaminants would be through play and yard work at their homes. Residents are evaluated for exposure to surficial soil/sludge from any of the dry areas of the site (Areas 2 through 7) under future land use. In addition, residents are also evaluated for exposure to "all soil"/sludge from Areas 1 through 7 under future land use. This scenario assumes that soil and sludge currently located in any area of the site, from any depth between 0 to 10 feet bgs, may be brought to the surface during construction of homes on the site. It is assumed that the open lagoon in Area 1 has been covered with soil and the sludge has dried and may be brought to the surface and mixed with the cover soil.

Hypothetical future residents (ages 1 to 31 years) may be exposed to site media primarily through incidental ingestion and dermal contact with soil and sludge. Exposure through inhalation of dust was not considered a major exposure pathway for future residents because it is assumed that future grass cover would prevent significant dust. Future residents are assumed to be exposed to site media frequently (150 days/year). This exposure frequency is the EPA Region I default exposure frequency for residents and is based on the assumption that residential soil exposures in New England are limited to the warmer months of the year when the ground surface is neither frozen nor snow-covered. For noncancer risks, the 1 to 7-year old child is considered the most sensitive receptor and therefore is the receptor of concem. Residential receptors are assumed to ingest an average of 200 mg/day for 6 years for the child and 100 mg/day for 24 years for the adult. For children, head, hands, forearms, lower legs, and feet are expected to be available for dermal contact with soil. For adults, head, hands, forearms, and lower legs are expected to be available for dermal contact with soil. Soil-to-skin adherence factors (SSAFs) were selected based on EPA's recommended default values for residents. The adult SSAF is based on the 50^{th} percentile value for gardening, a high-end activity. The child SSAF is based on the 50^{th} percentile for children playing in wet soil, a high-end activity. Exposure assumptions, including ingestion rates, exposure frequencies, skin surface areas, body weights, soil-to-skin adherence factors, etc. are shown on Table 2-24.3 and in the exposure factor equations on the risk summary tables, Tables 2-25.2b and 2-25.3 and Tables 2-26.2b and 2-26.3. The exposure assumptions shown on Table 2-24.3 apply to residents exposed either to surface soil/sludge from any of the dry areas of the site (Areas 2 through 7) or to "all soil"/sludge from Areas 1 through 7.

2.4.3.4 Exposure Pathways

The primary routes of exposure for potential human receptors are incidental ingestion of and dermal contact with soil and sludge. Inhalation of fugitive dust was also considered for adolescent trespassers engaged in dirt-biking activity.

2.4.3.5 Chemical Intake

Estimates of chemical intake are calculated by multiplying EPCs by the exposure factor for the route of exposure. Chemical intakes are not presented separately, but are incorporated in the hazard index and cancer risk equations presented in Tables 2-25.1 through 2-25.3 and Tables 2-26.1 through 2-26.3.

2.4.4 *Toxicity Assessment*

The toxicity assessment for the COPCs examines information concerning the potential human health effects of exposure to COPCs. The toxicity values presented in this section are integrated with the exposure assessment (Section 2.4.3) to characterize the potential for the occurrence of adverse health effects (Section 2.4.5).

Brief summaries of the toxicity profiles for the major COPCs are presented in Section 2.4.4.3

2.4.4.1 Noncarcinogenic Effects

The potential for noncarcinogenic health effects resulting from exposure to chemicals is assessed by comparing an exposure estimate (intake or dose) to a Reference Dose (RfD). The RfD is expressed in units of mg/kg/day and represents a daily intake of contaminant per kilogram of body weight that is not sufficient to cause the threshold effect of concern. A RfD is specific to the chemical, the route of exposure, and the duration over which the exposure occurs.

EPA is the primary source of information for Reference Dose values (USEPA, 1997b; USEPA, 2000c; USEPA, 2002). EPA's IRIS (Integrated Risk Information System) database (USEPA, 2002) was consulted as the primary source for RfD values, as well as for Cancer Slope Factors (CSFs). If values are not available in IRIS, the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b) were consulted, as well as the current Region IX EPA PRGs Table (USEPA, 2000d). Oral RfDs available from EPA sources represent administered toxicity values. Administered Reference Doses for the COPCs at the site are presented in Tables 2-25.1 through 2-25.3.

An absorbed RfD is developed by multiplying an administered RfD by the gastrointestinal tract absorption factor. The resulting absorbed RfD is used to evaluate dermal exposures and oral exposures when a reliable oral soil absorption factor is known. Absorbed RfDs and the absorption efficiencies used in their determination are included in Tables 2-25.1 through 2-25.3.

Inhalation RfDs are based on a conversion of Inhalation Reference Concentrations, available from the IRIS database. Inhalation RfDs for the COPCs at the site are presented in Table 2-25.2a.

PCB non-cancer risk characterization is addressed by evaluation of Aroclor 1242 concentrations, using the oral RfD for Aroclor 1254 since no RfD is available for Aroclor 1242. Aroclor 1242 was the only aroclor detected at concentrations exceeding screening criteria.

In the absence of significant concentrations of hexavalent chromium as determined by comparison of detected hexavalent chromium concentrations to respective screening values, evaluation of risks from exposure to total chromium concentrations were performed using chromium III toxicity values.

2.4.4.2 Carcinogenic Effects

The Cancer Slope Factor (CSF) is the toxicity value used to quantitatively express the carcinogenic hazard of cancer-causing chemicals. Slope factors are specific to a chemical and route of exposure and are expressed in units of $(mg/kg/day)^{-1}$. The primary source of information for CSFs is the EPA IRIS database, followed by other EPA sources described for non-carcinogens. Oral CSFs available from these EPA sources represent administered toxicity values. These administered CSFs for COPCs at the site are presented in Tables 2-26.1 through 2-26.3.

Absorbed CSFs are derived from the corresponding administered values. In the derivation of an absorbed CSF, the administered CSF is divided by the gastrointestinal absorption efficiency. Absorbed CSFs are used to evaluate dermal exposures and oral exposures when a reliable oral soil absorption factor is known. Absorbed CSFs and the absorption efficiencies used in their determination are also included in Tables 2-26.1 through 2-26.3.

Inhalation CSFs are based on a conversion of Inhalation Unit Risks, available from the IRIS database. Inhalation RfDs for the COPCs at the site are presented in Table 2-26.2a.

Risk estimates for dioxins were evaluated through the use of dioxin TEQs as described in Section 2.4.2.1. Dioxin TEQs were used in conjunction with the toxicity value for 2,3,7,8-TCDD in determining cancer risk.

PCB cancer risk characterization is addressed by evaluation of Aroclor 1242 concentrations only. This was the only aroclor detected at concentrations exceeding screening criteria. Aroclor 1254 was also detected, but at concentrations below the screening value.

2.4.4.3 Toxicity Summaries for Major Chemicals of Potential Concern

This section contains brief summaries of the toxicological profiles for the major COPCs.

Dioxins

The term "dioxin" refers to a group of 30 chemical compounds that share chemical structure and similar biological mechanisms of action (USEPA, 2000c). These compounds are members of three closely related families of chemicals: the chlorinated dibenzo-p-dioxins (CDDs), chlorinated dibenzofurans (CDFs), and certain polychlorinated biphenyls (PCBs). Dioxins are produced through combustion, chlorine bleaching of pulp and paper, certain types of chemical manufacturing and processing, and other industrial processes. PCBs were widely used as coolants and lubricants in electrical equipment before their manufacture in the United States was ended in 1977.

Dioxins are potent animal toxicants with a potential to produce a broad spectrum of adverse effects in humans. Dioxins can alter the fundamental growth and development of cells in ways that have the potential to lead to many kinds of impacts, including adverse effects upon reproduction and development; suppression of the immune system; chloracne (a severe acne-like condition that sometimes persists for many years); and cancer. The most studied and one of the most toxic dioxins is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). EPA characterizes 2,3,7,8-TCDD as a "human carcinogen" based on evidence of animal and human studies and characterizes other dioxins as "likely human carcinogens". 2,3,7,8-TCDD is used as the basis for defining the toxicity of other dioxins.

Dioxins enter the ecological food web by being deposited from the atmosphere, either directly from air-emissions or indirectly by processes that return dioxins already in the environment to the atmosphere. Dioxins are highly persistent in the environment and can accumulate in the tissues of animals.

Antimony

Acute intoxication from ingestion of large doses of antimony induces gastrointestinal (GI) disturbances, dehydration, and cardiac effects in humans. Chronic effects from occupational exposure include irritation of the respiratory tract, pneumoconiosis, eruptions of the skin called "antimony spots," allergic contact dermatitis, and cardiac effects, including abnormalities of the electrocardiograph (ECG) and myocardial changes. Cardiac effects were also observed in rats and rabbits exposed by inhalation for six weeks and in animals (dogs, and possibly other species) treated by intravenous injection .

The EPA published a RfD for chronic oral exposure to antimony from a lifetime study of rats. The heart is considered a likely target organ for chronic oral exposure of humans.

Arsenic

Inorganic arsenic is a human poison. Organic arsenic is less harmful. High levels of inorganic arsenic in food or water can be fatal. Arsenic damages many tissues including nerves, stomach and intestines, and skin. Breathing high levels can cause a sore throat and irritated lungs. Lower levels of exposure to inorganic arsenic may cause nausea, vomiting, diarrhea, decreased production of red and white blood cells, abnormal heart rhythm, blood vessel damage, and a "pins and needles" sensation in hands and feet.

Long term exposure to inorganic arsenic may lead to a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Direct skin contact may cause redness and swelling.

The U.S. Department of Health and Human Services (DHHS) has determined that arsenic is a known carcinogen. Breathing inorganic arsenic increases the risk of lung cancer. Ingesting inorganic arsenic increases the risk of skin cancer and tumors of the bladder, kidney, liver, and lung.

Chromium

Animal studies show that hexavalent chromium (chromium VI) is generally more toxic than trivalent chromium (chromium III), but neither oxidation state is very toxic by the oral route. The respiratory and dermal toxicity of chromium are well-documented. Compounds of both chromium VI and chromium III have induced developmental effects in experimental animals that include neural tube defects, malformations, and fetal deaths.

The inhalation of chromium compounds has been associated with the development of cancer in workers in the chromate industry. The relative risk for developing lung cancer has been calculated to be as much as 30 times that of controls. There is also evidence for an increased risk of developing nasal, pharyngeal, and gastrointestinal carcinomas. Based on sufficient evidence for humans and animals, chromium VI has been placed in the EPA weight-of-evidence classification A, human carcinogen. Chromium III is not classified as a carcinogen by EPA.

Lead

Unborn children and young children are particularly sensitive to the adverse effects of exposure to lead. Exposure to a fetus through its' mother may cause premature births, lower birth weight, and decreased mental ability of the infant. Lead exposure is dangerous for young children because they absorb lead at a greater rate than adults, retain more of the lead they ingest, and are more sensitive to its effects. Effects include decreased intelligence and decreased growth. EPA has classified lead as a B2 carcinogen based on the results of animal studies.

Manganese

Manganese is an essential trace element in humans that can elicit a variety of serious toxic responses upon prolonged exposure to elevated concentrations either orally or by inhalation. The central nervous system is the primary target. Initial symptoms are headache, insomnia, disorientation, anxiety, lethargy, and memory loss. These symptoms progress with continued exposure and eventually include motor disturbances, tremors, and difficulty in walking, symptoms similar to those seen with Parkinsonism. These motor difficulties are often irreversible.

Effects on reproduction (decreased fertility, impotence) have been observed in humans with inhalation exposure and in animals with oral exposure at the same or similar doses that initiate the central nervous system effects. An increased incidence of coughs, colds, dyspnea during exercise, bronchitis, and altered lung ventilatory parameters have also been seen in humans and animals with inhalation exposure.

4-Methylphenol (p-Cresol)

Three types of closely related cresols exist: ortho-cresol (o-cresol), meta-cresol (m-cresol), and para-cresol (p-cresol), also known as 4-methylphenol. Because these three types of cresols are manufactured separately and as mixtures, they can be found both separately and together. Cresols are natural products that are present in many foods and in animal and human urine. They are also present in wood and tobacco smoke, crude oil, and coal tar. In addition, cresols also are man-made and used as disinfectants and deodorizers, to dissolve substances, and as starting chemicals for making other chemicals.

Ingesting very high levels of cresols may result in a burning in the mouth and throat as well as stomach pains. Dermal contact with a substance containing high cresol levels may result in a rash or severe irritation. In some cases, a severe chemical burn might result. Through contact with high levels of cresols, for example, by drinking or spilling on the skin, one could experience anemia, kidney problems, unconsciousness, or even death.

It is possible that some of the acute effects in humans listed above, such as kidney problems and anemia, might occur at lower levels if exposure occurs over a longer time period. Effects on the nervous system, such as loss of coordination and twitching of muscles, are produced by low levels of cresols in animals, but it is not known whether low levels also cause such effects in humans. Cresols may enhance the ability of carcinogenic chemicals to produce tumors in animals, and they have some ability to interact with mammalian genetic material in the test tube, but they have not been shown to produce cancer in humans or animals. The EPA has determined that cresols are possible human carcinogens. Animal studies suggest that cresols probably would not produce birth defects or affect reproduction in humans.

Pentachlorophenol (PeCP)

PeCP is a man-made substance, made from other chemicals, and does not occur naturally in the environment. It is made by only one company in the United States. At one time, it was one of the most widely used biocides in the United States. Now the purchase and use of PeCPs are restricted to certified applicators. It is no longer available to the general public. Before use restrictions, PeCP was widely used as a wood preservative. It is now used industrially as a wood preservative for power line poles, cross arms, fence posts, and the like.

Short exposures to large amounts of pentachlorophenol in the workplace or through the misuse of products that contain it can cause harmful effects on the liver, kidneys, blood, lungs, nervous system, immune system, and gastrointestinal tract. Contact with PeCP (particularly in the form of a hot vapor) can irritate the skin, eyes, and mouth. If large enough amounts enter the body, heat is produced causing an increase in body temperature. The body temperature can increase to dangerous levels, causing injury to various organs and tissues and even death. This effect is the result of exposure to PeCP itself and not impurities. The lengths of exposure and the levels that cause harmful effects have not been well defined. Long-term exposure to low levels such as those that occur in the workplace can cause damage to the liver, kidneys, blood, and nervous system. Because sufficient reliable human exposure information is not currently available, levels of exposure that affect human health must be estimated from studies in animals. Results from animal studies show that short-term, high-level exposure to PeCP can damage all the organs mentioned above. The major organs or systems affected by long-term exposure to low levels in animals are the liver, kidney, nervous system, and the immune system. All of these effects worsen as the level of exposure increases.

In rats, slight changes in the formation of bones were seen in offspring of rats whose mothers were given PeCP orally. It is not known whether PeCP causes birth defects in humans. PeCP has also been shown to cause a decrease in the number of offspring born to animals that were exposed to it while they were pregnant, but it is not known if PeCP has this same effect in humans. An increased risk of cancer has been shown in some laboratory animals given long-term large amounts of PeCP orally, but there is no good evidence that PeCP causes cancer in humans.

The EPA has determined that PeCP is a probable human carcinogen. The classification is based on inadequate human data and sufficient evidence of carcinogenicity in animals: statistically significant increases in the incidences of multiple biologically significant tumor types (hepatocellular adenomas and carcinomas, adrenal medulla pheochromocytomas and malignant pheochromocytomas, and/or hemangiosarcomas and hemangiomas) in one or both sexes of B6C3F1 mice using two different preparations of PeCP. In addition, a high incidence of two uncommon tumors (adrenal medulla pheochromocytomas and hemangiomas/hemangiosarcomas) was observed with both preparations. This classification is supported by mutagenicity data, which provides some indication that PeCP has clastogenic potential.

Polyaromatic Hydrocarbons (PAHs)

Benzo(a)pyrene is the most widely studied chemical in this class. It is used as the basis for defining the toxicity of other potentially carcinogenic PAHs. Benzo(a)pyrene is widely distributed in the tissues of treated rats and mice but is primarily found in tissues high in fat. While the carcinogenicity of complex mixtures containing PAHs (such as coal tar, coke oven emissions, and cigarette smoke) is suggested, the carcinogenicity cannot be attributed solely to PAHs. The carcinogenicity of benzo(a)pyrene is based largely on the results of animal studies in which the animals were exposed to large doses of purified compound via atypical routes of exposure.

2.4.5 Risk Characterization

A summary of the quantitative risk evaluation for the site is provided in this section. Total noncarcinogenic hazard indices for each exposure route, as well as the cumulative hazard index, are presented in Tables 2-25.1 through 2-25.3. Total carcinogenic risks for each exposure route, as well as the cumulative risk, are presented in Tables 2-26.1 through 2-26.3. Table 2-27 presents the total health hazards and cancer risks for all scenarios.

- The estimated hazard index for residents exposed to surface soil/sludge from Areas 2 through 7 is 13.1. The estimated hazard index for residents exposed to "all soil"/sludge from Areas 1 through 7 is 72.4. Both of these scenarios exceed a total hazard index of 1.0, the threshold for potential non-carcinogenic effects and the EPA target level of concern. Prime contributors to the hazard index are antimony, chromium, manganese, and 4-methylphenol which each, individually, have hazard quotients exceeding 1.0.

- The estimated hazard index for trespassers in Area 1 is 42.5, due primarily to 4-methylphenol. The hazard quotient for antimony also exceeds 1.0 in this scenario.

- The estimated hazard index for trespassers in Area 2 through 7 is 0.35. This value is less than the EPA target level of concern of 1.0.

- The cancer risk estimate for residents exposed to surface soil/sludge from Areas 2 through 7 is 9.5E-05, within EPAs target cancer risk range of 1E-04 to 1E-06. The cancer risk estimate for residents exposed to "all soil"/sludge from Areas 1 through 7 is 1.9E-04. This cancer risk estimate exceeds EPAs target cancer risk range of 1E-04 to 1E-06, due primarily to dioxin. The cancer risk estimates for pentachlorophenol, arsenic, and benzo(a)pyrene also exceed 1E-06 in this scenario. Benzo(a)pyrene was detected only in a very localized area of the site, in one sample from Area 7. It does not appear to be a site-wide concern.

- The cancer risk estimate for trespassers in Area 1 is 1.9E-03. This cancer risk estimate exceeds EPAs target cancer risk range of 1E-04 to 1E-06, due primarily to dioxin and pentachlorophenol. The cancer risk estimate for arsenic also exceeds 1E-06 in this scenario.

- The cancer risk estimate for trespassers in Area 2 through 7 is 5E-06. This cancer risk estimate falls within EPAs target cancer risk range of 1E-04 to 1E-06.

Since lead cannot be evaluated using hazard index and/or cancer risk methodology, a qualitative comparison of site data to EPA's Office of Solid Waste and Emergency Response (OSWER) soil screening level of 400 mg/kg for residential land use (USEPA, 1994a) was performed. The EPA's Integrated Exposure Uptake and Biokinetic (IEUBK) model, which estimates the risk to a child resident is the basis for this soil screening level. Lead concentrations exceeding 400 mg/kg are found in only one sample, collected from Area 7. The maximum detected lead concentration is 427 mg/kg.

2.4.6 Uncertainties

Uncertainties associated with the various aspects of this risk evaluation include the following:

- The limited number of samples within each exposure point subgroup results in the use of maximum detected concentrations for all evaluations of exposures to surface materials. In addition, the limited number of samples in the "all soil" dataset resulted in the use of maximum concentrations for several contaminants.

- The use of composite samples collected from several locations or a large depth interval may under-estimate or over-estimate actual risks. Since composite samples represent an average concentration over the sampling interval, this can lead to under-estimating the risk presented by a discrete and more highly contaminated zone located within the sampling interval or over-estimating the risks presented by a discrete and less contaminated zone located within the sampling interval.

- Selection of high-end exposure parameters may overestimate actual exposures.

- Toxicity values based on animal studies introduce a degree of uncertainty to the risk characterization process.

- Use of the currently available dioxin cancer slope factor from IRIS (USEPA, 2002) may underestimate risks from dioxin exposure. EPA has recently prepared a Draft Dioxin Reassessment, which recommends a dioxin CSF of 1.0E+6. Appendix K presents the cancer risks for the Mohawk Tannery Site using this proposed dioxin CSF. Cancer risks estimated using this draft approach are approximately an order of magnitude greater than risks calculated using the current dioxin CSF.

2.5 Streamlined Ecological Risk Evaluation

The evaluation for the Mohawk Tannery Site was performed as a Screening-Level Ecological Risk Assessment (SERA), in order to satisfy the needs of the project and to comply with Region I U.S. EPA Guidance. The goal of the evaluation and the SERA is to estimate the current level of risk to ecological receptors, using conservative screening values and exposure assumptions. This is being done to determine what contaminants at the site may merit removal for protection of the environment.

The SERA provides the first two of eight steps required by the U.S. EPA guidance (USEPA, 1997a and 1998c). Figure 2-4 presents the Ecological Risk Assessment (ERA) Tiered Approach. The first two steps consist of the screening-level assessment. Steps 3 through 7 are conducted if additional evaluations or investigations are necessary based on the results of the first two steps. Finally, Step 8, Risk Management, is incorporated throughout the ERA process, in cooperation with the EPA Region I Biological Technical Assistance Group (BTAG).

2.5.1 Ecological Risk Assessment Approach

The first phase in the ERA process is the screening-level risk assessment. In this phase, conservative exposure estimates are made for grouped or individual ecological receptors, and these exposures are compared to screening-levels, or threshold toxicity values. The following general steps were followed for the SERA:

- Problem formulation
- Exposure Assessment
- Ecological Effects Assessment
- Risk Characterization

The process, described in detail below, follows the ERA approach in EPA guidance (USEPA, 1997a and 1998c).

2.5.2 Problem Formulation

Problem formulation is the first phase of a SERA and discusses the goals, breadth, and focus of the assessment. It includes general descriptions of the site with emphasis on habitats and ecological receptors. This phase also involves characterization of site contaminants, contaminant sources, migration pathways, and an evaluation of routes of contaminant exposure. Assessment and measurement endpoints are selected. Finally, a conceptual model is developed that describes how contaminants associated with the site may come into contact with ecological receptors. The following sections provide the problem formulation steps for the Mohawk Tannery site.

2.5.2.1 Site Characterization

The objectives of this step are to identify and characterize the habitats and ecological resources on and around the site, and to describe the nature and extent of chemical contamination associated with the site. The site characterization also describes likely contaminant sources, release mechanisms, and migration pathways, and the fate of chemicals resulting from site-related activities, as well as ecological resources that could be adversely affected by these chemicals.

Regional Setting

The site includes real property of the inactive Mohawk Tannery, located about 1 mile west of the center of Nashua, New Hampshire, and adjacent to the Nashua River (Figure 1-2). The property includes a 15-acre parcel containing buildings and waste disposal areas and a 15-acre parcel to the south that is not developed. All of the samples discussed in the assessment were taken in the developed parcel to the north (Figure 1-3).

The site is surrounded by the Nashua River to the west, a closed landfill to the north, and residential areas to the south and east. The main buildings are in the eastern portion of the site, where the elevation is highest. Waste disposal areas are located along the slope down to the river, which is steep in some areas and eventually becomes more level on the river's floodplain. Areas 3 through 7 are situated along the hillside, while Areas 1 and 2 are on nearly level ground near the river. The floodplain is very narrow on the northern end of the property where the river runs by a steep hill, and more broad at the southern end. The undeveloped, southern 15-acre parcel appears to be predominately floodplain, including some wetland areas.

Vegetative Cover Types

Vegetation and wildlife were noted during TtNUS' sampling events and on a brief site visit in January, 2002. Each sampling area is described below in reverse order (Area 7 to Area 1), that is roughly the sequence from east to west and from higher to lower elevation (Figure 1-3). Area

7 is southwest of, and adjacent to, the main building and is bordered to the east and south by mature oak-hickory woods. Area 7 has small cherry, aspen, and ash trees scattered among herbaceous growth and a large amount of debris, such as piping, wood, and electronic components. Area 6 is covered with demolished buildings and treatment system components and with much concrete remaining among scattered herbs. Area 5 abuts the hillside to the north of the property and, together with Area 4, shows the lowest level of disturbance among the areas. It is covered by oak, white pine, aspen, sumac, cherry, ash, and large herbs. The trees approach 20 to 25 feet in height. Area 4 is down slope from Area 5 and partially in the river's floodplain. It contains oak, ash, red maple, and cherry. The hillside north of Areas 4 and 5 (beyond the fence line) is covered by large hardwoods with a lesser number of pine trees.

Area 3 contains an old field assemblage of aspen, white pine, cherry, birch, oak, sumac, and large herbs, similar to the other upland areas. Area 2 is flat and in the floodplain; it is surrounded by the common reed (*Phragmites*), with some birch and red maple. The common reed is typically seen as a monoculture, like it is in Area 2, in low-lying areas that have been disturbed. About 50 percent of Area 1 is an open lagoon with surface water and the other half is covered by reed. It is the only area containing sludge from tannery waste treatment that has not been covered with soil. The water is about 1 foot deep.

The Preliminary Ecological Risk Evaluation for the Mohawk Tannery (Lockheed Martin) lists rare plants within 0.25 to 4 miles of the site, based on information in the Final Site Inspection Prioritization Report (NHDES, 1996). Given the level of disturbance on the site, especially in areas likely to contain contaminants, it is unlikely that rare plants are currently being harmed by site chemicals.

Wildlife Habitat

The upland part of the site is used by red-tailed hawks, crows, bluejays, and other songbirds. Sightings or signs were made of white-tailed deer, woodchuck, raccoon, beaver, rabbit, and rodent-sized mammals. Although likely to be domestic, cat and dog sign or sightings were also noted. The lagoon (Area 1) has had painted turtles, bull frogs, green frogs, mallards, and Canada geese.

The Nashua River is an important component of regional wildlife habitat. It is a large waterway, about 160 feet wide where it abuts the site. Mallards were observed during the January site visit. The river is likely to be important for migrating waterfowl as well as permanent residents. An aerial photograph of the site vicinity shows a continuous matrix of forests, wetlands, and parkland along the river. It seems likely that these natural (or at least uninhabited) lands form a corridor of wildlife habitat that would support local and migratory populations of birds, mammals, and other animals. Also, the river is stocked with shad and alewife, and its tributaries are stocked with trout (Lockheed Martin). The river is known to support yellow perch, sunfish, and largemouth bass.

2.5.2.2 Toxicity Profiles

VOCs, SVOCs, pesticides and PCBs, dioxins, and metals were detected in one or more of the sampled media (soil, sediment, and surface water). The following sections present a brief discussion regarding the toxicity, potential food chain and trophic transfer, and fate and transport properties of each class of contaminants.

Tables 2-28 through 2-30 present statistics for detected analytes. These tables are presented for the media sampled: surface soils (data for Areas 2 through 7 combined), sediment/sludge (Area 1), and surface water (Area 1).

Physical and chemical characteristics of contaminants may affect their mobility, transport, and bioavailability in the environment. These characteristics include bioconcentration factors (BCFs), biota-to-sediment accumulation factors (BSAFs), organic carbon partition coefficients, and octanol water partition coefficients. These factors are discussed in the following subsections, as necessary. The following paragraphs discuss the significance of each factor. The sections that follow present a discussion of each chemical class that was detected in each medium.

Bioconcentration factors measure the tendency for a chemical to partition from the water column and concentrate in aquatic organisms. The BCF is the equilibrium concentration of a chemical in an organism divided by the concentration of the chemical in water. Chemicals with high BCFs can accumulate in lower-order species and become toxic to, or accumulate further in, species higher up the food chain.

Biota-sediment accumulation factors (BSAFs) can be used to predict contaminant concentrations in fish or invertebrate tissue from contaminant concentrations in sediment. BSAFs for the organic compounds can be obtained from The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1: National Sediment Quality Survey (USEPA, 1997c). BSAFs for inorganic chemicals in fish are not available.

The organic carbon partition coefficient (K_{oc}) measures the tendency for a chemical to partition between soil or sediment particles containing organic carbon and water. This coefficient is important because it determines how strongly an organic chemical will bind to the organic carbon in the sediment. Bound chemicals are likely to be unavailable for direct exposure.

The octanol/water partition coefficient (K_{ow}) is the ratio of a chemical concentration in octanol divided by the concentration in water. The octanol/water partition coefficient has been shown to correlate well with bioconcentration factors in aquatic organisms and with adsorption to soil or sediment (i.e., with K_{oc}).

Metals

Many metals are found naturally in the surface water, sediment, and/or soil due primarily to chemical weathering of rock and soil/sediment and fallout from volcanoes. Most metals are toxic to aquatic (i.e., fish, and invertebrates) and terrestrial (i.e., plants, invertebrates, and vertebrates) ecological receptors at certain concentrations, with some metals being more toxic at lower concentrations than others. Also, different chemical forms of the metals may be more toxic than other forms. For example, hexavalent chromium is typically more toxic than trivalent chromium, and methylmercury is more toxic than inorganic mercury. In addition, the toxicity of several metals (cadmium, chromium, copper, lead, nickel, silver, and zinc) to aquatic receptors in freshwater systems decreases with increasing water hardness.

Only a portion of the total bulk concentration of metals in soils is bioavailable to ecological receptors. The uptake and accumulation of trace elements by plants are affected by several soil factors such as pH, Eh, clay content, organic matter content, cation exchange capacity, nutrient balance, concentration of other trace elements in soil, soil moisture, and temperature (Tarradellas et al., 1996). This makes the bioavailability of metals in soil very difficult to predict.

Many of these same factors also will influence the bioavailability of metals to invertebrates in sediment.

Of the 29 elements essential for plant growth, seven are micronutrients, including copper, iron, manganese, and zinc (Tarradellas et al., 1996). Also, the following metals may stimulate plant growth but are only essential for some plant species: aluminum, cobalt, nickel, sodium, selenium, and vanadium (Tarradellas et al., 1996). Finally, some elements such as lead, cadmium, and mercury are toxic elements with no known function in plant metabolism (Tarradellas et al., 1996).

Oak Ridge National Laboratory (ORNL, 1998) has calculated soil-to-plant uptake factors for several metals based on a compilation of various studies. Soil to plant uptake factors for some metals that are not listed in ORNL 1998 are listed in ORNL (2000). Cadmium, mercury, selenium, and zinc were the only metals (except for calcium and potassium) with mean uptake factors greater than one (1.02 to 2.25). Arsenic, cadmium, mercury, nickel, selenium, and zinc were the only metals (except for calcium, magnesium, and potassium) with upper 90th percentile uptake factors greater than one (1.1 to 5) (ORNL, 1998). This indicates that most metals will not biomagnify in plants. Finally, it is reported that for arsenic, copper, nickel, and zinc, the plant-based food chain may be protected because the toxic concentrations of these metals in plants are higher than those for animals, while cadmium and selenium are not toxic to plants at high concentrations and may be accumulated in plants at levels that may be toxic to animals (Cockerham and Shane, 1994). Other metals such as lead, cobalt and mercury can enter the food chain via plant uptake, but to a lesser extent (Cockerham and Shane, 1994).

Cadmium appears to accumulate in most species of earthworms at greater levels than any other metal (Satchell, 1983). This is supported by the high mean soil-to-earthworm uptake factor of 17 for cadmium, compared to mean uptake factors of 5.7 (zinc), 5.2 (mercury), 4.5 (silver), and 3.3 (lead) (Sample et al., 1998). The remaining metals (except potassium, sodium, and some radionuclides) had mean uptake factors below 1.8 (Sample et al., 1998). Cadmium, mercury, nickel, silver, and zinc are the only metals with median uptake factors greater than one (Sample et al., 1998). The upper 90th percentile uptake factors were 40.7, 20.6, 15.3, and 12.9 for cadmium, mercury, silver, and zinc (Sample et al., 1998). The remaining metals had upper 90th percentile uptake factors of 4.7 or less. Chromium is not accumulated in earthworms; chromium concentrations in worm are similar to soil concentrations (Sample et al., 1998).

Semivolatile Organic Compounds

Phenolic compound, a few PAHs, and some phthalates make up the SVOCs that were detected in the surface water, sediment, and surface soil samples from the site

The phenolic compounds found at the Mohawk Tannery site include phenol, 2,4,5-trichlorophenol, 4-methylphenol, and pentachlorophenol. Phenol is highly mobile in the environment and is expected to biodegrade rapidly under favorable conditions for microbes (HSDB, 2002). Favorable conditions include appropriate substrate concentrations and the availability of microbial populations, nutrients, and suitable temperatures. 4-Methylphenol has similar characteristics, but it has a higher K_{oc} and therefore may be retained to a small extent in soil and sediment. Both phenol and 4-methylphenol do not bioaccumulate. In contrast, pentachlorophenol is expected to bind to sediment and soil, biodegrade slowly, and accumulate in the biota. Trichlorophenol is expected to have fate and transport characteristics that are intermediate between phenol and pentachlorophenol.

PAHs are a diverse group of compounds consisting of two or more substituted and unsubstituted polycyclic aromatic rings. PAHs are transferred from surface water by volatilization and sorption to settling particles. The compounds are transformed in surface water by photooxidation, chemical oxidation, and microbial metabolism (ATSDR, 1989a). In soil and sediments, microbial metabolism is the major process for degradation of PAHs (ATSDR, 1989a). Although PAHs accumulate in terrestrial and aquatic plants, many organisms are able to metabolize and eliminate these compounds. Vertebrates can readily metabolize PAHs, but lower forms (insects and worms) can not metabolize PAHs as quickly. Food chain uptake does not appear to be a major exposure source to PAHs for aquatic animals (ATSDR, 1989a).

Plants and vegetables can absorb PAHs from soil through their roots and translocate them to other plant parts such as developing shoots (Eisler, 1987). In general, however, PAHs are not readily taken up by plants because these compounds are strongly adsorbed onto soil organic particles and root uptake is very inefficient (Donker, et al., 1994). Lower molecular weight PAHs (which would be more water soluble) are absorbed by plants more readily than higher molecular weight PAHs. This is indicated by the low (well below 1.0) soil-to-plant uptake factors, which were calculated using the K_{OW} for the contaminants (ORNL, 2000). Finally, many higher plants can catabolize benzo(a)pyrene and possibly other PAHs (Eisler, 1987).

PAHs vary substantially in their toxicity to aquatic organisms. In general, toxicity increases as molecular weight increases, with the exception of some high molecular weight PAHs that have low acute toxicity. Most species of aquatic organisms rapidly accumulate PAHs from low concentrations in the ambient medium. However, uptake of PAHs is highly species specific, it is higher in algae, mollusks, and other species that are incapable of metabolizing PAHs (Eisler, 1987). The ability of fish to metabolize PAHs may explain why benzo(a)pyrene is frequently not detected or is found at only very low levels in fish from environments heavily contaminated with PAHs (ATSDR, 1989a). The BSAF value for the PAHs as reported by EPA (USEPA, 1997c) was 0.29.

Phthalates are compounds that are used in production of plastics (ATSDR, 1993). Most phthalates are expected to sorb to soil or sediment particles after their release because of their high Log K_{OC} values (Howard, 1989). Some phthalates may bioconcentrate in aquatic organisms (Spectrum Laboratories, 1999; Howard, 1989; ATSDR, 1993).

Pesticides

The majority of the pesticides that were detected at the site include the organochlorine insecticides such as DDT, chlordane, aldrin, dieldrin, heptachlor, and endrin and their associated breakdown products. In general, these compounds degrade very slowly and tend to be soluble in lipids, which results in bioaccumulation and possible increases in concentrations through food webs (Newman, 1998).

Pesticides are used to control pestiferous invertebrates and, therefore, they are toxic to many soil and aquatic invertebrates. In addition, many pesticides are toxic to higher trophic level ecological receptors such as mammals and birds. For example, DDT compounds have been linked to eggshell thinning and subsequent decreased survival of several birds of prey (such as eagles and falcons). Other pesticides such as chlordanes, dieldrin, aldrin, endrin, and heptachlor also are very toxic to mammals and birds (Newell et al., 1987).

Chlorinated pesticides have high Log K_{OC} values so they are expected to sorb strongly to soil and sediment particles when released to the environment. Consequently, these compounds are not easily displaced from their site of application, whether by runoff or leaching to groundwater.

As a result, these compounds typically will not be taken up by plants as indicated by their soil-to-plant uptake factors, which are well below 1.0 (ORNL, 2000).

PCBs

PCBs are a group of compounds that consist of two joined benzene rings and up to 10 chlorine atoms. Mixtures of PCB congeners are known by their commercial designation of Aroclor. This trade name is followed by a four-digit number; the first two numbers indicate the type of isomer mixture and the last two numbers indicate the approximate weight percent of chlorine in the mixture (USEPA, 1985).

PCBs released into water adsorb to sediments and other organic matter. Typically, PCB concentrations are greater in the sediment and suspended material than in the water column. Substantial quantities of PCBs in aquatic sediments can act as an environmental reservoir from which PCBs may be released slowly over a long period of time (ATSDR, 1989d). For PCBs that exist in the dissolved state in water, volatilization becomes the primary fate process. PCBs have the capability to bioaccumulate and biomagnify (USEPA, 1985).

Degradation of PCBs in the environment is dependent upon the degree of chlorination. Generally, the more chlorinated the PCB molecule, the more persistent it will be in the environment. Factors that determine biodegradability include the amount of chlorination, concentration, type of microbial population, available nutrients, and the temperature (ATSDR, 1989d).

PCBs are expected to be highly immobile in the soil due to rapid and strong sorption (ATSDR, 1989d). Some data indicate that plants are capable of taking up PCBs and transferring them into polar metabolites or insoluble molecules (Donker et al., 1994). However, it is unlikely that uptake and transformation of these compounds occur to any great extent, because a large part (greater than 95 percent) will adsorb to the root surface (Donker et al., 1994). The soil-to-plant uptake factors for PCBs on a wet weight basis range from 0.00059 to 0.11 (ORNL, 2000). The transfer of vapor-phase PCBs from air to aerial plant parts may be the main source of vegetation contamination (ATSDR, 1989d).

Because PCBs are highly lipophilic (fat soluble), they can bioaccumulate in the fat of animal tissues. Bioconcentration factors in the thousands have been reported for various aquatic species (Eisler, 1986a). PCBs also can accumulate in upper trophic level animals such as piscivorous birds and mammals that feed on contaminated prey (Eisler, 1986a). Finally, Sample et al. (1998) calculated mean, median, and 90th percentile reported soil-to-earthworm bioaccumulation factors (BAF) of 8.9, 6.7 and 15.9, respectively, indicating the PCBs can accumulate in soil invertebrates.

Adverse effects of PCBs on terrestrial wildlife include increased mortality, reproductive effects, and behavioral effects (USEPA, 1985). As a group, birds are more resistant to acute toxic effects of PCBs than mammals (Eisler, 1986a). Among sensitive avian species, PCBs disrupt the normal pattern of growth, reproduction, metabolism, and behavior (Eisler, 1986a). Of the mammals, the mink is the most sensitive wildlife species tested for which data are available (Eisler, 1986a). Impacts to mink include anorexia, weight loss, lethargy, reproductive effects, and death (Eisler, 1986a).

Volatile Organic Compounds

VOCs are usually very mobile in the environment because they are poorly adsorbed to soil and sediment particles. Also, because they are very volatile, they typically are only detected in surface waters and surface soils at low concentrations.

Most VOCs have very little potential to bioaccumulate in ecological receptors; therefore, biomagnification through the food chain does not appear to be significant. VOCs are not expected to biomagnify in plants and are typically only toxic to ecological receptors only at relatively high concentrations.

Dioxins

Dioxins and dioxin-like compounds consist of the following chemical classes: polychlorinated dibenzo-p-dioxins (PCDDs or CDDs), polychlorinated dibenzofurans (PCDFs of CDFs), polybrominated dibenzodioxins (PBDDs or BDDs), polybrominated dibenzofurans (PBDFs or BDFs), and PCBs (USEPA, 1998d). The CDDs and BDDs each include 75 individual compounds, and the CDFs BDFs each include 135 different compounds (USEPA, 1998d). Of all these compounds, only 7 of the 75 congeners of CDDs or BDDs are thought to have dioxin-like toxicity, as are 10 of the 135 congeners of CDFs, or BDFs (USEPA, 1998d). These are the ones with chlorine/bromine substitutions in, at least, the 2, 3, 7, and 8 positions (USEPA, 1998d). Of the 209 PCB congeners, 13 are thought to have dioxin-like toxicity, which include the PCBs with four or more chlorine atoms with just one or no substitution in the ortho position (USEPA, 1998d).

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is the most toxic congener within these groups of compounds (Van den Berg et al., 1998). There are few toxicity data for dioxins except for 2,3,7,8-TCDD, which has been associated with lethal, carcinogenic, teratogenic, reproductive, mutagenic, histopathologic, and immunotoxic effects (Eisler, 1986b). Because of this, toxicity equivalency factors (TEFs) have been developed to estimate the relative toxicity of the dioxin and dioxin-like compounds to 2,3,7,8-TCDD (Van den Berg et al., 1998). There are substantial inter- and intraspecific differences in sensitivity and toxic responses to 2,3,7,8-TCDD (Eisler, 1986b).

Two species of earthworms showed no adverse effects at soil concentrations of 5 mg/kg; however, they died at 10 mg/kg of 2,3,7,8-TCDD (Eisler, 1986b). This indicates that terrestrial invertebrates may be resistant to 2,3,7,8-TCDD. Eisler (1986b) also reported that aquatic invertebrates, plants, and amphibians were comparatively resistant to 2,3,7,8-TCDD; however, accumulation from the aquatic environment was evident.

Although there presently is no evidence of biomagnification of PCDDs in birds, it is suspected that piscivorous birds have a greater potential to accumulate PCDDs than the fish that they eat (Eisler, 1986b).

2.5.2.3 Identification of Exposure Pathways and Potential Receptors

The potential pathways by which ecological receptors may be exposed to contaminants in each media were identified along with the species that could be adversely affected by these chemicals. Several potential exposure pathways may exist at the site as shown in the conceptual site model (Figure 2-5).

Conceptual Site Model

The sources of contamination at the site are presumed to be a result of releases from the former tanning and wastewater treatment operations at the site. A more detailed description of the processes leading to releases is in discussed Section 1.2.2. The contaminants were primarily collected in sludge formed during wastewater treatment, and disposed in soil pits that are now Areas 3 through 7. Other areas received releases directly from the wastewater handling system and potentially from other waste handling practices. Area 1 is a former wastewater treatment lagoon that contains contaminated sludge, and Area 2 is a former lagoon that has been covered with fill.

Terrestrial and aquatic species may be exposed to contaminants via different pathways including direct contact, ingestion of contaminated media, and inhalation of contaminants. Exposure of terrestrial wildlife to contaminants in the soil via dermal contact may occur, but is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons probably minimize transfer of contaminants across dermal tissue (note that this may not be true for amphibians). Therefore, the dermal pathway was not evaluated in this SERA, with the exception of aquatic organisms (i.e., benthic invertebrates, amphibians) since the surface water criteria take dermal contact into account through the nature of the tests. In addition, the inhalation pathway was not evaluated because air concentrations are expected to be minimal since that majority of the area is vegetated and/or wet. Also note that the dermal and inhalation pathways typically are not evaluated in SERAs because of the uncertainty in exposures and effects concentrations. Terrestrial vegetation may be exposed to contaminants via direct aerial deposition and root translocation.

Terrestrial and semi-aquatic animals may be exposed to soil/sediment contaminants through ingestion of contaminated food items (i.e., plants, invertebrates, mammals, birds, fish, etc.). Animals can also incidentally ingest soil/sediment while grooming fur, preening feathers, digging, grazing close to the soil/sediment, or feeding on items to which soil/sediment has adhered (such as roots and tubers). Terrestrial animal receptors may also come into contact with contaminants in surface water by drinking the water, although this exposure route represents a negligible portion of total exposure for most receptors because of the relatively low contaminant concentrations in surface water as compared to other media.

Terrestrial invertebrates and vegetation may be exposed to contaminants in the surface soil via direct contact. Finally, aquatic organisms may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items.

Based on the identification of contaminants and exposure pathways, five species groups were selected for evaluation in the risk assessment. These include terrestrial plants, terrestrial invertebrates, terrestrial and semi-aquatic vertebrates (mammals and birds), and aquatic receptors as shown on Figure 2-5.

Selection of Receptor Species

Many receptors in the soil and aquatic environments are adequately described in general categories such as soil invertebrates, vegetation, and sediment-dwelling (benthic) invertebrates. This is due to the nature of the threshold values, effects values, or water quality criteria that are typically used to characterize risk for such organisms. For vertebrate receptors, selection of particular species may be required so that intake through eating, drinking, and other routes can be estimated.

Receptor identification is influenced by the contaminants, their likely mode of transport, ultimate fate, and toxicity. For example, most metals (with notable exceptions of cadmium and mercury) typically do not bioaccumulate. For contaminants that bioaccumulate, such as mercury compounds and chlorinated pesticides, effects on upper trophic level receptors need to be assessed. For contaminants that do not bioaccumulate, organisms that are in direct contact with soil/sediment (i.e., sediment- and soil-dwelling organisms and plants) and animals that may incidentally ingest soil particles are selected as receptors for metals if exposure pathways are complete. Sensitivity to particular contaminants is also considered. For example, birds and mammals may have different sensitivities to organic compounds, so each group, or the most sensitive group for a particular contaminant, is assessed.

2.5.2.4 Identification of Assessment Endpoints and Measures of Effects

Assessment endpoints are an explicit expression of the environmental value that is to be protected (USEPA 1997a). The selection of these endpoints is based on the habitats present, the migration pathways of probable contaminants, and the routes that contaminants may take to enter receptors. Measures of effects are estimates of biological impacts (i.e., mortality, reproduction) that are used to evaluate the assessment endpoints. The selection of measurement endpoints is based on available data.

As indicated in Section 2.5.2.1, the habitat at the site consists largely of old field vegetation in various stages of development after disturbance, plus an open lagoon and a former lagoon covered with the common reed. Although different receptors may preferentially inhabit one particular habitat type, the assessment endpoints selected for this SERA are general enough to ensure that all the habitat types are evaluated. Therefore, for this SERA, the assessment endpoints are selected for protection of the following groups of receptors from adverse effects of contaminants on their growth, survival, and reproduction:

- Soil invertebrates
- Terrestrial Vegetation
- Herbivorous mammals
- Herbivorous birds
- Carnivorous Birds
- Carnivorous Mammals
- Omnivorous mammals
- Omnivorous birds
- Benthic invertebrates
- Fish
- Amphibians and reptiles

The following paragraphs discuss why assessment endpoints were selected to protect these groups of receptors for this SERA.

Soil Invertebrates: Soil invertebrates are expected to be present in the soil throughout the area. They aid in the formation of soil, redistribution and decomposition of organic matter in the soil and serve as a food source for higher trophic level organisms. They also can accumulate some contaminants, which can then be transferred to the higher trophic level organisms that consume invertebrates.

Terrestrial Vegetation: Terrestrial vegetation in the area consists of grasses, herbs, shrubs, and trees. They serve as a food source and provide shade and cover for many organisms, and help prevent soil erosion, among other important functions. They also can accumulate some contaminants, which can then be transferred to the higher trophic level organisms that consume plants (herbivores).

Herbivorous Birds and Mammals: Herbivorous birds and mammals (animals that consume only plant tissue) are present throughout the area in the different terrestrial habitats (i.e., forested, open field). Their role in the community is essential because without them, higher trophic levels (carnivores) could not exist (Smith, 1966). They may be exposed to, and accumulate contaminants that are present in the plants they consume.

Carnivorous Birds and Mammals: Carnivorous birds and mammals consume invertebrates and other mammals or birds. Soil invertebrate-eating birds and mammals are present throughout the area in the different terrestrial habitats (i.e., forested, open field). These animals are considered first-level carnivores and they serve as a food source for higher trophic level carnivores. Carnivorous birds and mammals that feed on other birds and mammals are at the top of the food chain. The top carnivores typically are less densely distributed than the herbivores and first-level carnivores because they require a larger area to hunt for their food. All of the carnivores may be exposed to and accumulate contaminants that are present in the food items they consume.

Omnivorous Birds and Mammals: Omnivorous birds and mammals (that consume both plant and animal tissue) are present throughout the area. They may be exposed to, and accumulate, contaminants that are present in the plants and animals they consume.

Benthic Invertebrates: Benthic invertebrates are similar to the soil invertebrates in that they serve as a food source for higher trophic level organisms (i.e., fish, amphibians, reptiles, birds, mammals). They also can accumulate some contaminants, which can then be transferred to the higher trophic level organisms that consume invertebrates.

Fish: Fish may or may not be present in the open lagoon. They are definitely in the Nashua River, and may be exposed to site contaminants that reach, or could reach, the river. Fish feed primarily on invertebrates, plants, and/or other fish, which is why the lower trophic level species are important. Fish are exposed to and can accumulate contaminants from the food they consume, or from the surface water in which they live.

Amphibians and Reptiles: Amphibians are expected to inhabit water bodies and surrounding areas. Reptiles can inhabit both aquatic and terrestrial areas that are away from water bodies. These species feed primarily on invertebrates, plants, fish, and/or small mammals, explaining why the lower trophic level species are important. Amphibians and reptiles are exposed to and can accumulate contaminants from the food they consume, or from the surface water/sediment in which they live.

The omnivores were not selected as assessment endpoints because exposure to contaminants in plants will be highest for herbivores and exposure to contaminants in animals will be highest for carnivores. Therefore, the omnivores should be protected by protecting the herbivores and carnivores.

The following text summarizes the assessment endpoints selected to protect the receptors identified above, poses risk questions, and presents the measures of effects to answer the risk questions.

Assessment endpoint #1: Aquatic invertebrate communities exposed to surface water and sediment, which are a forage resource for fish and wildlife populations.

- Question 1-1: Do measured concentrations of analytes in surface water exceed appropriate criteria and/or guidelines for the protection of aquatic life, with special consideration of reproduction and early life stage survival?

- Measure of Effect: Compare surface water concentrations to federal recommended water quality criteria, and/or data from aquatic toxicology literature.

- Question 1-2: Do measured concentrations of analytes in whole sediment exceed appropriate guidelines for the protection of benthic macroinvertebrate populations?

- Measure of Effect: Compare sediment concentrations to available sediment benchmarks and/or data from sediment toxicology literature.

Assessment endpoint #2: Soil invertebrate and plant communities exposed to surface soil, which are a forage resource for wildlife populations.

- Question 2-1: Do measured concentrations of analytes in surface soil exceed appropriate criteria and/or guidelines for the protection of soil invertebrates and plant, with special consideration of reproduction and early life stage survival?

- Measure of Effect: Compare surface soil concentrations to available soil benchmarks and/or data from soil toxicology literature.

Assessment Endpoint #3: Insectivorous and herbivorous mammal and bird populations exposed to soil.

- Question 3-1: Do estimated ingestion doses to insectivorous wildlife (such as shrew, meadow vole, American woodcock, American robin, etc.) exceed toxicity reference values (TRVs) for adverse effects on survival, growth or reproduction?

- Measure of Effect: Compare soil concentrations to calculated concentrations in food items that are not expected to cause adverse impacts to insectivorous or herbivorous wildlife that ingest the food items associated with soil. An assumption that the contaminant concentrations in the soil are equal to the contaminant concentrations in the food items is discussed in the uncertainty analysis section of this report.

2.5.3 Ecological Exposure Assessment

This portion of the SERA includes identification of contaminant concentration data used to represent ecological exposure in various media, and the selection of exposure point concentrations from the data. For each exposure pathway selected for quantitative evaluation, concentrations at the exposure point were estimated and the receptor-specific exposure were quantified. Exposure point concentrations were estimated using environmental sampling data. Maximum concentrations were used to assess risk in each case.

This section describes the potential or actual contact or co-occurrence of the contaminants with the receptors to determine their exposure. As discussed earlier in this report, soil, surface water, and sediment samples were collected. Only surface soil samples were used to estimate ecological risk from soil exposure, exposure occurs near the surface. For most of the areas, surface soil samples were taken from fill materials covering highly contaminated sludge deposits. Sediment and surface water samples were taken only from Area 1, the open lagoon.

2.5.4 Ecological Effects Assessment

In this step, the toxicity of the contaminants to terrestrial and aquatic organisms is characterized using screening values. The following sections discuss the sources of the screening values, and why they were selected as the screening values.

Soil

COPCs in soil pose potential risks to terrestrial invertebrates, plants, and wildlife; they were selected by comparing the maximum contaminant concentrations in the surface soil to screening values (Table 2-31). The following text discusses the screening values that were selected for each receptor. Note that the lowest screening value across all of the receptors was used for the selection of COPCs.

Invertebrates

Screening values for invertebrates were obtained from the Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision (Efroymson R.A. et al., 1997a). These benchmarks were intended to be used as screening values, and as such, may be overly conservative. They are based on a 20 percent reduction in growth, reproduction, or activity of invertebrates (Efroymson R.A. et al., 1997a).

Plants

Screening values for plants were obtained from the ORNL Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision

(Efroymson R.A. et al., 1997b). They are based on a 20 percent reduction in growth or yield for plants as the threshold for significant effects (Efroymson R.A. et al., 1997b).

The following study was used to obtain toxicity data for contaminants that were not included in the ORNL document: "Phytotoxicity Studies with Lactuca Sativa in Soil and Nutrient Solution" (Hulzebos et al., 1993). The study developed median effects concentrations (EC50s) for growth.

Terrestrial Wildlife

Screening values for wildlife were obtained from two ORNL documents, Preliminary Remediation Goals for Ecological Endpoints (Efroymson, et al., 1997c) and Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996). ORNL developed preliminary remediation goals (PRGs) for soil based on the lowest benchmarks among data for terrestrial plants, soil invertebrates, and wildlife. The candidate PRGs for wildlife were based on toxicity data in Sample et al. (1996), together with food chain modeling using empirical accumulation factors. These PRGs are listed in Table 2-31. Table 2-31 also lists contaminant concentrations in food items (Sample et al., 1996) that are not expected to adversely affect wildlife that ingest the food. Using these food concentrations as candidate screening levels for soil assumes that soil contaminant concentrations are equivalent to prey contaminant concentrations (accumulation factors for soil-to-prey are one). The uncertainty associated with this assumption is discussed in Section 2.5.6; the assumption will tend to overestimate the exposure for some contaminants and underestimate it for others. Because of this uncertainty, when both food-based benchmarks and PRGs for wildlife were available, the wildlife PRGs were used preferentially (Table 2-31).

The screening values for 2,3,7,8-TCDD and several other dioxins were obtained from Sample et al., (1996). The screening values for the remaining dioxins were calculated using the TEFs in the "Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife" (Van den Berg et al., 1998) (Table 2-31). The TEFs for mammals were used because the value for 2,3,7,8-TCDD obtained from Sample et al., (1996) was based on a mammal study.

Surface Water

The first choice for screening values selected to protect aquatic receptors (i.e., fish, invertebrates) were the most recent version of the Water Quality Criteria (WQC) developed by EPA (USEPA, 1999). These WQC are expected to protect 95 percent of the exposed species from mortality, reproductive effects, and other adverse effects. The chronic WQC were used, when available.

When WQC were not available, chronic values from the Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota:1996 Revision (Suter and Tsao 1996) were used. The Suter and Tsao (1996) benchmarks were calculated using Tier II methodology as described in the Proposed Water Quality Guidance for the Great Lakes System (USEPA, 1993a). Tier II values were developed so that aquatic benchmarks could be established with fewer data than are required for the EPA AWQC.

Sediment

COPCs in sediment based on potential risks to aquatic receptors (i.e., fish, benthic invertebrates) and semi-aquatic wildlife (i.e., mink, kingfishers) were selected by comparing the contaminant concentrations in the sediment to various screening values (Table 2-32). The following text discusses the screening values that were selected for each receptor. The lowest screening value across all of the receptors was used for the selection of COPCs.

Aquatic Receptors: The first choice for screening values selected to protect aquatic receptors (i.e., fish, invertebrates) were the draft USEPA Sediment Quality Criteria (SQC) that have been established for dieldrin and endrin (USEPA, 1993b and 1993c). The draft SQC for the three PAHs were not used because EPA had indicated that they would be withdrawn in favor of a total PAH SQC document (Riley, 1999).

The second choice for screening values selected to protect aquatic receptors was the Effects Range-Low (ER-L) value from the "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments" (Long et al., 1995). These values are generally accepted by many state agencies and EPA regions, even though they are based primarily on estuarine and marine studies. The ER-L is defined as the minimal-effects range that is a concentration below which adverse effects would be rarely observed.

The Lowest Effects Level (LEL) from the "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario" (OMOE, 1993) were used for contaminants that did not have ER-Ls. The LELs are based on freshwater studies and are defined as concentrations where sediment is considered marginally polluted but will not affect the majority of sediment-dwelling organisms.

Sediment quality benchmarks calculated for the Ecotox Thresholds (USEPA, 1996) were used for contaminants that did not have any of the above screening values. These benchmarks were calculated using equilibrium partitioning and assuming a total organic carbon concentration of 1 percent.

For some of the remaining contaminants, equilibrium partitioning or a complementary technique, was used to develop sediment screening levels. EPA's (1993d) equilibrium partitioning (EqP) approach was used for some of the organic compounds in sediment, based on the formula:

$$WQG \ X \ K_{oc} = SQG_{EP}$$

Where WQG = water quality guideline, mg/L

K_{oc} = organic carbon–water partition coefficient

SQG_{EP} = sediment quality guideline from EqP, mg/kg organic carbon in sediment

The equation indicates that the sediment guideline is based on the water quality guideline as an equilibrium concentration in the pore water of the sediment. As K_{oc} increases, less of the contaminant is dissolved in the pore water (more is associated with the solid phase) and the SQC_{EP} increases. K_{oc} was derived from the octanol-water partition coefficient (K_{ow}) using EPA's formula:

$$LOG_{10}K_{oc} = 0.00028+0.983*LOG_{10}(K_{ow}), \text{ or}$$

$$K_{oc} = 10^{0.00028+0.983*LOG10(Kow)}$$

The SQG_{EP} was expressed on a (dry) bulk sediment basis with a default fraction of organic carbon in sediment (.01, or 1 percent) because there are no organic carbon data for the site:

$$SQG_{EP}\ (mg/kg) = SQG_{EP}\ (mg/kg\ OC) \times 0.01$$

EqP has been applied by the EPA to organochlorine pesticides and PAHs, but not to the compounds from Mohawk Tannery in Table 2-33. The EqP model was designed for nonionic organic compounds and it may produce less reliable results as the K_{ow} values for organic compounds decrease or as polarity increases. Bioaccumulation can be predicted from K_{ow} when $\log_{10}K_{ow}$ is between 2 and 6 (USEPA, 2000a), indicating that there is less confidence in predicting bioavailability at $\log_{10}K_{ow}$ values less than 2. Several of the compounds in Table 2-33 are characterized by low K_{ow} values. Therefore, a check was performed on the EqP results. The check was done using the complementary approach, an extension of EqP theory. As K_{ow} gets lower, more of the organic compound is expected to be in the pore water. For a compound with a very low K_{ow}, such as acetone, it may be reasonable to assume that all of the compound is in pore water. Following the logic of the EqP approach, this is a conservative assumption. If the fraction of water in the wet sediment is known, the mass of material in the pore water at the WQG can be assigned to the solid fraction (water-to-sediment assignation), as explained below.

The average fraction of solids in sediments sampled for Area 1 is 0.257. Therefore, the average fraction of water is 1 - 0.257 = 0.743. Because the specific gravity of water is one, the volume of water in a kg of Area 1 sediment will be:

$$0.743\ kg / 1\ kg/L = 0.743\ L$$

The total mass of contaminant in a kg of sediment at the water quality guideline is:

$$\text{Contaminant mass (mg)} = \text{WQG (mg/L)} \times 0.743\ L$$

This mass, when divided by the mass of solid material, 0.257 kg, becomes a dry sediment concentration of:

$$SQG_{w\text{-}s}\ (mg/kg) = \text{Contaminant mass (mg)} / 0.257\ kg$$

Therefore, the SQG_{w-s} for sediment is equivalent to 0.743 / 0.257, or 2.89 times the guideline for surface water, as long as equivalent units are maintained.

The SQGs derived using both approaches are compared in Table 2-33. The SQG_{w-s} values vary directly with WQGs, at 2.89 times the WQG. The SQG_{EP} values change with K_{ow} as well as WQG. *For the compound* (pentachlorophenol) *with* $\log_{10}K_{ow}$ *greater than or equal to* 2, the effect of K_{ow} is to increase the SQG_{EP} relative to the SQG_{w-s}. This is expected from EqP theory, because a higher K_{ow} increases the fraction associated with the solid phase. This allows a higher SQG_{EP} while, theoretically, pore water concentrations remain below the WQG. Therefore, the assumption of all the chemical being in pore water is conservative, probably over-conservative, relative to EqP for the pentachlorophenol. The SQG_{EP} value will be used for pentachlorophenol in this assessment, because its K_{ow} is within the range expected to be useful for applying EqP.

For 4-methylphenol, carbon disulfide, phenol, 2-butanone and acetone, their lower K_{ow}s have the effect of decreasing SQG_{EP} relative to the SQG_{w-s} (Table 2-33). Because the SQG_{w-s} values represent a most conservative case in terms of the amount of chemical in porewater, the appropriateness of the SQG_{EP} values for these compounds is doubtful. As stated before, the fact that EqP is designed for nonionic organic chemicals suggests that its predictive capacity may be curtailed at low values of K_{ow} ($\log_{10}K_{ow} < 2$). Because the SQG_{w-s} values are simple and conservative, they were used to assess risk to sediment-dwelling organisms from 4-methylphenol, carbon disulfide, phenol, acetone, and 2-butanone.

Finally, the screening levels for the protection of aquatic life from exposure to dioxins were taken from EPA (1993e). TEFs for fish (van den Berg, 1998) were used to adjust the value for TCDD to other dioxin and furan congeners (Table 2-32).

Semi-Aquatic Receptors: For the semi-aquatic receptors, the screening value for 2,3,7,8-TCDD was obtained from the Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin Risks to Aquatic Life and Associated Wildlife (USEPA, 1993e). The 2,3,7,8-TCDD sediment concentration associated with low risk to mammals was selected as the screening value. The screening values for furans and the other dioxins were calculated using the TEFs for mammals in the "Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife" (Van den Berg et al., 1998).

For the other contaminants, the screening values for semi-aquatic receptors are the same as those for terrestrial receptors based on contaminant concentrations in food, as obtained from the ORNL document: Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996). The lowest acceptable concentration in the food items was used to select COPCs with the assumption that the concentration in the food item is equal to the concentration in the sediment. As is discussed in the uncertainty analysis section, this assumption will tend to overestimate the exposure for some contaminants and underestimate it for others.

2.5.5 Ecological Risk Characterization

The risk characterization is the comparison of exposure estimates to ecological effects values. It is at this step of the SERA that the likelihood of adverse effects occurring as a result of exposure to a stressor will be evaluated. A Hazard Quotient (HQ) approach was used to characterize the risk to ecological receptors.

The HQ is the ratio of the exposure point concentration to its benchmark value; when it exceeds 1.0, adverse impacts are possible. The HQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an exposure point concentration exceeds or is less than a benchmark. A HQ value greater than 1.0 indicates that ecological receptors are potentially at risk and additional evaluation or data may be necessary to confirm whether ecological receptors are actually at risk, especially because most benchmarks are conservative. The maximum soil, sediment, and surface water concentrations were compared to screening values using the following equations:

$$HQ = \frac{Cc}{\text{Screening Value}}$$

Where: HQ = Hazard Quotient, (unitless)

C_C = Maximum contaminant concentration in soil, sediment, or surface water

Contaminants with HQs greater that 1.0 are retained as contaminants of potential concern (COPCs) for further evaluation because they have a potential to cause risk. Calcium, magnesium, potassium, and sodium were not retained as COPCs in any medium because of their relatively low toxicity to ecological receptors, and their high natural variability in concentrations. Contaminants without screening values are retained as COPCs but are only evaluated qualitatively. The following sections present the contaminants that were retained as COPCs in each of the media.

Soil HQs

Among Areas 2 through 7, maximum concentrations of bis(2-ethylhexyl)phthalate, DDE, DDT, 12 dioxin/furans, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, vanadium, and zinc exceeded screening levels and became COPCs (Table 2-28). 1,2-Dichlorobenzene, methyl acetate, and sulfide were retained as COPCs because they had no screening levels. HQs indicating potential risk were low (<10) for bis(2-ethylhexyl)phthalate, DDE, DDT, seven dioxins/furans, arsenic, barium, cadmium, copper, and manganese. Four dioxin/furans, lead, vanadium, and zinc had moderate HQs ($10 \leq HQ < 100$), while one dioxin (HQ = 298), aluminum (HQ = 1741), antimony (HQ = 179), chromium (HQ = 528), iron (HQ = 200), and mercury (HQ = 8823) had HQs greater than 100. Of the COPCs with the highest HQs, aluminum and iron are typically not considered to be bioavailable, unless pH values are unusually low. Also, antimony and mercury are not directly associated with site tanning processes, and mercury has a screening value that is unusually low. Therefore, risks posed by dioxin and chromium appear to be of greatest concern in surface soil.

Maximum detected concentrations of the COPCs in surface soil pose a potential risk to soil invertebrates, plant communities, and insectivorous and herbivorous mammal and bird populations (Assessment Endpoints 2 and 3).

Sediment HQs

The sediment in Area 1 had 44 COPCs, of which 40 were greater than their screening levels and 4 had no screening levels (Table 2-29). In each chemical group, most of the detected chemicals became COPCs in sediment.

The maximum HQ (about 35,000) was associated 4-methylphenol. Chromium had the next highest HQ at about 30,400 and carbon disulfide (HQ = 2,293) was third highest.

HQs were low for VOCs other than carbon disulfide, but HQs for phenolics other than 4-methylphenol included 36 for pentachlorophenol and 72 for phenol. Pesticide HQs were generally low in sediment, and no PCBs were detected. The maximum dioxin/furan HQ was 218, while the highest metal HQ, other than chromium and aluminum, was 64 for lead. Phenolics, particularly 4-methylphenol, and chromium are associated with site tanning processes and have the highest potential risk levels in sediment.

Maximum detected concentrations of the COPCs in sediment pose a potential risk to aquatic invertebrate communities which are a forage resource for fish and wildlife (Assessment endpoint 1).

Surface Water HQs

Based on detected levels in two samples from Area 1, surface water COPCs were carbon disulfide, 4-methylphenol, pyrene, chromium, manganese, and selenium (Table 2-30). Manganese had the highest HQ at about 42, followed by carbon disulfide at 5.4. 4-Methylphenol and pyrene became COPCs because they had no screening levels.

Maximum detected concentrations of the COPCs in surface water pose a potential risk to aquatic invertebrate communities which are a forage resource for fish and wildlife (Assessment endpoint #1).

2.5.6 Ecological Risk Uncertainty Analysis

This section presents some of the uncertainties associated with ecological risk assessments. In this step risk levels are evaluated for possible over- or under-estimates.

2.5.6.1 Assessment Endpoints and Measures of Effects

Measures of effects are used to evaluate the assessment endpoints for the SERA. For this SERA, the measures of effects are not the same as the assessment endpoints. The measures used to predict effects are the lowest appropriate screening level. While a conservative choice, it is uncertain how the screening levels relate to the assessment endpoints.

Several endpoints were not quantitatively evaluated in this SERA. For example, risks to reptiles and amphibians were not quantitatively evaluated because exposure factors are not established for most species, and toxicity data are very limited. Therefore, potential risks to these species are not known.

2.5.6.2 Ecological Exposure Assessment

The food benchmarks presented in Sample et al., (1996) were generated by calculating contaminant doses to terrestrial wildlife using equations that incorporate ingestion rates, body weights, bioaccumulation factors, and other exposure factors. These exposure factors were obtained from literature studies or predicted using allometric equations. All of the factors vary within and among species, and from place to place, creating uncertainty in the food benchmarks.

Most of the screening values for terrestrial and semi-aquatic wildlife (i.e., mammals, birds) do not account for preferential uptake of contaminants in the food items (plants, invertebrates, fish). In other words, they simply assume the contaminant concentrations in the food items are the same as the contaminant concentrations in the substrate. For example, contaminant concentrations in soil invertebrates are assumed to be equal to the contaminant concentration in the soil. Exceptions to this are the ORNL wildlife PRGs and the TCDD sediment screening value for semi-aquatic receptors, which are based on estimated bioaccumulation through the food chain.

The application of uptake factors is not expected to substantially change the status of COPCs with high HQs. However, the following text describes how HQs based on wildlife screening levels may be affected by the application of uptake factors in each medium. A more detailed discussion of the uptake factors is presented in Section 2.5.2.2. Recall that many screening levels are based on plant or invertebrate screening levels; these would not change based on the use of uptake factors.

As indicated above, an uptake factor was applied to the TCDD screening value for semi-aquatic receptors, so the HQs calculated based on that screening value through the application of TEFs would not change. Because the 90th percentile soil-to-invertebrate factor for dioxins is above 1.0, the HQs for dioxins in surface soil would increase if uptake factors were used.

Most of the inorganics do not have 90th percentile soil-to-invertebrate uptake factors that are greater than 1.0 after accounting for wet weight of the invertebrate. That is why ORNL PRGs for wildlife tended to be higher than wildlife screening values in food (Table 2-31). Cadmium, mercury, and zinc had 90th percentile uptake factors that were greater than 1.0; each of these had ORNL PRGs that were used as candidate screening levels. Therefore, the HQs for some of the metals soil would decrease if uptake factors were used.

Soil-to-invertebrate uptake factors have not been developed for the SVOCs, although a table in Beyer (1990) indicates the factors would be less than 1.0. Other sources indicate that soil-to-plant uptake factors are expected to be less than 1.0 (ORNL, 2000). Therefore, SVOC HQs in soil would decrease if uptake factors were used. However, because no uptake factors have been developed for invertebrates, a screening evaluation would typically use a default value of 1.0. The biota-to-sediment accumulation factor (BSAF) for SVOCs requires the percentage of organic carbon in the sediment along with the percentage of lipids in the food item. Therefore, the effect of BSAF use on SVOC HQs is unknown.

Soil-to-invertebrate uptake factors have not been developed for the pesticides, although based on their high K_{ow} values, they would be expected to bioaccumulate in invertebrates. Because of their high K_{ow} values, they are not expected to bioaccumulate in plants (ORNL, 2000). Therefore, the pesticide HQs for soil would increase if uptake factors were used. The biota-to-sediment accumulation factor (BSAF) for pesticides reported in USEPA (1997b) range from 1.67 to 7.7. Although the lack of organic carbon data hampers an estimate, it is likely that HQs for pesticides in sediment would increase if BSAFs were used.

PCBs have 90th percentile soil-to-invertebrate uptake factors that are greater than 1.0 after accounting for wet weight of the invertebrate (Sample et. al., 1998). Because of their high K_{ow} values, PCBs are not expected to bioaccumulate in plants (ORNL, 2000). Therefore, the PCB HQs for soil would increase if uptake factors were used. The biota-to-sediment accumulation factor (BSAF) for PCBs reported in USEPA (1997c) is 1.85. Because of the lack of organic carbon data, it is unclear what effect BSAF use would have on PCB HQs for sediment.

There is uncertainty in the chemical data that are collected at the site. Measured levels of chemicals are only estimates of the true site chemical concentrations. For samples that are deliberately biased toward known or suspected high concentrations, predicted doses probably will be higher than actual doses.

Finally, the maximum concentrations are used in this screening evaluation. Very few receptors are exposed to the maximum concentrations for all (or even most) of the time. Using the maximum concentration overestimates risk. Most of the screening values that were used in this evaluation are based on food-chain modeling. Because the wildlife receptors will move across the site, average contaminant concentrations better represent their actual exposure.

2.5.6.3 Ecological Effects Data Assessment

There is uncertainty in the ecological toxicity values. The water quality criteria developed by USEPA in theory protects 95 percent of exposed species. Therefore, some sensitive species may be present at the site that are not protected by the use of these criteria. There also may be situations where the surface water screening values are over-protective, if the sensitive species used to develop the criteria do not inhabit the site. Finally, with the exception of hardness for a few metals and pH for pentachlorophenol, the screening values do not account for site-specific factors, such as total organic carbon or ionic strength, which may affect toxicity.

Potential adverse impacts to aquatic receptors from constituents in the sediment are evaluated by comparing the COPC concentration to sediment screening values. There are more uncertainties associated with sediment screening values than with surface water screening values for the following reasons: The procedures for developing sediment screening values are not as well established, so screening levels have been developed using different methodologies, and there are fewer sediment toxicity data than surface water toxicity data. Sediment characteristics (i.e., pH, grain size, and total organic carbon) also will have a large impact on the bioavailability and toxicity of constituents.

Potential adverse impacts to terrestrial plants and invertebrates from constituents in the surface soil are evaluated by comparing the COPC concentration to surface soil screening values. The surface soil screening values are similar to the sediment screening values in that they are less established than the surface water screening values. Fewer studies and fewer data are available for establishing surface soil screening values and many of the screening values are based on the results of only a few studies. In addition, the surface soil screening values are based on different endpoints, depending on the preference of the agency that developed them. Therefore, they have more uncertainty than surface water and sediment screening values.

The no observed adverse effects levels (NOAELs) that were selected for the wildlife endpoint species were based on species other than the endpoint species (i.e., rats, mice, ducks). There is uncertainty in the application of toxicity data across species because the contaminant may be more or less toxic to the endpoint species than it was to the test study species.

Much of the toxicity data used to develop screening values and NOAELs are based on bioavailable forms of the contaminants. For example, many of the soil screening values for invertebrates are based on soluble salts being added to the soil. Also, studies used to develop the NOAELs typically use a very bioavailable form of a contaminant to ensure that it is absorbed by the animal. Because contaminants in soil, sediment, and even surface water are typically less bioavailable than they are in the chemical forms used in toxicity tests, many of the screening values tend to be lower than what would be expected to actually cause risks to most species in the environment.

The toxicity of chemical mixtures is not well understood. All the toxicity information used in the ERA for evaluating risk to the ecological receptors is for individual chemicals. Chemical mixtures can affect the organisms very differently than the individual chemicals because of synergistic or antagonistic effects.

Finally, toxicological data for a few of the COPCs are limited or do not exist. Therefore, there is uncertainty in any conclusions involving the potential impacts to ecological receptors from these constituents.

2.5.6.4 Risk Characterization

Risks are projected if an HQ is greater than or equal to unity regardless of the magnitude of the HQ. Although the relationship between the magnitude of an HQ and toxicity is not necessarily linear, the magnitude of an HQ can be used as rough approximation of the extent of potential risks, especially if there is sufficient confidence in the guideline used. Finally, there is uncertainty in how the predicted risks to a species at the site translate into risk to the population in the area as a whole.

2.5.6.5 Risk From Background Conditions

Background data was not collected for the Mohawk Tannery site. Therefore, it is uncertain how much of the potential risk from metals may be based on local background. However, a comparison of maximum metals concentrations found in Areas 2 through 7 surface soil, with statewide background metals concentrations in the NH RCMP reveals that the maximum metals concentrations in site surface soils generally exceeded the RCMP background concentrations by a considerable amount (at least one order of magnitude). Although RCMP background concentrations would result in HQs exceeding 1.0 for several metals (antimony 6.61, arsenic 1.1, chromium 3.30, lead 1.26, mercury 608, and zinc 11.53), most of the potential risk at the site appears to result from metals concentrations above the statewide background concentrations. NH RCMP background metals concentrations are presented on Table 2-34.

2.5.7 Summary and Recommendations

The following text summarizes the COPCs that were retained in each medium. Tables 2-28 through 2-30 note each of the contaminants that were retained as COPCs.

Surface Soil (Areas 2 – 7)

- Two VOCs
- Bis(2-ethylhexyl)phthalate
- Two Pesticides
- 12 Individual Dioxins
- 14 Inorganic Compound or Metals

Sediment (Area 1)

- Three VOCs
- Five SVOCs
- Eight Pesticides
- 14 Individual Dioxins
- 13 Inorganic Compound or Metals

Surface Water (Area 1)

- One VOC
- Two SVOCs
- Three Metals

As seen from the above list, multiple contaminants from each contaminant class (i.e., dioxins, metals, SVOCs, etc.) were retained as COPCs in surface soil and sediment. As indicated earlier in this SERA, the screening values are very conservative (i.e., they over-estimate ecological risk). They are intended to be used as screening tools to ensure that contaminants that are detected at concentrations below the screening values are not posing a risk to ecological receptors. Therefore, contaminants that are detected at concentrations above the screening values do not necessarily pose a risk to ecological receptors. There are a lot of factors that influence toxicity of the contaminants, many of which were discussed in the uncertainty analysis section. Also, the screening was conducted using the maximum concentrations while most of the ecological receptors will not be exposed to the maximum concentrations 100 percent of the time.

While conservative, the results show some areas of real concern. Risks posed by dioxin and chromium are of greatest concern in surface soil. Phenolic compounds (particularly 4-methylphenol) and chromium have the highest potential risk levels in sediment (submerged sludge in Area 1).

Also, the presence of buried sludge is a concern for the future, even though fill material currently prevents most ecological exposure. A catastrophic event, or future land use changes, may allow exposure to the sludge in areas currently covered by fill. The high risk levels in the sediment of Area 1 indicate the potential toxicity of the sludge in other disposal areas.

Although the magnitude of the HQ may not accurately indicate the magnitude of risk, the very large HQs for many COPCs indicates that additional investigations should be considered to more accurately estimate potential risks.

The following recommendations are made for consideration as part of any future ecological risk assessment work that might be completed as part of the site-wide remedial investigation.

- Re-evaluate the data in a Baseline Ecological Risk Assessment that assesses the exposure of specific receptor species occurring on site using average and maximum contaminant concentrations, where appropriate.

- Conduct appropriate toxicity tests and biological sampling to determine if adverse effects or exposures are occurring to ecological receptors and to aid in the development of cleanup levels, if necessary.

- If there is insufficient time to perform further evaluation of ecological risk, the results suggest that removal of tannery-related sludge is justified.

3.0 NON-TIME-CRITICAL REMOVAL ACTION OBJECTIVES

This section describes the regulatory basis for conducting a NTCRA to address tannery sludge and waste at the site, identifies contaminants of concern for the site, presents proposed preliminary remediation goals for the sludge and soil, and presents the overall goals and objectives of the proposed NTCRA. It also identifies potential federal and state regulations with which the selected removal action must comply, and identifies the statutory limits of removal actions. A proposed NTCRA schedule is also presented in this section.

3.1 Regulatory Basis for a Removal Action

This section identifies the site conditions that provide the legal justification for conducting a NTCRA to address tannery sludge and waste at the site. These site conditions correspond to factors cited in Section 300.415(b)(2) of the NCP that provide a basis for conducting a removal action:

- *40 CFR 300.415(b)(2)(i): Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants:* Potential threats to human and ecological receptors exist through potential current and future direct exposures to contaminants present in surface and subsurface materials at the site. The streamlined human health risk evaluation identified non-cancer health threats for current trespasser exposure to sludge in the Area 1 lagoon (HI=42.5), future residential exposure to surface soil and sludge in disposal areas 2 through 7 (HI=13.1), and future residential exposure to surface and subsurface soil and sludge (0 to 10 feet bgs) in all seven disposal areas (HI=72.4). The human health risk evaluation also identified cancer risks in excess of 1.0E-04 for current trespasser exposure to sludge in the Area 1 lagoon (1.86E-03) and future residential exposure to surface and subsurface soil and sludge (0 to 10 feet bgs) in all seven disposal areas (1.87E-04). The streamlined ecological risk evaluation identified potential risks to ecological receptors from contact with sludge/sediment in the Area 1 lagoon and surface soil in Areas 2 through 7. Ecological risks posed by 4-methyphenol and chromium are of greatest concern in sludge/sediment and risks posed by dioxins and chromium are of greatest concern in surface soil.

- *40 CFR 300.415(b)(2)(ii): Actual or potential contamination of drinking water supplies or sensitive ecosystems:* Significant quantities of contaminated tannery sludge/waste are located beneath the water table in a number of the disposal areas at the site including the two largest disposal lagoons, Area 1 and Area 2. Based on October 2001 groundwater conditions as much as 6 feet and 9 feet of the sludge in Areas 1 and 2 respectively, are buried below the water table. The presence of contaminated sludge below the water table and the usage of the groundwater as a drinking water supply for populations nearby the site provides the potential for contamination of an important drinking water supply. In addition, for many years sludge/waste from the site was discharged directly into the Nashua River thereby potentially impacting this important and sensitive ecosystem. The impacts of the sludge/waste on the groundwater as well as the Nashua River will be addressed as part of the ensuing site-wide remedial investigation.

- *40 CFR 300.415(b)(2)(iv): High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate:* Contaminated tannery sludge/waste is present at the surface throughout Area 1, and at some locations in Areas 6, and 7. Analysis of sludge/waste samples collected from these areas revealed the presence of several contaminants at concentrations exceeding screening criteria. The surface contamination in Areas 6 and 7 may migrate via precipitation runoff and through leaching into the groundwater. Under both scenarios, contamination would likely end up discharging into and impacting the nearby Nashua River. Disposal Area 1 is located immediately adjacent to the Nashua River. The Area 1 open lagoon is surrounded by an earthen berm that is higher than the 100-year flood elevation. However, the sludge elevation in the lagoon is below the 100-year flood elevation. If the berm was breached by a major storm or flood event, a significant washout of highly contaminated sludge into the Nashua River and its floodplain could occur.

- *40 CFR 300.415(b)(2)(v): Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released:* Disposal Areas 1 and 2 are located immediately adjacent to the Nashua River. Most of Area 2 is situated in the 100-year floodplain of the Nashua River. Inundation of Area 2 with floodwaters could result in washout of the cover soils and mobilization of contaminated sludge/waste into the Nashua River and its floodplain. Additionally, a major storm event could cause a washout of sludge/waste in Area 1 into the Nashua River and its floodplain, as described above.

Based upon these factors, a potential threat exists to public health or welfare or the environment that justifies conducting an NTCRA to address the tannery waste in the seven disposal areas at the site. In particular, a removal action is necessary to prevent contact with and control and contain the release of hazardous substances from the site through source control measures. This removal action is designated as non-time critical because more than 6 months' planning time is available before on-site activities must be initiated. As a result, the completion of an Engineering Evaluation/Cost Analysis (EE/CA) is required pursuant to 40 CFR Section 300.415(b)(4)(i).

3.2 Selection of Contaminants of Concern

Using analytical results from the EE/CA field investigation and the results of the streamlined human health risk evaluation, contaminants of concern (COCs) that pose threats to human health were identified. No COCs were developed for protection of ecological receptors because the streamlined ecological risk evaluation was a screening-level, qualitative evaluation only and therefore could not be used to definitively identify COCs. The streamlined ecological risk evaluation identified numerous chemicals of potential concern to ecological receptors at the site and concluded that additional investigations should be considered to more accurately estimate potential risks. A comprehensive, quantitative ecological risk assessment may be performed as part of the comprehensive Remedial Investigation/Feasibility Study (RI/FS) for the site that is to be initiated later this year.

The COCs identified for the site are compounds that posed an excess carcinogenic risk greater that 1.0E-6 or an excess non-carcinogenic risk indicated by a hazard index greater than 1 for any exposure scenario. The COCs identified for the site are identified on the table below.

Contaminants of Concern	Cancer Risk > 1.0E-6	Non-Cancer HI >1.0
Benzo(a)Pyrene	X	
Pentachlorophenol	X	
4-Methylphenol		X
Dioxin TEQ	X	
Antimony		X
Arsenic	X	X
Barium		X
Cadmium		X
Chromium		X
Manganese		X
Vanadium		X

3.3 Identification of Preliminary Remediation Goals (PRGs)

Preliminary Remediation Goals (PRGs) are the numerical chemical concentrations in environmental media that would not cause excess health risks to humans or the environment. Protection of human health and the environment can be achieved by treating, removing, containing, or preventing exposure to environmental media containing contaminants above these PRGs. PRGs may be selected from a combination of risk-based values developed for the site, regulatory standards, available guidance or screening criteria.

PRGs for site sludge/waste and soil were developed using risk-based values calculated from exposure scenarios identified in the streamlined human health risk evaluation; available guidance for addressing dioxin contamination: EPA OSWER Directive 9200.4-26, Approach to Addressing Dioxins in Soil at CERCLA and RCRA Sites (USEPA, 1998a); and the NHDES RCMP background concentrations of metals in soils. NHDES RCMP Method 1 Soil standards were considered, but not used in selection of the proposed PRGs because the Method 1 standards are non-promulgated criteria used as default standards in absence of a site-specific risk assessment. Because a comprehensive risk evaluation was performed for site soil/sludge, the risk-based PRGs calculated for the site were used in place of the Method 1 standards. There are no other applicable or relevant and appropriate regulatory standards for soil/sludge. Risk-based PRGs were not developed for protection of ecological receptors because the streamlined ecological risk evaluation was qualitative in scope and could not be used to quantitatively determine PRGs.

Potential PRGs representing human cancer risk levels of 1.0E-6, 1.0E-5, and 1.0E-4 and non-cancer hazard indexes of 0.1 and 1.0 were calculated for each COC identified in Section 3.2 to provide risk managers with a range of options for reducing human health risks at the site. The risk-based PRGs were calculated using the exposure assumptions developed for residential exposure to site soil/sludge. The residential exposure scenario is more conservative than the scenario that considers current trespasser exposure to surface soil/sludge in Areas 2 through 7, but less conservative than the scenario for current trespasser exposure to wet sludge in Area 1. As a result, the PRGs calculated for the residential scenario are protective for future residents as well as current trespassers exposed to surface soil/sludge. Although lower PRGs could be calculated for the wet sludge in Area 1 based on the exposure assumptions for protection of trespassers in that area, the PRGs calculated based on the residential exposure scenario are considered adequate for the site because several contaminants in the Area 1 sludge exceed the calculated PRGs and it would be completely removed under all of the NTCRA alternatives considered.

The risk-based PRGs were used along with the EPA OSWER Directive Approach to Addressing Dioxins in Soil at CERCLA and RCRA Sites (USEPA, 1998a) and the NH RCMP background concentrations to select proposed PRGs for each COC. For all COCs except dioxins, the proposed PRG was selected from the lower of the risk-based PRGs corresponding to a cancer risk level of 1.0E-6 and a hazard index of 1.0. If the selected risk-based PRG was lower than the NH RCMP background concentrations of metals in soil, then the background concentration was selected as the proposed PRG. For dioxins, the proposed PRG was selected based on the EPA OSWER Directive Approach to Addressing Dioxins in Soil at CERCLA and RCRA Sites (USEPA, 1998a). The directive recommends a cleanup level for dioxin TEQs of 1000 ng/kg for residential settings. This value is proposed for use pending completion of EPA's comprehensive reassessment of the toxicity of dioxin. Table 3-1 presents the potential and proposed PRGs for each compound.

Because the scope of the proposed NTCRA is limited to source control for contaminated soils, sludges, and wastes, PRGs were not developed for groundwater, surface water or river sediments. These media will be evaluated in the RI/FS scheduled to begin later this year.

3.4 Volume of Wastes to be Addressed in the NTCRA

As detailed in Section 2.1.3 and summarized on Table 2-20, sample analytical results were compared with the proposed PRGs to estimate the volume of sludge/waste and soil to be addressed under the NTCRA. The following table provides a summary of the estimated volume of sludge/waste in each disposal area that contains contaminants at concentrations exceeding the proposed PRGs. No visual evidence of sludge/waste was found in Area 5 and no contaminants were detected in Area 5 samples at concentrations exceeding the proposed PRGs. As a result, no sludge/waste volume was estimated for this area. Contaminant concentrations in overlying and underlying soil also did not exceed the proposed PRGs, so no sludge/waste volume was estimated for the soils.

Disposal Area	Estimated Volume of Sludge/Waste (CY)
Area 1	25,185
Area 2	29,630
Area 3	370
Area 4	1,000
Area 6	648
Area 7	3,556
TOTAL VOLUME:	60,389

3.5 Removal Action Objectives

Based on the conditions described in Section 3.1, a NTCRA is necessary to mitigate risks posed by tannery sludge/waste at the site and to stabilize conditions while long-term remedial options for the site are evaluated.

To achieve these goals, removal action objectives were developed that are protective of human health and the environment and consider potential future use of the site. These removal action objectives are presented below.

Prevent, to the extent practicable, direct contact with, ingestion of, and inhalation of contaminants in tannery sludge/waste and associated soil at concentrations exceeding PRGs.

- Prevent, to the extent practicable, ecological receptor exposure to contaminants exceeding PRGs in tannery sludge/waste and associated soil.
- Prevent, to the extent practicable, migration of contaminants exceeding PRGs from tannery sludge/waste and associated soil to site groundwater and the Nashua River.
- Address tannery sludge/waste and associated soil with contaminants exceeding PRGs to restore the site to its intended use for residential purposes.

3.6 Statutory Limits on Removal Actions

40 CFR Part 300.415(b)(5) and Section 104(c)(1) of CERCLA set limits of 12 months and 2 million dollars for fund-financed removal actions. An exemption from the time and dollar limitations in the statute can be granted in situations where EPA determines that the proposed removal action is appropriate and consistent with the anticipated long-term remedial action.

Because the NTCRA proposed in this EE/CA would be a fund-financed action, it would have to comply with these statutory limits or obtain an exemption. An exemption may be possible because the alternatives evaluated in this EE/CA are consistent with any anticipated long-term remedial action for the site. The risk-based evaluation was performed that further supports consistency between this NTCRA and any long-term remedial actions.

3.7 ARARs and TBCs

Section 300.415(j) of the NCP requires that "Fund-financed removal actions under CERCLA Section 104 and removal actions pursuant to CERCLA Section 106 shall, to the extent practicable considering the exigencies of the situation, attain applicable or relevant and appropriate requirements (ARARs) under federal environmental or state environmental or facility siting laws...Other federal and state advisories, criteria, or guidance may, as appropriate [to be considered - TBC], be considered in formulating the removal action." The NTCRA guidance states that "...only State standards that are promulgated, identified by the State in a timely manner, and more stringent than Federal requirements may be applicable or relevant and appropriate."

ARARs are promulgated, enforceable federal environmental and state environmental or facility siting requirements. There are two categories of requirements: "applicable" and "relevant and appropriate". CERCLA does not allow a regulation to be considered as both "applicable" and "relevant and appropriate". These categories are defined below:

Applicable Requirements - Section 300.5 of the NCP defines applicable requirements as "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site".

Relevant and Appropriate Requirements - Section 300.5 of the NCP defines relevant and appropriate requirements as "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site."

To be considered (TBCs) guidelines are non-promulgated criteria, advisories, and guidances issued by the federal or state governments. Along with ARARs, TBCs may be used to develop the interim action limits necessary to protect human health and the environment or to guide development of the removal action source control measures, i.e., cap system conceptual design.

While ARAR requirements under CERCLA pertain only to on-site activities, off-site activities relating to hazardous waste disposal are required to meet all applicable laws including, but not limited to: Department of Transportation regulations governing the marking and labeling of hazardous materials shipments (49 CFR 192), shipping requirements (49 CFR 173), and transport of hazardous materials by motor vehicles (49 CFR 173 and 49 CFR 177); and Resource Conservation and Recovery Act (RCRA) regulations governing transporter activities and treatment, storage, and disposal facilities (40 CFR 261-264), land disposal restrictions (40 CFR 268), and off-site response actions (40 CFR 300.440); and CERCLA 121(d)(3). Other non-ARAR off-site requirements include state labeling, shipping, and transport requirements for state-designated hazardous wastes and CERCLA Section 121 (d)(3) requirements for the off-site transfer of CERCLA wastes.

The Occupational Safety and Health Administration (OSHA) regulations are not ARARs, but apply to both on- and off-site activities. These include regulations governing performance of activities at hazardous waste sites (29 CFR 1910.120), general construction guidelines (29 CFR 1926), and occupational exposure to asbestos (29 CFR 1910.1001).

ARARs, and standards and guidance to be considered are divided into three categories: chemical-specific, location-specific, and action-specific. In Sections 3.4.1 through 3.4.3, these categories are briefly described and potential ARARs and TBCs for the site are identified.

3.7.1 Chemical-Specific ARARs and TBCs

Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the determination of numerical values that establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. In general, chemical-specific requirements are set for a single chemical or a closely-related group of chemicals. These requirements do not consider the mixture of chemicals. Because there are no promulgated federal or state criteria for contaminated soil or sludge, no chemical-specific ARARs were identified for the site. However, several chemical-specific TBCs were identified.

The EPA Region IX Preliminary Remediation Goals, EPA's OSWER Directive *Approach to Addressing Dioxin in Soil at CERCLA and RCRA Sites*, and the NHDES RCMP Method 1 soil standards and background concentrations of metals in soils are among the TBCs that were used in the data evaluation and human health risk evaluation to identify potential contaminants of concern and develop PRGs. A summary of potential chemical-specific ARARs and TBCs for each removal action alternative is presented with the detailed analysis of each alternative (Section 5.0).

3.7.2 Location-Specific ARARs and TBCs

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances, or the conduct of activities solely because they are performed in specific areas. The general types of location-specific ARARs that may be applied to the site are briefly described below.

Several federal and state ARARs regulate activities that may be conducted in wetlands and floodplains. These regulations and requirements may apply because portions of the site are either occupied by wetlands or are situated in the 100-year floodplain. The Wetlands Executive Order (E.O. 11990) and the Floodplains Executive Order (E.O. 11988), incorporated into 40 CFR Part 6, Appendix A, require that wetlands and floodplains be protected and preserved, and that adverse impacts be minimized. Section 404 of the Clean Water Act and state wetland protection regulations restrict activities that adversely affect wetlands and waterways.

Additional location-specific ARARs include the Fish and Wildlife Coordination Act, which requires that any federal agency proposing to modify a wetland or body of water must consult with the U.S. Fish and Wildlife Service. Regulations governing endangered species at the federal and state levels would need to be considered for any proposed on-site actions, if such species are encountered. A summary of potential location-specific ARARs and TBCs for each removal action alternative is presented with the detailed analysis of each alternative (Section 5.0).

3.7.3 Action-Specific ARARs and TBCs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are generally focused on actions taken to remediate, handle, treat, transport, or dispose of hazardous wastes. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be implemented. The general types of action-specific ARARs that may be applied to removal actions at the site are briefly described below.

Most action-specific ARARs fall into three primary categories: federal and state regulations pertaining to the Clean Water Act (CWA), Clean Air Act (CAA), and Resource Conservation and Recovery Act (RCRA). CWA ARARs generally regulate the discharge of treated groundwater. CAA requirements typically pertain to air emissions from hazardous waste treatment operations. RCRA ARARs typically establish design, operating, and monitoring requirements for hazardous waste treatment facilities. A summary of potential action-specific ARARs and TBCs for each removal action alternative is presented with the detailed analysis of each alternative (Section 5.0).

The determination of whether RCRA regulations are applicable or relevant and appropriate is contingent on whether site sludge/waste is classified a RCRA hazardous waste. In April of 2002, the NHDES completed an updated hazardous waste determination for site sludge/waste using data gathered during the EE/CA field investigation. The data and the NHDES determination support the current assumption that sludge/waste from the site would not be considered a RCRA hazardous waste. However, based on the reactive sulfide concentrations found in Area 1 during the EE/CA investigation, it is possible that sludge/waste may be encountered in this area during implementation of the NTCRA that could be considered hazardous. Although it does not appear likely that the sludge/waste at the site will be classified as RCRA hazardous, a final decision on the regulatory status of the sludge/waste will be made during implementation of the removal action based on the results of the waste characterization samples collected from sludge/waste stockpiles during excavation.

For the purposes of identifying ARARs for removal alternatives in the EE/CA, it is assumed that sludge/waste would not be classified as a hazardous waste. Therefore several of the action-specific ARARs pertaining to hazardous wastes are considered relevant and appropriate rather than applicable. If characterization sampling and analysis performed during the removal action determines that sludge/waste must be classified as hazardous, the status of these action-specific ARARs would change to applicable.

4.0 DEVELOPMENT OF REMOVAL ACTION ALTERNATIVES

This section presents the rationale for developing removal action alternatives that address the removal action objectives (RAOs) presented in Section 3.0, and provides descriptions of the assembled removal action alternatives. The development of removal alternatives consists of identifying statutory and policy considerations, formulating a list of potential technologies and process options, evaluating the ability of technologies and process options to achieve RAOs, and assembling selected technologies and process options into removal action alternatives. The detailed evaluations of alternatives and associated costs are presented in Section 5.0.

The following subsections detail the key factors or considerations used in the formulation of potential technologies and process options and the development of removal action alternatives.

4.1 Statutory, Policy, and Other Considerations

Statutes and policies identified and reviewed to help evaluate potential technologies and formulate the range of removal action alternatives are presented in the following narrative.

4.1.1 Statutory Considerations

Removal action alternatives were developed in accordance with the NCP (40 CFR 300.415) requirements for assessing and selecting response actions. The NCP (40 CFR 300.415(c)) encourages the development of alternatives that, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the release concerned. The NCP (40 CFR 300.415(d)) also identifies appropriate removal actions that address risks to the public health or welfare, or the environment including:

- Establishing site control and security measures.
- Installing drainage controls to reduce or prevent contaminant migration.
- Capping to prevent contact and reduce contaminant migration.
- Using chemicals or materials to prevent or mitigate contaminant releases.

- Excavating, consolidating, or removing highly contaminated soils to reduce direct contact with or spread of contamination.
- Containing, treating, disposing, or incinerating hazardous materials.

Section 121(b) under CERCLA (and amendments) expresses the preference for treatment over conventional containment or land disposal to address a principal threat at a site. This preference for treatment appears to apply to remedial actions, but the overall philosophy is also appropriate for removal actions. Where viable, the preference for treatment over disposal will be considered for this EE/CA.

4.1.2 Policy, Guidance, and Other Considerations

The Superfund Accelerated Cleanup Model (SACM) policy is a process change for all Superfund activities, consistent with the NCP and CERCLA, to take early actions that achieve prompt risk reduction and increase the overall efficiency of site responses. Early actions at the site to address contaminated sludge/waste would prevent potential human and ecological direct exposures and mitigate excessive health risks. Early actions would also prevent further contaminated media transport during flood occurrences. Consideration for early action will be given during the development of removal action alternatives.

4.1.3 Hazardous Waste Determination Considerations

As noted in Section 3.7.3, based on site data and an April 2002 hazardous waste determination for site sludge/waste completed by NHDES, it does not appear likely that the sludge/waste at the site will be classified as RCRA hazardous. However, based on the reactive sulfide concentrations found in Area 1 during the EE/CA investigation, it is possible that sludge/waste may be encountered in Area 1 during implementation of the NTCRA that could cause the material be considered hazardous.

The RCRA classification of the sludge/waste could have considerable impacts on the implementability and cost of the removal action. A hazardous waste determination would require that sludge/waste be disposed of at a RCRA Subtitle C landfill, and could potentially make applicable RCRA land disposal standards for dioxin-containing material as defined in 40

CFR 268.31. As a result, scenarios under which the material from Area 1 would be considered a RCRA hazardous waste were included in the EE/CA. The final determination of the regulatory status of the sludge/waste will be made based on the results of the waste characterization samples collected from sludge/waste stockpiles during implementation of the removal action.

4.1.4 Floodplain Considerations

As depicted on Figure 1-3, part of Area 2 resides within the 100-year floodplain. The base flood elevation is approximately 131 feet above MSL along the Nashua River at the west end of the site. The Area 1 open lagoon is not located within the 100-year floodplain due to the elevation of the manmade soil berm located along its perimeter; however the top of the sludge in the lagoon is below the 100-year floodplain. If the berm were to be breached, the Area 1 lagoon would also be located within the 100-year floodplain.

The floodplains and the flood storage capacity of the site will be considered in the development of removal action alternatives. Executive Order 11988 requires that remedial alternatives be evaluated to avoid the effects of incompatible development in floodplains, and to minimize potential harm to floodplains if the only practicable alternative requires siting an action in a floodplain. The order also provides opportunities for public review.

For the purpose of the EE/CA, the potential impact (loss of flood storage capacity) of each alternative will be briefly evaluated, where applicable. Once a removal action alternative is selected for the site, a formal floodplains assessment, if necessary, will be completed to accurately estimate impacts to the floodplain capacity, effects of construction/excavation on the floodway, and determine whether impedances exist to flood conveyance. Based on those findings, options for developing compensatory flood storage capacity may be established.

4.1.5 Wetlands Considerations

TtNUS performed an ecological survey of the Mohawk Tannery Site during the summer of 2001, which included a wetland delineation. As described in Section 1.4.5, two wetland areas were identified onsite (see Figure 1-3). Both of the identified wetland areas are located on the undeveloped, southern parcel of the Mohawk Tannery property and are not likely to be impacted by removal actions at the site. The Area 1 open lagoon is not considered a jurisdictional wetland.

4.1.6 Considerations for Future Use of the Mohawk Tannery

The intended future use of the Mohawk Tannery site includes restoration of the property for residential purposes. One of the RAOs developed for the EE/CA addresses this objective. The alternatives evaluated under the EE/CA will consider future use of the site for residential purposes in analysis of effectiveness.

4.2 General Response Actions, Technology Types, and Process Options

General response actions were identified for the site that would address the removal action objectives. Technologies and process options corresponding to the general response actions were identified based on the nature of chemicals to be addressed; their effectiveness in reducing contaminant mobility, toxicity, and volume; and statutory and guidance considerations. Removal action objectives, general response actions, technology types, and process options that are potentially applicable to the contaminated sludge and soil at the site are presented on Table 4-1.

4.3 Screening of Technologies and Process Options

The technology types and process options identified on Table 4-1 were screened according to their potential effectiveness and implementability for treating site sludge/soil waste. The evaluation considered site-specific factors such as ability to meet removal action objectives, the nature of contaminated media, moisture content of sludge, contaminants present, location of wastes within the 100-year floodplain, and proximity to residential areas. A summary of screening results is presented on Table 4-2. Technology and process options that passed the screening are identified below:

- Off-Site Landfill
- On-Site Landfill

- Incineration (off-site)
- Stabilization (potentially applicable for treatment residuals following thermal treatment)

These technologies and process options were used to form a range of viable removal action alternatives that address the removal action objectives. The assembled alternatives provide a range of options for risk reduction through on-site and off-site containment and treatment alternatives. A description of the rationale used to assemble removal action alternatives and detailed descriptions of the identified alternatives are provided in the following sections.

4.4 Rationale for Development of Removal Action Alternatives

The screening of technologies and process options concluded that ex-situ treatment and/or disposal options were the most feasible considering the nature (contaminant type, moisture content) and extent (60,000 CY, portions located below the groundwater table) of sludge/waste observed at the site and the location of the majority of the waste (within the 100 year floodplain of the Nashua River). Therefore, excavation using common construction techniques would be part of any removal action implemented under the EE/CA.

Three alternatives were developed to provide a range of on-site and off-site containment and treatment options. Off-site landfill disposal was retained as an effective, implementable containment alternative. Disposal in a newly constructed on-site landfill was retained to provide an on-site alternative to off-site disposal. Finally, a third alternative was assembled to provide an option that would treat all the waste. This alternative is the only one that would satisfy the statutory preference for treatment. Due to the nature of contaminants and the moisture content of sludge/waste, incineration (off-site) was the selected treatment option.

4.5 Descriptions of Removal Action Alternatives

The three removal alternatives were developed by assembling the various response technologies and treatment options retained in the screening presented in Section 4.3. The alternatives are consistent with the guidelines identified in the NCP (40 CFR 300.415 (d)) and address the RAOs established for the site:

- Alternative 1 involves the excavation of contaminated sludge/waste, and transportation and disposal in an EPA-approved off-site landfill facility.

- Alternative 2 involves the excavation and consolidation of excavated sludge/waste into a lined on-site landfill designed to reduce leaching of contaminants and prevent direct exposure to contaminated sludge/waste.

- Alternative 3 involves the excavation of sludge/waste and transportation to an off-site incineration facility.

As discussed in Section 4.1.3, the regulatory classification of the sludge/waste could have considerable impacts on the implementability and cost of the removal action. As a result, each of the above alternatives was evaluated under various scenarios based on the nature and regulatory status of the sludge/waste. Based on data from the EE/CA field investigation, it is assumed that only sludge from Area 1 would be impacted by the final waste determination.

The RCRA waste status of the sludge/waste would directly impact only the off-site and on-site disposal alternatives. Therefore, Alternatives 1 and 2 were evaluated under the following three potential regulatory scenarios:

- Scenario A – All sludge/waste classified as non-hazardous
- Scenario B – Area 1 sludge classified as hazardous, land ban for dioxin-containing material not applicable
- Scenario C – Area 1 sludge classified as hazardous, land ban for dioxin-containing material applicable

Implementability and cost issues for the off-site incineration alternative are not necessarily related to regulatory status, but to the differing availability of incinerators in the United States and Canada that are able to accept dioxin-containing material. Because use of incineration facilities in the U.S. and Canada has different implementability condsiderations and costs, Alternative 3 was evaluated under the following two scenarios:

- Scenario 3-US – All sludge/waste treated and disposed at a U.S. incineration facility

- Scenario 3-CAN – All sludge/waste treated and disposed at a Canadian incineration facility

Detailed descriptions of the three alternatives are presented in the following sections. Several aspects of the removal are the same for all three alternatives. These are discussed in detail in the Alternative 1 description only. Then the variations or differences from Alternative 1 are presented in descriptions of the other two removal action alternatives.

4.5.1 Alternative 1 – Excavation and Off-Site Disposal

Alternative 1 features the excavation, transportation, and off-site disposal of contaminated sludge/waste. All sludge/waste containing concentrations of contaminants in excess of PRGs would be excavated and transported to an EPA-approved, off-site landfill facility. The estimated volume of sludge/waste requiring removal and disposal would be as presented in Section 3.4. Engineering controls would be implemented during the removal action to minimize the impact to human health and the environment during excavation. Excavated areas would be backfilled with overlying soil and/or clean common fill and revegetated.

The key features of Alternative 1 are identified on Table 4-3. The Alternative 1 site implementation layout is depicted in Figure 4-1. The following is a description of the key aspects of this alternative.

i. <u>Pre-Design Investigation (PDI)</u>

Prior to the implementation of Alternative 1, it may be necessary to conduct a PDI to verify the effectiveness and assist in the design of any sludge pre-treatment techniques that would be required to manage the high moisture content and strong sulfide odors that are characteristic of site sludge. Pre-treatment would be used to prepare excavated sludges in the stockpiling/staging area so that they will be suitable for transportation and disposal. The effectiveness of air treatment/odor control technologies may also need to be verified during the PDI. These technologies will be an integral part of the engineering controls that will be used to control sulfide odors and contaminant emissions during excavation. The objective of the PDI would be to determine the optimal reagent mixtures and volumes required to adequately control moisture and odor concerns during excavation and handling of sludge/waste.

The PDI might also include an evaluation of potential dewatering options that may be used during excavation of sludge/waste from below the water table. This evaluation may include aquifer testing to provide a basis for the estimation of recharge rates, and volume of water requiring removal, that would be expected during excavation. Groundwater samples would be collected and analyzed during the PDI to determine the need for pretreatment of dewatering effluent prior to discharge to the city sewer system.

ii. **Mobilization**

Field project personnel, field support services, and subcontractor personnel and equipment would be mobilized prior to the initiation of site work. Equipment and support facilities to be employed may include:

- Field office trailer, storage trailers, and sanitary facilities.
- Heavy equipment (excavator, backhoe, dump trucks, bulldozer, odor control equipment, vibratory compactor, etc.).
- Health and safety, sampling, and decontamination equipment.
- Subcontractor equipment needed for clearing and grubbing, excavation, and waste management.
- Utility extension/hook-ups (including telephone, electricity).

iii. **Site Preparation**

As mobilization of personnel, equipment, and materials to the site commences, site preparation activities would be implemented to prepare for the subsequent construction activities. Some of the site preparation activities, such as the installation of erosion and sedimentation controls, may occur simultaneously with mobilization activities. Erosion and sedimentation controls would be installed prior to the implementation of other site preparation activities.

Silt fences, hay bales, and other erosion control measures would be installed, as necessary, along the edges of the cleared/disturbed areas of the site, around any sludge/waste or soil stockpiles, and around the decontamination pads. A reinforced silt fence and hay bales would be placed along the Nashua River prior to any earth moving activities. Other site controls would be implemented, as necessary, to minimize impacts to the environment resulting from excavation and stockpiling activities.

Following the installation of erosion control measures, clearing and grubbing of site vegetation and demolition/removal of any obstructions would be performed to facilitate earth moving, construction of site improvements (access road, stockpiling areas), and hauling.

In order to accommodate the heavy truck traffic that would be required to haul contaminated sludge/waste off site, a site access road would be constructed to provide a direct route from the site to Broad Street and Route 3 (Figure 4-1). The proposed access road would leave the site at the existing truck gate at the north end of the site between Area 5 and the gravel pit. The road would run to the west of the Fimbel Landfill, around the Fimbel Door Company Building, and onto Broad Street less than one-half mile from Route 3. The access road would improve access to major roadways in the site vicinity, while alleviating potential short-term impacts from truck traffic through the residential neighborhoods located along the current site access route (Fairmont Street). Construction of the road would primarily involve the improvement of existing roads or rights-of-way. Pavement on the Fimbel Property would be reinforced or reinstalled, and unpaved road surfaces would be improved with compacted gravel fill.

Existing on-site roads would be graded and improved to improve access to disposal areas and facilitate loading and transportation of sludge/waste and soil throughout the site. Crushed stone and gravel would be placed, graded, and compacted to provide a suitable surface. Appropriate locations would be identified for the decontamination pads and the soil/sludge stockpiling and staging areas so that the haul road is optimally designed.

Prior to excavation activities in Area 1, the wood-frame clarifier building located to the north of the lagoon would be demolished. Demolition of this building would improve the access for excavation and hauling equipment to the northern portion of the lagoon. A reinforced concrete clarifier tank is currently located inside of the building. This tank was emptied during a time-critical removal action in late 2000, but has since been partially refilled by groundwater seepage. Evacuation and removal of the clarifier tank would be performed prior to building demolition.

iv. Excavation and Backfill

All sludge/waste determined to contain concentrations of contaminants exceeding PRGs (see Section 3.0) would be excavated using common construction equipment (bulldozers, scrapers, hydraulic excavators, etc.). For the EE/CA, it is estimated that approximately 60,000 cubic yards of contaminated sludge/waste would require excavation. This volume includes an estimated quantity of waste or fill that was not readily identifiable as tannery sludge, but was determined to contain contaminants in excess of PRGs. Excavated sludge/waste would be staged on-site in a predetermined stockpiling location. Overlying soil excavated from Disposal Areas 2, 3, 4, and 6 (approximately 9,500 CY) would be segregated from sludge/waste during excavation and staged in a separate stockpile area.

Prior to commencing excavation in Area 1, all surface water would be pumped from the lagoon and staged in a portable water storage tank on the site, sampled and analyzed. Contingent on the results of laboratory analysis, the surface water would be discharged to the Nashua wastewater treatment plant via the onsite sewer line. Because excavation of contaminated sludge in Areas 1 and 2 (and possibly Area 3) will likely extend below the water table into saturated sludge, excavation and removal of sludge/waste in these areas would require the design of an in-situ dewatering system. During removal of saturated sludge, standing water from the open excavation would be pumped into a fractionation tank where solids would be allowed to settle. Water from the fractionation tank would be transferred into a second tank from which samples would be collected and analyzed. Contingent on the results of laboratory analysis, dewatering effluent would be discharged to the Nashua wastewater treatment plant via the onsite sewer line. It is assumed that the surface water from the lagoon and the dewatering effluent would not require additional treatment (other than settling) prior to discharge to the sewer line.

As warranted, engineering controls would be implemented during excavation activities to prevent odors and fugitive dust emissions. Odor control technologies and other controls such as dust suppressants and water sprays would be applied as appropriate during excavation, hauling, and handling to suppress odors and dust. A conceptual design for the odor control system that would be used at the point of excavation and possibly in the sludge/waste stockpiling area is presented below. Many of the design details will have to be developed during the pre-design investigation or during implementation of the removal action, but a general description of the system was developed for the EE/CA.

Sulfide odors would be neutralized during excavation of sludge/waste through the delivery of an atomizing mist to the active excavation area. The mist would consist of a solution of potable water mixed at varying ratios (depending on the strength of the odor) with an atomizing reagent. The odor control solution would be delivered to the excavation area through a nozzle line installed at the perimeter of the active excavation area. The nozzle line would contain up to several hundred nozzles, and would be placed to optimize coverage of the area of concern.

A self-contained trailer-mounted system with a 535-gallon water tank, a mixing tank, and a diesel powered generator would likely be used to deliver the reagent solution to the nozzle line. An injection pump would be used to inject the atomizing reagent into the water flow at any desired dilution rate, so that the dilution ratios could be easily varied depending on the strength of the odors in a given area.

Due to high moisture contents observed during the EE/CA field investigation and likelihood of excavation below the water table, it is likely that an ex-situ dewatering system will be needed in the sludge/waste stockpiling area to prepare excavated media for transport and disposal. This would be accomplished through the construction of a concrete pad with water collection sumps to be used for the sludge/waste handling and stockpiling area. Free water released from excavated sludge that is collected in the sumps would be pumped into the fractionation tank, along with water generated from excavation activities below the water table. Once solids are allowed to settle and water is transferred to the storage tank, samples would be collected and analyzed. Pending the results of analysis, this water would be discharged to the onsite sewer line.

Additional moisture control measures, such as the addition of bulking agents (i.e. lime), would be taken to provide further moisture reduction during stockpile handling and maintenance, if necessary. The need for addition of bulking agents would be dependent primarily on the moisture content of sludge/waste as it is placed in the stockpile area and the moisture requirements for transport and disposal of the sludge at the landfill. Odor control is not expected to be a significant factor for transport and disposal. Therefore, if the material meets the moisture requirements for transport and disposal without lime addition, odors in the stockpile area would likely be controlled using atomizing mist to neutralize odors. The anticipated demand for lime or other bulking agents would be assessed through the performance of a pre-design investigation and/or through periodic assessment of conditions during the removal action and communication with the disposal facility during transportation and disposal.

Sludge/waste would be segregated in the stockpiling area pending the results of waste characterization analysis. Excavation limits within each disposal area would initially be determined through visual observation, if possible, and subsequently confirmed through the collection of soil samples from the bottom and sidewalls of the excavations. Excavation will proceed to the bottom of sludge/waste (with concentrations in excess of PRGs) or to the designed depth within each excavation area.

The excavation would be conducted in stages to limit the size of open excavations, minimize delays related to confirmation sampling, and avoid disturbing important site features such as the sewer intercepter that runs along the western side of Areas 1 and 2. Once the final extent of excavation in an area (or sub-area) has been reached and confirmed, the excavation would be backfilled. Overlying soil would be loaded and hauled from the soil stockpiling area and used to backfill the bottom of the excavation. Clean, common fill would be imported to the site and used to complete the backfill of each excavation. The backfill would be placed, compacted, graded, and vegetated. At the conclusion of the removal action, a topographic survey would be performed to facilitate the preparation of as-built drawings.

Air monitoring for odorous sulfides, particulate matter, and other likely contaminants of concern would be performed on-site and at the site perimeter as needed, during the removal action to ensure that impacts to workers and neighboring residents are minimized. A detailed air monitoring plan, identifying contaminants of concern and monitoring/sampling methods, locations, and frequency will be developed prior to implementing the removal action. If air contaminants are detected during the removal action, emission control measures would be reassessed and modified as necessary.

v. **Transportation and Off-Site Disposal**

Once sludge/waste has been hauled to the stockpiling areas, engineering measures would be taken to prepare the sludge/waste for loading, transport, and disposal. Pretreatment measures such as the addition of drying agents and odor control agents, as discussed above, would be used to manage moisture and odor issues that would compromise transportation and disposal efforts.

Stockpile samples of sludge/waste would be collected at a rate of one sample per 500 tons for waste characterization. Subsequent to waste characterization analysis, stockpiled sludge/waste would be loaded onto 20-cubic yard dump trailers and transported to an EPA-approved off-site disposal facility.

It is assumed that waste characterization samples will confirm that sludge/waste is suitable for disposal at a RCRA Subtitle D landfill. However, for costing purposes under the EE/CA, cost scenarios have been evaluated for the potential that sludge from Area 1 is determined to be hazardous, requiring disposal at a RCRA Subtitle C (hazardous waste) landfill. Additionally, a hazardous waste determination for Area 1 sludge may also make applicable the RCRA land disposal standards for dioxin-containing waste (40 CFR 268-31), in which case disposal in a Canadian landfill would be the most viable disposal option. This option is addressed under a second contingency alternative. Land disposal considerations related to the classification of sludge/waste, and the implications they would have on the implementability and cost of Alternative 1 are discussed in Section 5.0.

vi. **Site Restoration**

Following completion of the excavation and backfill activities, cleared or denuded areas would be graded and revegetated by hydroseeding to reduce erosion and sediment transport.

vii. **Flood Storage Capacity Restoration**

All excavations would be backfilled to an elevation no higher than the original grade and at certain locations it may be appropriate to backfill to below the original grade. As a result, there would be no net increase in the elevation of the land surface resulting from the implementation of this alternative. Therefore, the flood storage capacity of the site would not be reduced and in fact may be increased if some of the areas within the floodplain are backfilled to a final elevation below the original grade.

viii. **Post-Removal Site Control (PRSC)**

The site would be inspected on a quarterly basis for the first 2 years (for EE/CA costing purposes) following the removal action. The site inspection would focus on the integrity of new vegetation and erosion controls.

4.5.2 Alternative 2 – Excavation and Consolidation into On-Site Landfill

Alternative 2 features the excavation and consolidation of contaminated sludge/waste into an on-site landfill. This alternative is similar to Alternative 1, except that sludge/waste is not transported to an off-site landfill, but consolidated on-site into a newly constructed landfill designed to meet all applicable state and federal requirements.

The design requirements for solid waste landfills (NH Env-Wm 2500) and hazardous waste landfills (RCRA Subtitle C) are very similar, both requiring a double liner, leachate collection and removal system, leak detection system, and stormwater management system. However, the criteria for hazardous waste landfills are somewhat more conservative, specifying a double leachate collection system, wind dispersal controls, and a construction quality control program. Because of the uncertainty of the final waste determination, the possibility that characterization sampling during excavation could result in portions of the sludge/waste being classified as hazardous, and the similarity in design requirements for solid and hazardous waste landfills, it was determined that the on-site landfill should be designed to meet the substantive requirements for both solid and hazardous waste landfills.

The key features of Alternative 2 are identified on Table 4-3. The Alternative 2 site implementation layout is depicted in Figure 4-2, and the conceptual design of the landfill liner and cover systems are presented on Figure 4-3. The following sections describe the key aspects of Alternative 2, with only those aspects that vary from Alternative 1 described in detail.

i. **Pre-Design Investigation (PDI)**

All of the components of the PDI that are mentioned in the description of Alternative 1 would be included in the PDI for Alternative 2. The effectiveness of moisture and odor control technologies would be the primary focus of the PDI, so that the on-site landfill would be compliant with all state and federal requirements and provide minimal impact to current and future neighboring residents.

ii. **Mobilization**

Personnel, equipment, materials, and subcontractors would be mobilized to the site as previously described for Alternative 1. Additional earth-moving equipment and materials would be mobilized to the site to construct the on-site landfill liner system and manage sludge/waste as it is placed into the landfill.

iii. **Site Preparation**

As mobilization of personnel, equipment, and materials to the site commences, site preparation activities would be implemented to prepare for the subsequent construction activities as described in Alternative 1. Similar to Alternative 1, a new site access road would be constructed to provide a direct route from the site to Broad Street and Route 3 for trucks delivering landfill construction materials to the site, and existing on-site roads would be graded and improved to facilitate loading and transportation of sludge/waste and soil throughout the site (Figure 4-2).

Additional site preparation activities unique to Alternative 2 include preparation of the area where the landfill will be located and construction of the landfill liner, which would be completed prior to any excavation activities. A more detailed description of the landfill construction is provided below.

iv. On-Site Landfill Construction

Prior to excavation of sludge/waste, a landfill liner system designed to meet applicable state and federal requirements for solid waste and hazardous waste landfills would be constructed as a consolidation cell for excavated media. The landfill would be sited in a manner that would comply with state and federal siting requirements, to the extent practicable, in order to minimize impacts to the environment and to current and future residents in the site vicinity. The area selected for landfill construction would be cleared, graded, and prepared to provide sufficient structural stability for the life of the landfill.

The on-site landfill would be underlain by a two-liner system designed to prevent any migration of wastes from the landfill to soil or groundwater in the adjacent area. Each liner would consist of a layer of low permeability soil overlain by a 60-mil high-density polyethylene (HDPE) liner. Primary and secondary leachate collection and removal systems would be constructed immediately above the upper and lower HDPE liners, respectively. These systems would be constructed of coarse-grained soil and sloped toward the perimeter of the landfill to facilitate the collection and removal of water that has passed through the sludge/waste layer. The secondary leachate collection and removal system, located immediately above the lower liner, would function as a leak detection system and would be utilized only in the event that the primary upper landfill liner has been breached. A visual depiction of the conceptual design of the landfill liner system is presented on Figure 4-3.

v. **Excavation and Backfill**

Excavation and backfill activities would be performed in the same manner, with the same quantity of sludge/waste, as described for Alternative 1. The only difference in operations would be that sludge/waste would not be hauled for off-site disposal, but instead hauled directly to the on-site landfill after the addition of any necessary amendments for moisture and odor control. As discussed for Alternative 1, a hazardous waste determination for sludge originating in Area 1 may trigger RCRA land disposal standards for dioxin-containing waste. In the event that waste characterization samples collected during the removal action indicate that sludge from Area 1 is governed by land disposal restrictions for dioxins, disposal in a Canadian landfill would be the most likely course of action. Land disposal considerations related to the classification of sludge/waste and the implications they would have on the implementability and cost of Alternative 2 are discussed in Section 5.0.

vi. **Landfill Cover Construction and Site Restoration**

Following the consolidation of site sludge/waste into the on-site landfill, the landfill would be capped to reduce leachate generation by limiting the infiltration of precipitation and/or surface water. A low permeability cover would be placed on top of the consolidated sludge/waste. The cover would be designed according to applicable standards to promote drainage of stormwater and other surface waters away from the landfill, limit erosion and sedimentation, control the release of odors, and prevent direct contact with consolidated material by future site users. The landfill cover would consist of a gas venting layer, a clay layer, a 60-mil HDPE liner, a soil cover, and a surface layer of topsoil vegetated to resist erosion. A visual depiction of the conceptual design of the landfill cover system is presented on Figure 4-3.

Following completion of excavation and backfill activities, cleared or denuded areas would be graded and revegetated by hydroseeding to reduce erosion and sediment transport. The final grade of the on-site landfill would be designed to blend with the surrounding topography. The perimeter of the on-site landfill would be fenced to prevent unauthorized entry, posted with signs, and secured at all access points.

vii. **Flood Storage Capacity Restoration**

Since the on-site landfill would not be constructed within the 100-year floodplain, it would not impact the flood storage capacity of the site. All excavations would be backfilled to an elevation no higher than the original grade and at certain locations it may be appropriate to backfill to below the original grade. As a result, there would be no net increase in the elevation of the land surface in the floodplain resulting from the implementation of this alternative. Therefore, the flood storage capacity of the site would not be reduced and in fact may be increased if some of the areas within the floodplain are backfilled to a final elevation below the original grade.

viii. **Post-Removal Site Control (PRSC)**

Subsequent to completion of the removal action, a post-closure care plan would be instituted to ensure the proper operation and maintenance of the landfill. The landfill would be inspected for evidence of deterioration or malfunction of run-off control systems or leachate collection and removal systems. Air sampling would be conducted to monitor air emissions from the landfill. Groundwater monitoring wells would be installed upgradient and downgradient of the landfill, and sampled periodically to assess the effectiveness of the landfill liner system. Other routine maintenance activities such as mowing, seeding, fertilizing, and repairing the landfill cover would also be part of the post-closure care plan. It is assumed that post-closure care activities would be performed on a monthly basis for the first 2 years, on a quarterly basis during years 3 to 5, and on a semi-annual basis thereafter. For costing purposes, it is assumed that the post-closure care period would be 30 years in duration.

The rest of the site would be inspected on a quarterly basis for the first 2 years following the removal action, as described for Alternative 1. This portion of the site inspection would focus on the integrity of new vegetation in the excavated areas and erosion controls.

4.5.3 Alternative 3 – Excavation, Off-Site Treatment and Disposal

Alternative 3 features the excavation and stockpiling of sludge/waste as described for Alternative 1. The difference between the two alternatives is that stockpiled sludge/waste would be loaded and transported to an off-site treatment, storage, and disposal facility (TSDF). Based on the screening of ex-situ treatment options, incineration would be the selected treatment method. Treatment residuals would be disposed of in a hazardous waste or solid waste landfill depending upon their hazardous waste characterization.

The key features of Alternative 3 are identified on Table 4-3. The Alternative 3 site implementation layout is depicted in Figure 4-1.

i. **Pre-Design Investigation (PDI)**

PDI activities required for Alternative 3 would be similar to those described for Alternative 1.

ii. **Mobilization**

Personnel, equipment, materials, and subcontractors would be mobilized to the site as previously described for Alternative 1.

iii. **Site Preparation**

As mobilization of personnel, equipment, and materials to the site commences, site preparation activities would be implemented to prepare for the subsequent construction activities as described in Alternative 1.

iv. **Excavation and Backfill**

Excavation and backfill activities and procedures would be the same as described for Alternative 1.

v. **Transportation, Off-Site Treatment, and Disposal**

As described for Alternative 1, engineering controls would be used to manage moisture and odor issues in the sludge/waste stockpile area. Sludge/waste would be loaded onto trucks and transported to an off-site TSDF, where it would be incinerated. Treatment residuals would be characterized and disposed of at the TSDF. For the purposes of this EE/CA, it is assumed that a domestic incinerator would be permitted and available to accept dioxin-containing waste. TtNUS has identified at least one U.S. facility that would accept such waste pending final characterization and waste determination. However, an alternative cost estimate has been provided for the case where a Canadian incinerator is the only available treatment option due to the dioxin content of sludge/waste and its RCRA characterization. A further discussion of the implementability and cost of Alternative 3 is presented in Section 5.0.

vi. Site Restoration

Following completion of the excavation and backfill activities, cleared or denuded areas would be graded and revegetated by hydroseeding to reduce erosion and sediment transport.

vii. Flood Storage Capacity Restoration

All excavations would be backfilled to an elevation no higher than the original grade and at certain locations it may be appropriate to backfill to below the original grade. As a result, there would be no net increase in the elevation of the land surface resulting from the implementation of this alternative. Therefore, the flood storage capacity of the site would not be reduced and in fact may be increased if some of the areas within the floodplain are backfilled to a final elevation below the original grade.

viii. Post-Removal Site Control (PRSC)

The site would be inspected on a quarterly basis for the first 2 years (for EE/CA costing purposes) following the removal action. The site inspection would focus on the integrity of new vegetation and erosion controls.

5.0 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The analysis of alternatives provides information to facilitate the selection of a specific removal action option. The alternative analysis was developed in accordance with the EPA Guidance on Conducting NTCRAs under CERCLA (OERR Publication No. 9360.0-32, EPA/540-R-93) and the NCP. Section 5.1 provides an overview of the evaluation criteria used in the detailed analysis. Removal action alternatives are evaluated individually in Section 5.2. Section 5.3 presents a comparative analysis of removal alternatives. Section 5.4 presents the recommended removal action for the site.

5.1 Alternatives Evaluation Criteria

In conformance with the NTCRA guidance, the following three criteria and their components were used to evaluate each of the removal action alternatives developed in the previous section:

1. Effectiveness
   - overall protection of human health and the environment
   - compliance with ARARs
   - long-term effectiveness and permanence
   - reduction of toxicity, mobility, or volume through treatment
   - short-term effectiveness

2. Implementability
   - technical feasibility
   - administrative feasibility
   - availability of services and materials
   - state acceptance
   - community acceptance

3. Cost
   - direct and indirect capital costs
   - post-removal site control (PRSC) costs

5.2 Individual Analysis of Removal Action Alternatives

Three removal action alternatives were developed, as described in Section 4.0, to address contaminated sludge/waste located in Disposal Areas 1, 2, 3, 4, 6, and 7. Detailed evaluations of each alternative using the three criteria established above are presented in this section. The state and community acceptance criteria would be further addressed following receipt of comments during the public comment period.

As discussed in Section 4.0, each alternative was evaluated under various scenarios based on the hazardous waste classification of the sludge/waste or the location of the treatment facility. The Alternatives evaluated for the EE/CA are as follows:

Alternative 1 – Excavation and Off-Site Disposal

- 1A – All sludge/waste classified as non-hazardous
- 1B – Area 1 sludge classified as hazardous, land ban for dioxin-containing material not applicable
- 1C – Area 1 sludge classified as hazardous, land ban for dioxin-containing material applicable

Alternative 2 – Consolodation into On-Site Landfill

- 2A – All sludge/waste classified as non-hazardous
- 2B – Area 1 sludge classified as hazardous, land ban for dioxin-containing material not applicable
- 2C – Area 1 sludge classified as hazardous, land ban for dioxin-containing material applicable

Alternative 3 – Excavation, Off-Site Treatment, and Disposal

- 3-US – All sludge/waste treated at a U.S. incineration facility
- 3-CAN – All sludge/waste treated at a U.S. incineration facility

In the detailed analysis provided below, the sub-scenarios (e.g. 1B or 3-US) are cited where the waste classification or treatment facility location would have an impact on the specific evaluation criteria. In instances where regulatory status or treatment facility location does not impact the evaluation criteria, the evaluation refers to the removal action alternative in general (e.g. Alternative 1, 2, or 3).

5.2.1 Alternative 1 – Excavation and Off-Site Disposal

Alternative 1 features the excavation and off-site disposal of contaminated sludge/waste at an EPA-approved off-site landfill.

Effectiveness

Alternative 1 would meet the removal action objectives of this NTCRA by preventing direct contact and ingestion of contaminated sludge/waste, preventing ecological receptor exposure to contaminants, preventing the migration of contaminants to groundwater and surface water, and restoring the site to a condition suitable for residential use. These objectives would be achieved through excavation and off-site disposal of all sludge/waste containing concentrations of contaminants exceeding PRGs. This alternative would also be consistent with long-term remedial actions for this site.

Overall Protection of Human Health and the Environment – By removing all sludge/waste from the site that exceeds PRGs and replacing it with clean material, Alternative 1 would prevent direct contact with and ingestion of contaminated sludge/waste by human and ecological receptors at the site. The excavation and removal of sludge/waste from the site would also prevent migration of contaminants to groundwater and the Nashua River through leaching, flooding, or sediment transport, thus protecting the groundwater, surface water, river sediments, and biological receptors. Through the removal of sludge/waste exceeding PRGs, and implementation of site restoration activities, this alternative would restore the site to conditions suitable for residential use.

While Alternative 1 would not reduce, control, or eliminate risk through treatment, overall risks to human health and the environment would be reduced and controlled through off-site landfill disposal. EPA's Off-Site Rule (40 CFR 300.440) requires that an off-site facility selected for treating, storing, or disposing of hazardous substances, pollutants, and contaminants generated as the result of a CERCLA response action be fully compliant with RCRA or other applicable federal and state requirements. Of specific concern to EPA is the presence of "relevant releases or relevant violations at a facility prior to the facility's initial receipt of CERCLA waste". To ensure that contaminated sludge/waste is disposed of properly so that the NTCRA is protective of human health and the environment, this alternative would be implemented consistent with the Off-Site Rule.

Compliance with ARARs – Alternative 1 would be designed and implemented to comply with all federal and state ARARs. A summary of ARARs as they pertain to Alternative 1 is presented on Tables 5-1 through 5-3.

Long-Term Effectiveness and Permanence – Under Alternative 1, the leaching of contaminants to groundwater, impacts to the environment, and exposure of ecological and human receptors to contaminated sludge/waste would be eliminated as the result of excavation and off-site disposal of all sludge/waste containing contaminant concentrations above PRGs. Excavation and off-site disposal would be effective in the long term, would be permanent, and would contribute to future remedial objectives.

Implementation of Alternative 1 would require limited PRSC to ensure the integrity of revegetation, erosion and sediment controls.

Reduction of Toxicity, Mobility, or Volume Through Treatment – Because treatment of contaminated media is not a featured component of Alternative 1, there would not be any reduction in the toxicity, mobility, or volume of contaminated materials through treatment or recycling. Contaminated media would instead be consolidated and disposed of off site. While treatment is not a featured component, this alternative would effectively reduce the mobility of contaminants into groundwater and the Nashua River through removal.

Short-Term Effectiveness – Implementation of Alternative 1 would be expected to have limited short-term impacts to the local community, workers, and the environment. Short-term impacts during on-site activities would be expected to last approximately 11 months.

Increased heavy vehicle traffic into and out of the site would be expected along Fairmount Street during mobilization of equipment and construction of the temporary site access road.

Vehicular access into the site would be through the Fairmont Street entrance during this phase of the project. Impacts to local residences are expected to be minimal, and would last approximately two weeks.

Subsequent to access road construction, heavy vehicle traffic would be concentrated along the road adjacent to the gravel pit and Fimbel Landfill, onto the Fimbel Door Company property, and onto Broad Street and Route 3 during mobilization, site preparation, contaminated sludge/waste transport, wetland re-creation, site restoration, and demobilization. Heavy traffic along this route might cause some inconvenience to local residents, property tenants along the access route, and traffic patterns on Broad Street near the terminus of the access road. To reduce the potential for accidents and/or traffic congestion due to heavy vehicles merging into traffic on Broad Street, it may be necessary to post warning signs and use traffic control flagmen. To prevent unwanted off-site conveyance of contaminated sludge/waste by vehicles that have entered on-site work areas, the vehicle bodies, undercarriages, and tires would be pressure washed at a designated decontamination station each time they leave the Mohawk Tannery property.

Excavation of contaminated sludge within each disposal area may result in the release of offensive sulfide odors. While it is unlikely that the excavation of sludge will present a fugitive dust problem, the excavation of overlying soil or improvement of site roads may result in the release of fugitive dusts bearing dioxins, SVOCs, metals, and particulates. Sulfides, fugitive dust, and particulate emissions would be monitored during excavation activities and would be controlled or reduced using odor control agents, water sprays, or other engineering controls. Appropriate health and safety protocol, including using personnel protective equipment (PPE) and securing work areas, would be developed and implemented to protect workers and community residents from airborne contaminants and particulates.

As with any construction activity, an increase in noise levels during the removal action would be expected. Efforts would be made to minimize the potential impact to the local community by working during normal work-day hours and coordinating with the nearby residents, if necessary.

Implementation of Alternative 1 would have some short-term impacts to the environment. Excavation of sludge/waste in Areas 1 and 2 would occur along the Nashua River and within the 100-year floodplain. Erosion control measures along the river, such as silt fencing and hay bales, would be necessary during excavation activities to prevent the migration of contaminated soils. Revegetation of excavated areas following backfill would prevent erosion of the streambank.

Implementation of Alternative 1 would result in the temporary alteration of the 100-year floodplain, but would not result in any permanent loss of flood storage capacity. If it is determined to be appropriate to backfill some areas to below the original grade, there may in fact be an increase in flood storage capacity.

Implementability

The following is a discussion of the implementability of Alternative 1.

Technical Feasibility – Alternative 1 would be technically feasible, but there would be some technical challenges associated with excavation of sludge/waste and access to the site.

Some difficulties would be anticipated during the excavation of sludge/waste below the water table (Areas 1, 2, and possibly 3). Excavation below the water table presents potential problems including unstable excavation sidewalls, which leads to sloughing of contaminated material into the bottom of the excavation. This makes confirmation of the vertical limits of excavation extremely difficult to determine (both visually and through analytical sampling). More importantly, excavation below the water table could have significant adverse impacts on excavation rates, and increase the time required for excavation. Without the benefit of a full characterization of the aquifer, at the conceptual design stage, it is assumed that excavation would proceed at 75 percent of normally assumed production rates due to the anticipated impact of excavation below the water table in Areas 1 and 2. Unfavorable weather or hydrogeological conditions could potentially decrease production rates even further. Dewatering would be implemented during excavation to minimize impacts as much as possible.

Weather conditions and seasonal variations in groundwater levels would play a significant role in the ease of implementation of the alternative. Therefore, the period between late summer and early winter would be most favorable for the initiation of removal activities, due to the higher probability of cooler and drier weather and the assumption that the water table would likely be at its seasonal low.

Another technical challenge would involve excavation of sludge/waste in the vicinity of the sewer interceptor that runs along the western side of Areas 1 and 2. Care would have to be taken during excavation to prevent damage to the sewer line. Accurate surveying and marking of the location of the interceptor and careful planning and execution of excavation in these areas would mitigate impacts. It is assumed that sludge/waste does not extend beneath the sewer line. Any sludge that does extend beneath the interceptor may have to be left in place to avoid structural damage to the line.

Another technical challenge will be controlling odors and moisture during the excavation and handling of sludge/waste. A PDI may be required prior to initiating sludge/waste excavation. The PDI could be used to aid in the selection and design of engineering controls that would be used to control odors and moisture during the excavation and handling of sludge/waste, including stockpiling activities and transportation to the disposal facility. No technical difficulties are anticipated with the implementation of the PDI. Use of data from a PDI would help minimize odor and moisture control problems during implementation.

Site access is an important technical consideration for Alternative 1. Currently, the only vehicle access point to the site is through the truck gate at the terminus of Fairmont Street. Access to Fairmont Street from Route 3 requires travel through densely populated residential neighborhoods. In order to implement Alternative 1, a temporary site access road would be constructed from Broad Street, alongside the Fimbel Door Company building, adjacent to the Fimbel Landfill, and entering the site from the north adjacent to Area 5. Construction of the access road would be technically feasible, provided that property access agreements were reached with landowners located along the proposed route for the access road.

Another technical consideration for Alternative 1 is the proximity of the Nashua River. Because Area 2 is located within the 100-year floodplain and is subject to flooding; if possible, removal activities would be restricted to seasons with low flooding probability to reduce potential migration of contaminated sludge/waste during excavation activities and to protect on-site workers.

Administrative Feasibility – Although permits would not be required for any of the site preparation and excavation activities because these activities would be performed at a site under CERCLA initiative, all removal actions would be performed to comply with the substantive requirements of all ARARs. Coordination with the NHDES would be necessary for on-site activities. Coordination with local municipal representatives would be required to initiate discharge of dewatering effluent to the City sewer system and to determine appropriate measures to reduce traffic impacts along Broad Street at the outlet of the temporary site access road. Coordination with landowners along the proposed access route would be required to construct and utilize the temporary site access road.

In April of 2002, the NHDES completed an updated hazardous waste determination for site sludge/waste using data gathered during the EE/CA field investigation. The data and the NHDES determination support the assumption that sludge/waste from the site would not be considered a RCRA hazardous waste. However, the regulatory determination could change based on the results of the waste characterization samples collected from sludge/waste stockpiles during excavation. As discussed above, three potential scenarios were evaluated to analyze the impact of a hazardous waste classification. Alternative 1A was developed under the assumption that all excavated sludge/waste would be determined to be non-hazardous and suitable for disposal at a RCRA Subtitle D landfill facility. Alternative 1B was created to evaluate the implementability and cost of the disposal of Area 1 sludge at a RCRA Subtitle C landfill, which would be the required disposal option for waste characterized as hazardous but not subject to 40 CFR 268.31 (Waste-Specific Prohibitions – Dioxin-Containing Wastes). Alternative 1C was created to evaluate the implementability and cost of the disposal of Area 1 sludge at a Canadian landfill, which would be the required disposal option for waste characterized as hazardous and subject to 40 CFR 268.31, land disposal restrictions for dioxin-containing wastes.

From an administrative standpoint, Alternatives 1A and 1B would be similarly implementable. All of the administrative requirements for transportation and off-site disposal of waste at an

American landfill could easily be met. Alternative 1C would be implementable, but more difficult than Alternatives 1A and 1B due to permitting and compliance issues associated with international transport of hazardous waste.

Availability of Services and Materials – Companies with the trained personnel, equipment, and materials to perform all necessary earth moving, demolition, excavation, dewatering, and backfilling activities are readily available. Since contaminated materials are to be handled, trained personnel would be required. Mobile laboratory facilities with 24-hour sample turnaround time capabilities are available to handle the analytical requirements of the alternative. All proposed aspects of the removal action could be bid competitively.

Qualified off-site disposal facilities, in compliance with EPA's Off-Site Rule, have been identified during the EE/CA preparation. Sludge/waste that is characterized as solid waste would be transported and disposed of at one of several potential Subtitle D landfill facilities. Sludge/waste that is characterized as hazardous, but not subject to the land disposal ban, would be transported and disposed of at a RCRA Subtitle C disposal facility. Sludge/waste that is subject to the land disposal ban for dioxin-containing wastes would be transported to a Canadian facility. Subtitle C landfills and Canadian landfills capable of accepting site sludge/waste are available, and have been identified during preparation of the EE/CA.

State Acceptance – The State of New Hampshire has been involved in the development of removal alternatives for the EE/CA. The state's acceptance and comments on this alternative will be evaluated following the public comment period.

Community Acceptance – Community acceptance will be considered based on comments received during the public comment period for EPA's proposed removal action alternative, prior to selecting the removal action in the Action Memorandum.

Cost

Based on the assumptions presented in Section 4 and detailed in Appendix L, the capital costs for Alternative 1A are estimated to be approximately $14,939,000; the PRSC costs for the first two years are $4,000 per year; and the total present worth costs are approximately

$14,946,000. This cost estimate was based on the assumption that final waste determination and analytical results of waste characterization samples collected from stockpiles would indicate that sludge/waste is suitable for disposal at a RCRA Subtitle D facility.

Alternative cost estimates were generated to analyze the additional costs that would be incurred should sludge from Area 1 be characterized as hazardous waste. The capital costs of Alternative 1B ($20,428,000) represent the estimated capital costs for disposal of sludge/waste from Area 1 at a RCRA Subtitle C disposal facility. The difference in cost between Alternatives 1A and 1B is attributed to increases in transportation and disposal costs for the hazardous portion of sludge/waste (Area 1). The capital costs of Alternative 1C ($22,819,000) represent the estimated capital costs for disposal of sludge/waste from Area 1 at a Canadian landfill facility. The additional costs for Alternative 1C are attributed to increased transportation and disposal costs and the permitting requirements associated with disposal at a Canadian landfill. Assuming PRSC cost schedules identical to those for Alternative 1A, the total present worth costs for Alternatives 1B and 1C would be approximately $20,435,000 and $22,826,000, respectively.

Total present worth costs were calculated using a 7 percent discount rate in accordance with OSWER directive No. 9355.3-20, June 25, 1993.

5.2.2 Alternative 2 – Consolidation into On-Site Landfill

Alternative 2 features the excavation of contaminated sludge/waste from Disposal Areas 1, 2, 3, 4, 6, and 7; and the consolidation of excavated material into a newly constructed on-site landfill. As discussed in Section 4.5.2, the on-site landfill would be designed and constructed to meet applicable state and federal requirements for solid waste and hazardous waste landfills.

Effectiveness

Alternative 2 would meet the removal objectives of this NTCRA by preventing direct contact and ingestion of contaminated sludge/waste, and preventing continued ecological and environmental impacts from the release of contaminants into groundwater and the Nashua

River. This alternative would only partially satisfy the future site use removal objective by consolidating sludge/waste into a designated, controlled disposal area, and allowing the remainder of the site to be used for residential purposes. This alternative would be consistent with the removal action objectives for the site and the long-term remedial actions for the site.

Overall Protection of Human Health and the Environment – Alternative 2 would prevent direct contact with and ingestion of contaminated sludges and soils by human and ecological receptors by excavating and consolidating sludge/waste exceeding PRGs into an on-site landfill, and replacing it with clean soil. The removal of sludge/waste from the Disposal Areas would prevent the migration of contaminants to the Nashua River through flooding and sediment transport, thus protecting the surface water, river sediments, and biological receptors. The on-site landfill would include design elements and long-term maintenance that would prevent direct contact with sludge/waste and migration of contaminants from sludge/waste to groundwater and the Nashua River. The long-term protection of human health and the environment provided by this Alternative would depend on adequate long-term maintenance of the landfill and enforcement of permanent restrictions on use of the landfill area.

Compliance with ARARs – Alternative 2 would be designed and implemented to comply with all federal and state ARARs. A summary of ARARs as they pertain to Alternative 2 is presented on Tables 5-4 through 5-6.

Long-Term Effectiveness and Permanence – Under Alternative 2, risks to human health and the environment due to contact with sludge/waste would be reduced in the long-term, provided that the on-site landfill cap is properly operated and maintained. An estimated 60,000 cubic yards of sludge/waste would remain on site, but would be consolidated into an engineered landfill designed to contain sludge/waste. Institutional controls, if implemented and enforced, would restrict or prohibit landfill access that may impair the integrity of the cap or result in bringing contaminated materials above the cap.

Alternative 2 would be effective in the long term in meeting removal objectives and would constitute a permanent solution, assuming that the landfill were properly operated and maintained. However, in order to ensure the long-term effectiveness of the remedy, this alternative requires that permanent restrictions be placed on how the landfill-portion of the site could be used, thereby limiting the future use and development of these portions of the site. If the landfill cap were damaged, contaminants could pose risks to human and ecological receptors.

Under Alternative 2, PRSC would be needed to ensure the integrity of revegetation, erosion and sedimentation controls. Additionally, long-term monitoring and maintenance of the landfill would be required to ensure the effectiveness of the landfill as a containment cell. A post-closure care program outlining the operations and maintenance schedule would need to be developed and approved by the State in order to achieve this goal. The landfill is potentially viable in the long-term and may not require replacement if maintenance is continual. Imposition and enforcement of deed restrictions and long-term monitoring and maintenance of the landfill would be required to maintain the long-term effectiveness of this alternative. Long-term groundwater monitoring would be included as part of the post-closure care program and would be used to analyze the effectiveness of the landfill.

No difficulties or uncertainties are anticipated in performing the long-term maintenance. All materials to be used are readily available and can be replaced. If the landfill was damaged, repairs would likely be performed without difficulty.

Reduction of Toxicity, Mobility, or Volume Through Treatment – Because treatment of contaminated media is not a featured component of Alternative 2, there would be no reduction in the toxicity, mobility, or volume of contaminated materials through treatment or recycling. However, the consolidation of sludge/waste into the on-site landfill would reduce the ability of contaminants to migrate into groundwater and surface water bodies.

Short-Term Effectiveness – Implementation of Alternative 2 would be expected to have limited short-term impacts to the local community, on-site workers, and the environment.

As discussed in the analysis of Alternative 1, increased truck traffic, odor and dust emissions during sludge/waste excavation and handling, and noise would be the primary short-term concerns. Short-term impacts to the environment, such as temporary alteration of the 100-year floodplain would also occur. Engineering controls would be implemented to minimize these impacts, as outlined in the detailed analysis of Alternative 1.

The estimated site time needed to complete Alternative 2 would be approximately 16 months.

<u>**Implementability**</u>

The following is a discussion of the implementability of Alternative 2.

Technical Feasibility – Alternative 2 would be feasible and moderately complex. All of the same technical difficulties identified for Alternative 1 would apply to the implementation of Alternative 2.

Additional technical considerations unique to Alternative 2 would include designing the landfill to provide minimal impact to the local community. Due to space restrictions at the site, the gravel pit would be the most feasible location for the on-site landfill. However, due to the volume of sludge/waste to be excavated, a 30- to 40-foot sludge/waste thickness would be required because of the space restrictions in this area of the site. Depending on final determination of the mean high water level (which dictates the lowest possible elevation of the landfill liner), it is possible that construction of an on-site landfill of the required size would result in unacceptable changes in site topography. Of specific concern would be possible visual/aesthetic impacts of the landfill to neighboring residents.

Administrative Feasibility – The primary administrative issue confronting the implementation of Alternative 2 would be coordination with NHDES for approval to construct the on-site landfill. The proximity of the site to a residential neighborhood and to the Nashua River may complicate the process and require extra time and effort.

Assuming that all of the necessary approvals could be obtained for the on-site landfill, a secondary issue that may arise is the potential effect of a hazardous waste determination for

Area 1 sludge. As discussed in the detailed analysis for Alternative 1, the possibility exists that final waste determination would require Area 1 sludge to be handled as a hazardous waste. Under scenario B (hazardous waste, no land ban), Area 1 sludge/waste would still be suitable for on-site landfill disposal, since the landfill would be designed to meet RCRA Subtitle C (hazardous waste) standards. However, under regulatory scenario C (hazardous waste, land ban applicable), Area 1 sludge would have to be disposed of at an off-site location outside of the United States. Therefore, Alternative 2C was created to evaluate the implementability and cost of transporting Area 1 sludge to a Canadian landfill. From an administrative standpoint, Alternative 2C would be implementable, but more difficult than Alternatives 2A and 2B due to permitting and compliance issues associated with the international transport of hazardous waste.

As discussed for Alternative 1, permits would not be required for any of the site preparation and excavation activities because these activities would be performed at a site under a CERCLA initiative. Coordination with the EPA, NHDES, and local municipal representatives would be required to facilitate implementation of Alternative 2. Coordination with other agencies and property owners along the route of the site access road would be required to construct and utilize the temporary site access road.

Availability of Services and Materials – As discussed in the detailed analysis of Alternative 1, several contractors are available to implement all aspects of the site work that would be required for the alternative. Several contractors and the necessary materials are also available to construct the on-site landfill. At least one Canadian landfill has been identified as a potential disposal option for Area 1 waste, should implementation of Alternative 2C be required.

State Acceptance – The State of New Hampshire has been involved in the development of removal alternatives for the EE/CA. The state's acceptance and comments on this alternative will be evaluated following the public comment period.

Community Acceptance - Community acceptance will be considered based on comments received during the public comment period for EPA's proposed removal action alternative, prior to selecting the removal action in the Action Memorandum.

Cost

Based on the assumptions presented in Section 4.0 and detailed in Appendix L, the capital costs for Alternatives 2A and 2B are estimated to be $5,572,000; the PRSC costs for the first year are $155,275; and the total present worth costs are approximately $6,300,000.

Alternative 2C capital costs were estimated to be $18,428,000, with a PRSC cost schedule assumed to be the same as for Alternative 2A and a present worth of approximately $19,156,000. Additional costs for Alternative 2C are attributed to transportation and disposal costs for Area 1 waste at the Canadian landfill, which outweighed the cost savings realized from the reduction in on-site landfill capacity.

Total present worth costs were calculated using a 7 percent discount rate in accordance with OSWER directive No. 9355.3-20, June 25, 1993.

5.2.3 Alternative 3 – Excavation, Off-Site Treatment, and Disposal

Alternative 3 features excavation of contaminated sludge/waste and off-site treatment and disposal at an EPA-approved incineration facility. Alternative 3 is similar to Alternative 1, except that contaminated sludge/waste would be transported to an off-site incinerator and treated prior to disposal, rather than transported to an off-site landfill and disposed of without treatment. A change in regulatory status of site sludge/waste would not have significant impacts on the implementation of this alternative, but the availability of treatment facilities capable of accepting dioxin-containing waste would have implementation impacts. Therefore, off-site treatment and disposal options utilizing a treatment facility in the United States (Alternative 3-US) and Canada (Alternative 3-CAN) have been evaluated.

Effectiveness

Alternative 3 would meet the removal objectives of this NTCRA by preventing direct contact and ingestion of contaminated sludge/waste, and preventing continued ecological and environmental impacts from the release of contaminants into groundwater and the Nashua River. This alternative would also satisfy the future site use removal objective. This alternative would be consistent with the removal action objectives for the site and the long-term remedial actions for the site, and would satisfy the statutory preference for treatment over disposal.

Overall Protection of Human Health and the Environment – Alternative 3 would provide short-term and long-term protection of human and ecological receptors from direct contact exposures to contaminated sludge/waste exceeding PRGs. Alternative 3 would also provide long-term protection of human health and the environment by preventing the migration of contaminants to groundwater and the Nashua River through leaching, flooding, or sediment transport. Through the removal of sludge/waste exceeding PRGs and implementation of site restoration activities, this alternative would restore the site to conditions suitable for residential use. Alternative 3 would be implemented in compliance with EPA's Off-Site Rule.

Compliance with ARARs – Alternative 3 would be designed and implemented to comply with all federal and state ARARs. A summary of ARARs as they pertain to Alternative 3 is presented on Tables 5-7 through 5-9.

Long-Term Effectiveness and Permanence – Under Alternative 3, impacts to the environment and exposure by ecological and human receptors to contaminated sludge/waste would be eliminated as the result of excavation, treatment, and off-site disposal of all sludge/waste containing contaminant concentrations above PRGs. Excavation, off-site treatment, and disposal would be effective in the long term, would be permanent, and would contribute to future remedial objectives.

Implementation of Alternative 3 would require limited PRSC to ensure the integrity of new vegetation, erosion and sediment controls, and wetland re-creation.

Reduction of Toxicity, Mobility, or Volume Through Treatment – Alternative 3 would reduce the toxicity, mobility, and volume of contamination through the destruction of contaminants during the incineration process. Incineration of contaminated sludge/waste would be required by regulation 40 CFR 264, Subpart O to provide a 99.9999% reduction in total dioxins and a 99.99% reduction in total SVOCs. Incineration is likely to result in greater than 50 percent volume reduction prior to disposal. Residual ash containing concentrations of metals may need to be stabilized to reduce their mobility and toxicity prior to disposal. The mobility of metal constituents would be reduced to regulatory limits specified under 40 CFR 261.24.

Short-Term Effectiveness – Short-term effectiveness concerns of Alternative 3 would be identical to those described in the detailed analysis of Alternative 1, since on-site activities performed under the two alternatives would be the same.

<u>Implementability</u>

The following is a discussion of the implementability of Alternative 3.

Technical Feasibility – On-site technical feasibility issues for Alternative 3 would be identical to those discussed in the detailed analysis of Alternative 1, since on-site activities performed under the two alternatives would be the same. Incineration has been proven effective in treating contaminated media with similar physical and chemical characteristics as those observed at the site.

Administrative Feasibility – Although permits would not be required for any of the site preparation and excavation activities because these activities would be performed at a site under a CERCLA initiative, all removal actions would be performed to comply with the substantive requirements of all ARARs. Coordination with NHDES would be necessary for on-site activities. Coordination with local municipal representatives would be required to initiate discharge of dewatering effluent to the City sewer system and determine appropriate measures to reduce traffic impacts along Broad Street.

Administrative approvals would be required for the off-site treatment and disposal of the contaminated sludge/waste. Depending on the availability of U.S. incineration facilities willing to receive dioxin-containing waste, obtaining such approvals may be difficult. Approvals for international off-site treatment and disposal would be feasible, but would require additional time and effort.

Availability of Services and Materials – As discussed for Alternative 1, there are several companies available with the personnel, equipment, and materials to perform all of the necessary site work required for this alternative. Sufficient contractors would be available for competitive bidding.

TtNUS identified at least one qualified off-site treatment and disposal facility within the United States that is able to accept dioxin-contaminated waste, although the availability of such facilities nationwide is extremely limited. For this reason, an incineration facility in Canada was identified as a potential alternative should incineration options in the U.S. not become available.

State Acceptance – The State of New Hampshire has been involved in the development of removal alternatives for the EE/CA. The state's acceptance and comments on this alternative will be evaluated following the public comment period.

Community Acceptance – Community acceptance will be considered based on comments received during the public comment period for EPA's proposed removal action alternative, prior to selecting the removal action in the Action Memorandum.

Cost

Based on the assumptions presented in Section 4.0 and detailed in Appendix L, the capital costs for Alternative 3-US are estimated to be $69,715,000; the PRSC cost schedule for Alternative 3-US would be the same as detailed for Alternative 1, and would result in total present worth costs of approximately $69,722,000.

Alternative 3-CAN, which would involve treatment and disposal at a Canadian incinerator, would involve capital costs of approximately $50,152,000 with a total present worth cost of approximately $50,160,000. The PRSC costs would be the same as for Alternative 3-US.

Total present worth costs were calculated using a 7 percent discount rate in accordance with OSWER directive No. 9355.3-20, June 25, 1993.

5.3 Comparative Analysis of Removal Action Alternatives

As part of the alternatives analysis, the removal action alternatives evaluated individually above were compared in order to identify differences between the alternatives and to analyze their comparative benefits and drawbacks. Generally, all alternatives offer similar degrees of protection and would achieve all of the removal action objectives established for this NTCRA. For each of the three alternatives, no residual contamination would remain at the site that would pose a risk to human health or the environment once the removal action was completed. Alternatives 1 and 3 would not require PRSC operations to maintain the protectiveness of the alternative, except for monitoring of site restoration measures until the actions satisfy applicable federal and state standards. Alternative 2, unlike Alternatives 1 and 3, would consolidate and contain contaminated sludge/waste on site rather than remove it from the site and would require more extensive PRSC to monitor the integrity of the on-site landfill and prevent impacts to human health and the environment. In addition, the placement of wastes in an on-site landfill under Alternative 2 would restrict the future use and development of the site to a greater extent than for Alternatives 1 and 3. Table 5-10 presents a summary of the alternatives evaluation that is presented in the following text.

5.3.1 Effectiveness

The following is a comparative analysis of the effectiveness of each of the three removal action alternatives analyzed for the EE/CA.

Overall Protection of Human Health and the Environment

Alternatives 1, 2, and 3 would all meet the removal action objectives of this NTCRA because all contaminated sludge/waste that exceeds the proposed PRGs would be removed, contained, or treated. Alternative 2 would not be as effective as Alternatives 1 and 3 in meeting the future residential site use objective since Alternative 2 would leave wastes on site, thereby restricting how the landfill area could be developed and used in the future. The time to achieve removal objectives for Alternatives 1 and 3 would be approximately 17 months from initiation of design through demobilization from the site. Alternative 2 would require additional time for design and on-site implementation, with a total project duration of approximately 26 months.

Compliance with ARARs

Alternatives 1, 2, and 3 would all be designed and implemented to comply with ARARs. Each alternative involves collection of water generated from dewatering the Area 1 lagoon, groundwater infiltration during excavation, and free liquids from stockpiled sludge/waste, and discharging to the Nashua sewer system. These alternatives would be implemented to comply with state and federal regulations concerning discharge to wastewater treatment plants.

During implementation, the three alternatives would comply with federal testing and waste identification requirements, the New Hampshire Solid Waste Management requirements and state air pollution control requirements. Alternative 2 would also follow relevant and appropriate federal and state regulations for landfill closure and post-closure care.

Long-Term Effectiveness and Permanence

Alternatives 1 and 3 would be effective in the long term and would be permanent because all contaminated sludges and soils exceeding PRGs would be removed from the site. Alternative 2 would be effective in the long term and would be permanent, provided that the landfill is properly operated and maintained and is not allowed to erode or degrade. If the landfill is damaged or breached, and the cap or liner is allowed to erode or degrade, contaminants could leach into groundwater, migrate by erosion or runoff, or pose direct exposure risks to human and ecological receptors. Alternative 2 would require enforcement of access and use restrictions for the landfill area and would require additional PRSC measures over those proposed for Alternatives 1 and 3 to ensure the effectiveness of the removal action.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 and 2 would not employ treatment. Alternative 3 would achieve a 99.9999 percent destruction and removal efficiency (DRE) for total dioxins and a 99.99% DRE for total SVOCs (per federal regulations) and a greater than 50 percent reduction in volume. Air emissions from the incineration process would be treated, and solid phase treatment residuals would be stabilized, if necessary, to limit mobility of contaminants in sludge/waste. Alternative 3 would satisfy the statutory preference for treatment, while Alternatives 1 and 2 would not.

Short-Term Effectiveness

There would be limited impacts to on-site removal workers, the local community, and the environment during the implementation of Alternatives 1, 2, and 3. For the three alternatives, monitoring for sulfide odors and other potential contaminants of concrern (particulate matter, dioxins, SVOCs, and metals) would be performed as needed, and appropriate engineering controls would be used to minimize or prevent adverse impacts. On-site air emissions concerns would be similar for Alternatives 1 and 3, and slightly greater for Alternative 2 due to the increased onsite handling of sludge/waste during construction of the landfill. All three alternatives would include erosion and sediment controls and other management controls to prevent contaminated sludges and soils from migrating into the Nashua River during removal activities.

Increased noise and vehicular traffic would be anticipated under all three alternatives. Implementation of Alternative 2 would result in less vehicular traffic to and from the site since transport of sludge/waste would not be part of the removal action.

Alternatives 1 and 3 have similar on-site removal action durations (11 months). Landfill construction activities that would be implemented under Alternative 2 would require additional time and would result in an estimated 16-months of on-site removal action activities. Figure 5-1 provides a comparison of anticipated project duration for each of the three removal action alternatives.

5.3.2 Implementability

The following is a comparative analysis of the implementability of the three removal action alternatives analyzed for the EE/CA.

Technical Feasibility

All three alternatives would be technically feasible, but some difficulties would be expected. No technical difficulties are anticipated for site preparation and site restoration activities since common construction techniques and equipment are required. Excavation of sludge/waste located below the water table and near the sewer interceptor would present difficulties, but they would be the same for each alternative. Landfill construction techniques and equipment are readily available (for Alternative 2). Access, spatial limitations, and odor and moisture control issues could be overcome through the use of a well-developed site management plan.

Spring flooding and summer weather conditions would be expected to complicate the implementation of all three alternatives. Odor and moisture control concerns would be less likely to be problematic if the removal action were implemented in cooler, drier weather and during periods of seasonal low groundwater.

Administrative Feasibility

Actual permits are not required for on-site work but the substantive requirements of any ARARs would be addressed and met for work performed under all alternatives. However, administrative approvals would be required for off-site transport and disposal of contaminated sludge/waste (Alternatives 1A, 1B, 1C, and 2C) or off-site transport, treatment, and disposal of sludge/waste (Alternatives 3-US and 3-CAN). Alternative 2 would require coordination with NHDES to satisfy all requirements for the construction of the on-site landfill.

The administrative feasibility of each alternative depends largely on the final waste determination for Area 1. A hazardous waste determination would make each alternative administratively more difficult. But regardless of the final waste determination or waste characterization during excavation, Alternative 1 could be implemented with the least administrative difficulty. Acquisition of landfill approvals for off-site disposal of sludge/waste—whether at a RCRA D, RCRA C, or Canadian facility—would be easier from an administrative standpoint than obtaining concurrence and acceptance from the State and public to construct an on-site landfill (Alternative 2) or obtain administrative approval for off-site incineration (Alternative 3).

Availability of Services and Materials

Qualified contractors with trained personnel, equipment, and hazardous waste site experience would be readily available to perform all of the on-site services that would be required for all three alternatives. RCRA D, RCRA C, and Canadian landfills have been identified that would have the off-site disposal capacity to receive the anticipated volume of contaminated sludge/waste, but final decisions on the ability or willingness of these facilities to accept site sludge/waste could not be made at the time of the EE/CA preparation.

Availability of a qualified off-site incineration facility within the United States that is capable of receiving dioxin-containing waste is expected to be limited. At least one such facility was identified during preparation of the EE/CA, but final decisions on the ability or willingness to accept site sludge/waste could not be made at the time of the EE/CA. The option of using a Canadian facility (Alternative 3-CAN) is available and was evaluated as an alternative off-site treatment option in the case that no U.S. incinerator would accept sludge/waste from the site.

State Acceptance

This factor will be addressed after the close of the public comment period.

Community Acceptance

This factor will be addressed after the close of the public comment period.

5.3.3 Cost

Summaries of the costs for each alternative are presented in Table 5-10, along with the implications of final waste determination or characterization during implementation. If the entire volume of sludge/waste were to be classified as non-hazardous waste, Alternative 2 would be the least expensive, followed by Alternative 1, then Alternative 3-CAN and Alternative 3-US. If Area 1 sludge were to be classified as hazardous waste but not governed by the land disposal ban on dioxin-containing materials, the difference in cost between Alternatives 1 and 2 would widen, with Alternative 1 costs increasing and Alternative 2 costs remaining the same.

The cost of Alternatives 3-CAN and 3-US would not change, but would still be the most expensive. If Area 1 sludge were to be classified as hazardous and governed by the land disposal ban, Alternative 2 would still be the least expensive option, followed by Alternative 1, but the difference in costs would be considerably smaller. Alternatives 3-Can and 3-US would still be considerably more expensive than either of the other Alternatives. PRSC costs for Alternatives 1 and 3 are the same. The PRSC costs for Alternative 2 are greater than those for Alternatives 1 and 3, under all potential regulatory scenarios, due to the need for long-term post-closure care of the on-site landfill.

5.4 Recommended Removal Alternative

Based on the comparison of alternatives, Alternative 1 was selected as the recommended removal alternative. All alternatives met the NTCRA removal objectives and were protective of human health and the environment. Alternatives 1 and 3 fully satisfied the removal objective of restoring the site for future residential use; Alternative 2 only partially satisfied this removal objective since Alternative 2 would leave wastes on site in an on-site landfill, thereby restricting how the landfill area could be developed and used in the future. Although Alternatives 1 and 3 constituted a more permanent measure due to fewer PRSC requirements, all alternatives may be considered permanent and would be effective in the long term provided that the on-site landfill (in Alternative 2) is properly operated and maintained and land use restrictions are enforced. Only Alternative 3 would satisfy the statutory preference for treatment.

The primary differences among the three alternatives lie in their implementability. Alternative 1 would be the most easily implemented. Several off-site landfill facilities in reasonably close proximity to the site are available to accept the volume of sludge/waste that is expected to be generated during the removal action. In addition, obtaining the necessary approvals for the off-site landfill disposal alternative is expected to present the fewest challenges from an administrative feasibility standpoint.

Alternative 2 would be much more challenging to implement than Alternative 1 due to the size of the on-site landfill that would be required to accommodate the volume of contaminated sludge/waste at the site and the potential for public opposition to an on-site landfill. Design and construction of an on-site landfill that would be adequate to encapsulate 66,000 cubic yards of material would place considerably more constraints on how the site could be used and developed in the future and require more long-term efforts associated with PRSC. As a result, obtaining concurrence and acceptance from the State and public to construct an on-site landfill may be difficult.

Alternative 3 would be more difficult to implement than Alternative 1 because of the limited number of off-site incineration facilities within the U.S. and Canada that are permitted to receive dioxin-containing waste. Alternative 3 would be easier to implement than Alternative 2 because locating available incineration facilities and obtaining the necessary approvals for off-site incineration would present fewer challenges than obtaining concurrence and acceptance from the State and public to construct a landfill at the site.

Although Alternative 1 is only slightly more implementable than Alternative 3, it was selected as the preferred alternative because it would be considerably less costly. Off-site treatment at a Canadian incinerator (Alternative 3-CAN) would be the least expensive treatment option, but would still cost over three times more than off-site disposal, if Area 1 sludge were classified as non-hazardous waste; and more than two times more than off-site disposal if Area 1 sludge were classified as hazardous waste. For this reason, Alternative 1 (A, B, or C) is selected as the preferred removal action alternative, pending final waste determination and/or characterization results.

REFERENCES

REFERENCES

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TABLES

TABLE 1-1
ANALYTICAL METHODS SUMMARY
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Analytical Parameter	Region I Method Code	Instrument	Title, Revision Date and/or Number	Modified for Project Work Y or N	Fixed Laboratory Performing Analysis
VOCs	5035/ OLM04.2VM	GC/MS	Sludge/Soil – Volatile Organic Compounds, USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Modified May 1999. Laboratory SOP #045, 11/07/00	Y(1)	DAS/Ceimic Corporation
SVOCs	OLM04.2S	GC/MS	Sludge/Soil – Semivolatile Organic Compounds, USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Modified May 1999. Laboratory SOP #045, 11/21/00	Y(1)	DAS/Ceimic Corporation
Pesticides/ PCBs	OLM04.2P	GC/ECD	Sludge/Soil – Pesticides/PCBs, USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Modified May 1999. Laboratory SOP #023, 9/22/00	Y(1)	DAS/Ceimic Corporation
Metals	ILM04.1MT	ICP/CV	Sludge/Soil – Total Metals, USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Effective March 2000. Laboratory SOP #METICP4.1-1.0, 05/17/00	Y(2)	DAS/Chem Tech Consulting
Dioxins	8290	HRGC/HR MS	Sludge/Soil – Dioxins, USEPA SW-846 3rd Edition Method 8290, Low-Medium Concentration. Laboratory SOP # DSP105, 07/31/98 DHR182, 03/25/98	Y(2)	DAS/Triangle Laboratories
TCLP VOCs	13113.IV	GC/MS	Sludge/Soil – TCLP Volatile Organic Compounds, USEPA SW-846 3rd Edition Method 1311 and USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Modified May 1999. Laboratory SOP #1311 (Draft), 5/15/01	N	DAS/Ceimic Corporation
TCLP SVOCs	13113.IS	GC/MS	Sludge/Soil – TCLP Semivolatile Organic Compounds, USEPA SW-846 3rd Edition Method 1311 and USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Modified May 1999. Laboratory SOP #1311, 10/24/00	N	DAS/Ceimic Corporation
TCLP Pesticides	13113.IP	GC/ECD	Sludge/Soil – TCLP Pesticides, USEPA SW-846 3rd Edition Method 1311 and USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Modified May 1999. Laboratory SOP #1311, 10/24/00	N	DAS/Ceimic Corporation
TCLP Metals	1311ILM04	ICP/CV	Sludge/Soil – TCLP Metals, USEPA SW-846 3rd Edition Method 1311 and USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Effective March 2000. Laboratory SOP #6010B#4, 12/27/00 and TCLP 1311-001, 2/18/00	N	DAS/Chem Tech Consulting
Reactive Cyanide Reactive Sulfides	SW846 Chap7.3.3/ 7.3.4	AS T	Sludge/Soil – Reactive Cyanide/Reactive Sulfides, USEPA SW-846 3rd Edition Chapter 7, Revision 3, December 1996. Laboratory SOP #Rev7.3-001, 02/18/00	N	DAS/Chem Tech Consulting

TABLE 1-1 (cont.)
ANALYTICAL METHODS SUMMARY
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Analytical Parameter	Region I Method Code	Instrument	Title, Revision Date and/or Number	Modified for Project Work Y or N	Fixed Laboratory Performing Analysis
pH	9045	Meter	Sludge/Soil – Corrosivity, US EPA SW-846 3rd Edition Method 9045B, Revision 2, December 1996. Laboratory SOP #CORR904OB-001, 02/17/00	N	DAS/Chem Tech Consulting
Hexavalent Chromium	30607196	AS	Sludge/Soil – Hexavalent Chromium, USEPA SW-846 3rd Edition Methods 3060A and 7196A, Revision 2, December 1996. Laboratory SOP #CCG-HXCD-404, 03/12/99	N	DAS/Chem Tech Consulting
Sulfides	9030B	T	Sludge/Soil – Total Sulfides, USEPA SW-846 3rd Edition Methods 9030B and 9034, Revision 2, December 1996. Laboratory SOP #9030, 02/21/00	N	DAS/Chem Tech Consulting
VOC	TO-14	GC/MS	Air – Volatile Organic Compounds, Analysis of Volatile Organic Compounds by EPA Methods TO-14/TO-14A/TO-15, Laboratory SOP #37, 03/10/01	N	DAS/Air Toxics, Ltd.
Sulfur Compounds	D-5504	GC/SCD	Air – odorous sulfides, analysis of sulfur compounds by modified ASTM Method 5504, Rev. 3 Laboratory SOP # 13	N	DAS/Air Toxics, Ltd.
Free Liquid	9095A	--	Sludge/Soil – Paint Filter Test, USEPA SW843 3rd Ed. Method 9095A, SOP #FREELIQUID, 02/18/00	N	DAS/Chem Tech Consulting

NOTES:
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compounds
PCBs = Polychlorinated Biphenyls
TCLP = Toxicity Characteristic Leaching Procedure
GC = Gas Chromatograph
MS = Mass Spectrometer
ECD = Electron Capture Detector
ICP = Inductively-Coupled Plasma
CV = Cold Vapor
HRGC = High Resolution Gas Chromatograph
HRMS = High Resolution Mass Spectrometer
AS = Semi-Automated Spectrophotometric
T = Titrimetric
SCD = Sulfur Chemiluminescence Detector
DAS = Delivery of Analytical Services

(1) Modified according to Tetra Tech Technical Specification S01-RAC1-174 to account for high percent moisture of the samples.
(2) Modified according to Tetra Tech Technical Specification S01-RAC1-175 to account for high percent moisture of the samples.

TABLE 2-1
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-101-0010		MT-SL-102-0012		MT-SL-103-0010		MT-SL-DUP-06		MT-SL-104-0010	
Sample Location			SL-101		SL-102		SL-103		SL-103		SL-104	
Date Sampled			9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001	
Interval			0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0	
QC Identifier			None		None		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-104-0010	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
Volatile Organic Analysis (UG/KG)												
1,2-Dichlorobenzene	37000	66000	820	J	960	J	3200	J	940	J	440	J
1,4-Dichlorobenzene	3400	6000	1200	U	150	J	370	J	130	J	1200	U
2-Butanone	730000	2000	2200		1300	U	1500		1700		2000	
Acetone	160000	9000	1700	EB	1900	EB	1100	EB	1500	EB	1700	EB
Carbon Disulfide	36000	400	1500		6100		1800		1800		2100	
Methyl Acetate	2200000		5700		8900		5800		4500		2800	
Semivolatile Organic Analysis (UG/KG)												
2,4,5-Trichlorophenol	610000	120000	5000	J	22000	J	24000	J	19000	J	85000	U
2-Methylnaphthalene	5600	150000	16000	U	21000	J	34000	U	34000	U	34000	U
4-Methylphenol	31000	5000	630000	*	1300000	*	530000	*	580000	*	700000	*
Pentachlorophenol	3000	3300	14000	J	160000	U	32000	J	32000	J	9100	J
Phenol	3700000	56000	9000	J	23000	J	7200	J	7300	J	6300	J
Pesticide/PCB Analysis (UG/KG)												
4,4'-DDD	2400	700	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	5.9	J
4,4'-DDE	1700	700	10	J	5.7	J	6.8	J	7.0	J	4.8	J
4,4'-DDT	1700	900	4.4	J	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U
Aldrin	29	90	1.7	UJ	1.7	UJ	1.7	UJ	1.7	UJ	6.1	J
alpha-BHC	90	60	4.9	J	1.7	UJ	4.3	J	19	*J	24	J
alpha-Chlordane	1600		8.2	J	3.5	J	11	J	1.7	UJ	62	*J
beta-BHC	320	60	1.7	UJ	1.7	UJ	1.7	UJ	7.3	J	1.7	U
Dieldrin	30	60	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	7.0	J
gamma-Chlordane	1600		3.3	J	3.9	J	15	J	5.9	J	48	*J
Heptachlor	110	200	28	*J	1.7	UJ	1.7	UJ	1.7	UJ	56	*J

TABLE 2-1 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-101-0010		MT-SL-102-0012		MT-SL-103-0010		MT-SL-DUP-06		MT-SL-104-0010	
Sample Location			SL-101		SL-102		SL-103		SL-103		SL-104	
Date Sampled			9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001	
Interval			0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0	
QC Identifier			None		None		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-104-0010	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
Dioxin Analysis (NG/KG)												
1,2,3,4,6,7,8-HpCDD			39200	JEB*	2580	JEB*	69400	JEB*	39900	JEB*	7970	JEB*
1,2,3,4,6,7,8-HpCDF			3820	JEB*	1130	JEB	6610	JEB*	2870	JEB*	1590	JEB
1,2,3,4,7,8,9-HpCDF			159	JEB	53.2	JEB	530	JEB	286	JEB	80.2	JEB
1,2,3,4,7,8-HxCDD			371	JEB	40.4	JEB	521	JEB	259	JEB	57.8	JEB
1,2,3,4,7,8-HxCDF			157	JEB	55.2	JEB	421	JEB	217	JEB	70.5	JEB
1,2,3,6,7,8-HxCDD			2150	JEB*	421	JEB	3200	JEB*	1720	JEB*	662	JEB
1,2,3,6,7,8-HxCDF			119	J	39.5	J	262	J	129	J	48.6	J
1,2,3,7,8,9-HxCDD			1530	JEB	135	JEB	1760	JEB	832	JEB	195	JEB
1,2,3,7,8-PeCDD			395	JEB	26.5	JEB	470	JEB	253	JEB	40.1	JEB
1,2,3,7,8-PeCDF			89.3	EMPC	0.8	UJ	0.2	UJ	295	EMPC	107	EMPC
2,3,4,6,7,8-HxCDF			205	JEB	48.4	JEB	305	JEB	152	JEB	61.4	JEB
2,3,4,7,8-PeCDF			24.3	JEB	5.8	JEB	29.9	JEB	14.1	JEB	5.7	JEB
2,3,7,8-TCDD	3.9		94.5	J	7.3	J	129	J	77.8	J	9	J
2,3,7,8-TCDF			13.9	J	4.3	J	18.5	J	7.6	J	3.7	J
OCDD			340000	JEB*	19200	JEB*	541000	JEB*	272000	JEB*	65200	JEB*
OCDF			3510	JEB*	870	JEB	6460	JEB*	3350	JEB	1580	JEB
Total HpCDD			73600	JEB*	4440	JEB*	138000	JEB*	77200	JEB*	14700	JEB*
Total HpCDF			8980	JEB*	2330	JEB	16000	JEB*	6910	JEB*	2010	JEB*
Total HxCDD			15000	JEB*	2110	JEB	19300	JEB*	10200	JEB*	3290	JEB
Total HxCDF			4120	JEB	651	JEB	5740	JEB*	3550	JEB	1470	JEB
Total PeCDD			5100	JEB	142	JEB	5320	JEB	2340	JEB	366	JEB
Total PeCDF			839	JEB	153	JEB	1060	JEB	1010	JEB	254	JEB
Total TCDD			1470	J*	50.7	J	1880	J	1220	J	87.5	J
Total TCDF			470	J	63.7	J	554	J	380	J	90	J
Toxicity Equivalency	1000#		1400	J	150	J	2100	J	1100	J	270	J

TABLE 2-1 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-101-0010		MT-SL-102-0012		MT-SL-103-0010		MT-SL-DUP-06		MT-SL-104-0010	
Sample Location			SL-101		SL-102		SL-103		SL-103		SL-104	
Date Sampled			9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001	
Interval			0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0	
QC Identifier			None		None		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-104-0010	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
TAL Metal Analysis (MG/KG)												
Aluminum			5380		6510		4010		5060		8770	
Antimony	31	8	0.74	UJ	0.74	UJ	77	J	0.74	U		R
Arsenic	0.39	11	6.7	J	5.1	J	4.7	J	1.5	J	7.6	J
Barium	540	750	36.4		26.3		38.0		34.8		45.7	
Beryllium	15	0.95	0.080		0.090		0.050		0.12		0.24	
Calcium			151000	J	75000	J	208000	J	105000	J	114000	J
Chromium	12000	1000	20100		18300		16900		19500		25200	
Cobalt			5.2	J	5.3	J	4.3	J	5.5	J	7.4	J
Copper			23.7		24.6		27.2		29.0		34.7	
Iron			5570		10700		5810		8240		8350	
Lead	400	4003	43.5		45.3		60.0		60.9		60.2	
Magnesium			955		787		1010		906		1470	
Manganese	180		3990		13300		8750		9660		5380	
Nickel	160	580	5.1		6.2			R	6.8	J	10.1	J
Potassium			458	J	518	J	424	J	478	J	892	J
Selenium	39	260	1.0	U	1.0	U	1.0	U	2.1		1.0	U
Silver	39	45	1.8	J	6.2	J	1.0	U	1.0	U	1.0	U
Sodium			8160		11300		9410		10100		8990	
Vanadium	55		24.4		25.6		17.5		23.8		34.0	
Zinc	2300	1000	128		145		121		141		183	

TABLE 2-1 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-101-0010		MT-SL-102-0012		MT-SL-103-0010		MT-SL-DUP-06		MT-SL-104-0010	
Sample Location			SL-101		SL-102		SL-103		SL-103		SL-104	
Date Sampled			9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001	
Interval			0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0	
QC Identifier			None		None		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-103-0010		Field Dup. MT-SL-104-0010	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
Miscellaneous Analyses												
Chromium VI (MG/KG)	30		6.1	U	6.6	U	6.3	U	5.5	U	10.9	UJ
Corrosivity/pH (SU)			7.61		7.43		7.48		7.61		7.47	
Redox Potential (mV)			122.1		58.7		48.2		63.7		77.1	
Sulfide (MG/KG)			49.0	J	16.6	UJ	15.8	UJ	230	J	280	J
Paint Filter (ML/KG)	1 @			NA		NA		NA		NA	1.0	U

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)
NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.
Black background = Criteria exceeded
U = Analyte not detected above laboratory detection limits
J = Quantitation approximate
UJ = Detection limit approximate
NA = Not analyzed
* = From dilution analysis
EB = Analyte associated with equipment blank contamination
EMPC = Estimated maximum possible concentration
\# = The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal.
(EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))
@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure of the paint filter test

TABLE 2-2
RCRA ANALYSIS OF SLUDGE - AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-A1-SLCOMP		MT-SL-DUP-08	
Sample Location		SL-A1		SL-A1	
Date Sampled		9/17/2001		9/17/2001	
Interval		0.0-0.0		0.0-0.0	
QC Identifier		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP	
Project Screening Criteria	TCLP				
TCLP Volatile Organic Analysis (UG/L)					
NOT ANALYZED					
TCLP Semivolatile Organic Analysis (UG/L)					
2,4,5-Trichlorophenol	400000	26	J	13	J
4-Methylphenol	200000	10000	*J	7200	*
TCLP Metal Analysis (UG/L)					
Barium	100000	1110		814	
Chromium	5000	117		113	
Miscellaneous Analyses					
Corrosivity/pH (SU)		7.7		7.51	
Reactive Cyanide (MG/KG)	250 +	0.4	U	0.4	U
Reactive Sulfide (MG/KG)	500 +	694		663	

NOTES:

Black Background = Criteria exceeded

Area 1 sludge composite sample consists of sludge from SL-101, SL-102, SL-103, and SL-104

No TCLP VOC sample collected from Area 1 sludge

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic. (except as noted by +)

U = Not detected above laboratory detection limits

J = Quantitation approximated

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-3
SUMMARY OF CONTAMINANTS DETECTED IN HEADSPACE AIR SAMPLES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-104-0010		MT-SL-205-0616		MT-SL-403-0510		MT-SL-704-0207		MT-SL-DUP-04	
Sample Location		SL-104		SL-205		SL-403		SL-704		SL-704	
Date Sampled		9/17/2001		8/30/2001		8/30/2001		8/31/2001		8/31/2001	
Interval		0.0-10.0		6.0-16.0		5.0-10.0		2.0-7.0		2.0-7.0	
QC Identifier		None		None		None		Field Dup. MT-SL-704-0207		Field Dup. MT-SL-704-0207	
Project Screening Criteria	AAL										
Volatile Organic Compounds Headspace Analysis (PPBV)											
Benzene	1.76	11	J	5	U	5	U	5	U	5	U
Chlorobenzene	49.35	5	UJ	14		1200		5	U	5	U
Ethylbenzene	226.51	5	UJ	5	U	27		1200	U	1400	U
m&p-Xylene	351.09	5	J	5	U	71		5	U	5	
Methylene Chloride	175.95	17	J	15		11		1200	U	1400	U
o-Xylene	351.09	5	UJ	5	U	27		5	U	5	U
Tetrachloroethene	88.07	21	J	5	U	5	U	5	U	5	U
Toluene	175.25	110	UJ	5	U	4500		4000		3800	
Trichlorofluoromethane	4949.31	5	UJ	9.4		7.4		1200	U	1400	U
Sulfur Compounds Headspace Analysis (PPBV)											
2,5-Dimethylthiophene		10	J	4.0	U	4.0	U	40	U	40	U
2-Ethylthiophene		6.2	J	4.0	U	4.0	U	40	U	40	U
3-Methylthiophene		100	J	4.0	U	8.9		40	U	40	U
Carbon Disulfide	221.27	370	J	62		460		60		60	
Carbonyl Sulfide		26	J	32		430		40	U	40	U
Diethyl Sulfide		9.2	J	4.0	U	4.0	U	40	U	40	U
Dimethyl Disulfide		100	J	4.0	U	4.0	U	1600	J	2900	J
Dimethyl Sulfide		650	*J	4.0	U	4.0	U	40	UJ	3000	J
Isopropyl Mercaptan		14	J	4.0	U	4.0	U	2700	J	40	UJ
Methyl Mercaptan	2.47	4.3	J	4.0	U	4.0	U	40		47	
Thiophene		19	J	4.0	U	4.0	U	40	U	40	U

NOTES:

AAL = ENV-A 1400 NHDES 24-hour ambient aire limit

Black Background = Criteria exceeded

U = Not detected

J = Quantitation approximate

UJ = Detection limit approximate

TABLE 2-4
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 2
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-201-0616		MT-SL-202-0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618		MT-SL-205-0616	
Sample Location			SL-201		SL-202		SL-202		SL-203		SL-204		SL-205	
Date Sampled			8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/30/2001	
Depth Interval			6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0		6.0-16.0	
QC Identifier			None		Field Dup. MT-SL-202-0717		Field Dup. MT-SL-202-0717		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1												
Volatile Organic Analysis (UG/KG)														
1,2,4-Trichlorobenzene	65000	15000	200	U	230	U	250	U	39	J	35	J	170	U
1,2-Dichlorobenzene	37000	66000	200	U	960		620		720		940		67	J
1,4-Dichlorobenzene	3400	6000	200	U	230		150	J	53	J	140	J	15	J
Acetone	160000	9000	200	U	790		850		180	U	210		170	U
Carbon Disulfide	36000	400	200	U	450	J	210	J	1900		60	J	300	
Chlorobenzene	15000	6000	200	U	230	U	250	U	180	U	120	J	170	U
Chloroform	240	100	27	J	28	J	28	J	20	J	25	J	19	J
Methyl Acetate	2200000		200	U	170	J	280	J	64	J	490		56	J
Semivolatile Organic Analysis (UG/KG)														
2,4,5-Trichlorophenol	610000	120000	63000	U	3600	J	38000	U	39000	U	59000	U	2600	UJ
2-Chloronaphthalene			5200	J	15000	U	15000	U	1700	J	24000	U	1000	UJ
2-Methylnaphthalene	5600	150000	25000	U	1700	J	2000	J	16000	U	24000	U	1000	UJ
4-Methylphenol	31000	5000		R	12000	J	11000	J	3100	J		R		R
Naphthalene	5600	5000	9000	J	75000		47000		3700	J	24000	U	1000	UJ
Pentachlorophenol	3000	3300	63000	U	61000	J	24000	J	28000	J	12000	J	2600	UJ
Phenol	3700000	56000	25000	U	67000	J	37000	J	16000	U	24000	U	1000	UJ
Pesticide/PCB Analysis (UG/KG)														
4,4'-DDE	1700	700	6.1		51		51		20		10		4.0	U
Aldrin	29	90	2.5	U	14	J	43		3.1	U	2.4	U	2.0	U
alpha-Chlordane	1600		6.0	EB	220	*JEB	450	*JEB	16	EB	22	EB	2.0	U
Aroclor-1254	220		49	U	110		290	U	61	U	38	J	40	U
beta-BHC	320	60	2.5	U	13		15	U	18		9.7		2.0	U

TABLE 2-4 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 2
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-201-0616		MT-SL-202-0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618		MT-SL-205-0616	
Sample Location			SL-201		SL-202		SL-202		SL-203		SL-204		SL-205	
Date Sampled			8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/30/2001	
Depth Interval			6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0		6.0-16.0	
QC Identifier			None		Field Dup. MT-SL-202-0717		Field Dup. MT-SL-202-0717		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1												
delta-BHC			2.5	U	2.9	UJ	35		3.1	U	3.2		2.0	U
Dieldrin	30	60	4.9	U	8.5	J	29	U	6.1	U	4.6	U	4.0	U
Endrin Ketone			4.9	U	5.7	U	29	U	6.1	U	5.8		4.0	U
gamma-Chlordane	1600		2.5	U	330	*J	660	*J	4.5		13		2.0	U
Heptachlor Epoxide	53	100	2.5	U	11	J	84		3.1	U	2.4	U	2.0	U
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD			7760	*	51100	J*	132000	J*	19700	*	90300	*	427	
1,2,3,4,6,7,8-HpCDF			1690		2700	EMPC*	5400	J*	1500	*	9800	*	95.5	
1,2,3,4,7,8,9-HpCDF			76.8		28.3	J	91.3	J	103		265	J	3.3	J
1,2,3,4,7,8-HxCDD			24.6		120	J	220	J	78.8		285		0.9	J
1,2,3,4,7,8-HxCDF			40.9		177	J	184	J	121		294		1.9	J
1,2,3,6,7,8-HxCDD			392		1400	EMPC*	3000	EMPC	1070		2500	EMPC*	14.4	
1,2,3,6,7,8-HxCDF			15		49.5	J	67.5	J	35.1		227		1.8	J
1,2,3,7,8,9-HxCDD			94.9		451	J	422	J	314		997		4	J
1,2,3,7,8-PeCDD			19.7		135	J	89.2	J	77.9		161		0.64	EMPC
1,2,3,7,8-PeCDF			1.5	J	4.1	J	13.2	J	3.3	J	0.2	U	0.09	U
2,3,4,6,7,8-HxCDF			29.8		139	J	220	J	60.6		375		3.6	J
2,3,4,7,8-PeCDF			2	JEB	9.7	JEB	25.4	JEB	5.2	JEB	22.8	JEB	0.31	EMPC
2,3,7,8-TCDD	3.9		16.9		35	J	23.6	J	32.4		46.4		0.68	J
2,3,7,8-TCDF			1.7	J	4.7	J	10.1	J	3.4	J	10.8	J	0.24	EMPC
OCDD			52700	*	443000	J*	1370000	J*	157000	*	762000	*	6260	*
OCDF			3200		1500	EMPC*	8500	J*	2330		16700	*	164	
Total HpCDD			13600	J*	88400	J*	210000	J*	32800	J*	155000	J*	817	J
Total HpCDF			4670	J*	2600	J*	12900	J*	4170	J*	25100	J*	291	J

TABLE 2-4 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 2
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-201-0616		MT-SL-202-0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618		MT-SL-205-0616	
Sample Location			SL-201		SL-202		SL-202		SL-203		SL-204		SL-205	
Date Sampled			8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/30/2001	
Depth Interval			6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0		6.0-16.0	
QC Identifier			None		Field Dup. MT-SL-202-0717		Field Dup. MT-SL-202-0717		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1												
Total HxCDD			1760	J	1800	J*	8700	J*	4640	J	6500	J*	80.7	J
Total HxCDF			1510	J	8300	J*	4400	J*	3050	J	3400	J*	108	J
Total PeCDD			324	JEB	1680	JEB	1050	JEB	887	JEB	2170	JEB	11.7	JEB
Total PeCDF			51	J	177	J	464	J	147	J	685	J	7.2	J
Total TCDD			173	J	630	J	287	J	302	J	638	J	2.3	J
Total TCDF			28	J	85.2	J	181	J	78.1	J	327	J	1.4	UJ
Toxicity Equivalency	1000[#]		200	J	990	J	2100	J	510	J	1800	J	10	J
TAL Metal Analysis (MG/KG)														
Aluminum			7950		5970		7030		3590		7730		4760	
Antimony	3.1	8	12.2		2.9		5.3		63.5		10.7		1.3	
Arsenic	0.39	11	9.0		10.5		9.4		1.0	U	5.4		8.0	
Barium	540	750	42.4		49.5		20.7		19.7		26.7		17.8	
Beryllium	15	0.95	0.27		0.29		0.40		0.16		0.41		0.30	
Calcium			6460	J	3150	J	11200	J	40900	J	14000	J	1570	J
Chromium	12000	1000	1430	J	328	J	626	J	7490	J	1360	J	181	J
Cobalt			6.4		3.9		4.8		2.4		5.7		4.0	
Copper			13.0		6.5		8.8		14.5		10.7		5.6	
Iron			10100		7110		9310		4120		11000		6220	
Lead	400	4003	20.6		8.0		8.3		13.6		6.3		6.2	
Magnesium			4010		1850		2170		1310		2540		1380	
Manganese	180		148		90.5		108		137		130		74.2	
Mercury	2.3	13	0.040	J	0.46	J	0.31	J	0.080	J	0.080	J	0.28	J
Nickel	160	580	17.9		8.7		9.6		7.1		15.2		7.6	
Potassium			2410	J	671	J	521	J	510	J	620	J	464	J

TABLE 2-4 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 2
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE
PAGE 4 OF 4

Sample Number			MT-SL-201-0616		MT-SL-202-0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618		MT-SL-205-0616	
Sample Location			SL-201		SL-202		SL-202		SL-203		SL-204		SL-205	
Date Sampled			8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/30/2001	
Depth Interval			6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0		6.0-16.0	
QC Identifier			None		Field Dup. MT-SL-202-0717		Field Dup. MT-SL-202-0717		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1												
Sodium			103	J	822		1140		456		154		85.3	U
Vanadium	55		16.4		10.3		11.2		0.64	U	11.7		8.6	
Zinc	2300	1000	34.2		25.8		31.6		34.6		35.9		22.6	
Miscellaneous Analyses														
Chromium VI (MG/KG)	30		2.5	U	2.2	U	2.7	U	3.0	UJ	2.3	UJ	2.5	U
Corrosivity/pH (SU)			8.21		8.56		10.35		8.39		7.97		7.63	
Redox Potential (mV)			336.5		281.2		324.1		299.5		312		352	
Sulfide (MG/KG)			180	J	230	J	110	J	77.0	J	140	J	55.0	J
Paint Filter (ML/KG)	1@			NA		NA		NA		NA		NA	1.0	U

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

EB = Analyte associated with equipment blank contamination

EMPC = Estimated maximum possible concentration

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal.
(EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure of the paint filter test

TABLE 2-5
RCRA ANALYSIS OF SLUDGE - AREA 2
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-A2-SLCOMP		MT-SL-DUP-02	
Sample Location		SL-A2		SL-A2	
Date Sampled		8/29/2001		8/29/2001	
Depth Interval		0.0-0.0		0.0-0.0	
QC Identifier		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP	
Project Screening Criteria	TCLP				
TCLP Volatile Organic Analysis (UG/L)					
NOT ANALYZED					
TCLP Semivolatile Organic Analysis (UG/L)					
2,4,5-Trichlorophenol	400000	37		53	
4-Methylphenol	200000	19	J	45	J
Pentachlorophenol	100000	500	*	770	*
TCLP Metal Analysis (UG/L)					
Barium	100000	46.3	J	159	J
Chromium	5000	9.4	J	204	J
Lead	5000	3.0	UJ	3.7	J
Miscellaneous Analyses					
Corrosivity/pH (SU)		8.12		10.4	
Reactive Cyanide (MG/KG)	250 +	0.4	U	0.4	U
Reactive Sulfide (MG/KG)	500 +	39.6	U	39.6	U

NOTES:

Black Background = Criteria exceeded

Area 1 sludge composite sample consists of sludge from SL-101, SL-102, SL-103, and SL-104

No TCLP VOC sample collected from Area 1 sludge

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity *Characteristic. (except as noted by +)*

U = Not detected above laboratory detection limits

J = Quantitation approximated

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-6
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 3
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618	
Sample Location			SL-301		SL-302		SL-303	
Date Sampled			8/30/2001		8/30/2001		8/30/2001	
Interval			2.0-8.0		3.0-9.0		6.0-18.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
Volatile Organic Analysis (UG/KG)								
1,2-Dichlorobenzene	37000	66000	330	U	240	U	130	J
Carbon Disulfide	36000	400	330	U	240	U	64	J
Toluene	52000	100000	330	U	240	U	220	J
Semivolatile Organic Analysis (UG/KG)								
2,4,5-Trichlorophenol	610000	120000	2200	U	470	U	16000	J
Naphthalene	5600	5000	900	U	190	U	8600	J
Pentachlorophenol	3000	3300	2200	U	470	U	22000	J
Pesticide/PCB Analysis (UG/KG)								
4,4'-DDD	2400	700	1.7	U	1.8	UJ	5.0	J
4,4'-DDE	1700	700	1.7	U	1.8	UJ	7.4	J
alpha-Chlordane	1600		1.6		0.93	UJ	3.2	J
Aroclor-1254	220		8.6	J	18	U	18	UJ
gamma-Chlordane	1600		1.7		0.93	UJ	5.0	J
Dioxin Analysis (NG/KG)								
1,2,3,4,6,7,8-HpCDD			22570	*	479		548	
1,2,3,4,6,7,8-HpCDF			2250	*	67.4		56.1	
1,2,3,4,7,8,9-HpCDF			84.9	J	3.6	J	3.4	J
1,2,3,4,7,8-HxCDD			123		1.8	J	2.2	J
1,2,3,4,7,8-HxCDF			86.1		2.1	J	2.4	J
1,2,3,6,7,8-HxCDD			1390		21.7		22.2	
1,2,3,6,7,8-HxCDF			76	EB	1.3	JEB	2.2	JEB
1,2,3,7,8,9-HxCDD			452	EB	5.2	EB	8.3	EB
1,2,3,7,8,9-HxCDF			0.5	U	0.3	U	1	EMPC
1,2,3,7,8-PeCDD			97.2	JEB	0.91	JEB	1.3	JEB
2,3,4,6,7,8-HxCDF			150	J	2.6	J	3.5	J
2,3,4,7,8-PeCDF			12.7		0.25	EMPC	0.3	U
2,3,7,8-TCDD	3.9		16		0.61	J	0.72	J
2,3,7,8-TCDF			3.9	EMPC	0.51	J	0.2	U
OCDD			248220	EB*	1960	JEB*	5320	EB*
OCDF			2210	JEB	158	JEB	48.8	JEB
Total HpCDD			42930	J*	854	J	1100	J
Total HpCDF			5240	J*	238	J	134	J
Total HxCDD			5900	JEB*	103	JEB	134	JEB
Total HxCDF			3590	JEB	73.8	JEB	48.5	JEB
Total PeCDD			2020	JEB	15.3	JEB	10.3	JEB
Total PeCDF			679	J	9.8	J	4.4	J
Total TCDD			364	J	0.99	J	2	J
Total TCDF			48.9	JEB	2.3	JEB	2	JEB
Toxicity Equivalency	1000#		620	J	11	J	13	J

TABLE 2-6 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 3
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618	
Sample Location			SL-301		SL-302		SL-303	
Date Sampled			8/30/2001		8/30/2001		8/30/2001	
Interval			2.0-8.0		3.0-9.0		6.0-18.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
TAL Metal Analysis (MG/KG)								
Aluminum			2890		5330		4160	
Antimony	3.1	8	35.2	J	0.74	U	3.6	
Arsenic	0.39	11	1.9	J	7.8		6.1	
Barium	540	750	13.5		19.1		16.3	
Beryllium	15	0.95	0.15		0.28		0.24	
Calcium			28100	J	671	J	2570	J
Chromium	12000	1000	4230	J	122	J	519	J
Cobalt			2.2		2.9		3.8	
Copper			8.7		5.7		6.6	
Iron			3370		5360		5560	
Lead	400	4003	8.7		4.2		7.2	
Magnesium			839		1500		1440	
Manganese	180		143		74.6		134	
Mercury	2.3	13	0.040	J	0.15	J	0.060	J
Nickel	160	580	7.0		7.2		11.2	
Potassium			413	J	712	J	623	J
Sodium			138		98.5	U	98.1	U
Vanadium	55		5.9		9.1		6.8	
Zinc	2300	1000	23.9		18.3		20.7	
Miscellaneous Analyses								
Chromium VI (MG/KG)	30		2.2	UJ	2.2	U	2.2	UJ
Redox Potential (mV)			383.1		447.6		410.2	
Sulfide (MG/KG)			90.0	J	35.0	J	140	J
Paint Filter (ML/KG)	1 @			NA		NA		NA

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

EB = Analyte associated with equipment blank contamination

R = Rejected

EMPC = Estimated maximum possible concentration

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal. (EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure the paint filter test

TABLE 2-7
RCRA ANALYSIS OF SLUDGE - AREA 3
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618	
Sample Location		SL-301		SL-302		SL-303	
Date Sampled		8/30/2001		8/30/2001		8/30/2001	
Interval		2.0-8.0		3.0-9.0		6.0-18.0	
QC Identifier		None		None		None	
Project Screening Criteria	TCLP						
TCLP Volatile Organic Analysis (UG/L)							
2-Butanone	200000	10	U	10	U	21	
TCLP Semivolatile Organic Analysis (UG/L)							
Pentachlorophenol	100000	9	J	25	U	25	U
TCLP Metal Analysis (UG/L)							
Barium	100000	56.9		57.6		46.6	
Chromium	5000	12.8	J	7.7	J	57.7	J
Lead	5000	3.0	U	3.0	U	3.2	J
Miscellaneous Analyses							
Corrosivity/pH (SU)		7.87		6.55		7.56	
Reactive Cyanide (MG/KG)	250 +	0.4	U	0.4	U	0.4	U
Reactive Sulfide (MG/KG)	500 +	40.1	U	40	U	39.6	

NOTES:

TCLP VOC samples collected from 6-8 feet bgs in SL-301, 4-8 feet bgs in SL-302, 8-12 feet bgs in SL-303

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic. (except as noted by +)

U = Not detected above laboratory detection limits

J = Quantitation approximated

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-8
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 4
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510	
Sample Location			SL-401		SL-402		SL-403	
Date Sampled			8/30/2001		8/30/2001		8/30/2001	
Interval			5.0-11.0		3.0-11.0		5.0-10.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
Volatile Organic Analysis (UG/KG)								
1,2,4-Trichlorobenzene	65000	15000	430	U	83	J	590	U
1,2-Dichlorobenzene	37000	66000	2800		13000		3800	
1,4-Dichlorobenzene	3400	6000	440		2200		670	
2-Butanone		2000	510		850	U	590	U
Acetone	160000	9000	590		620	J	550	J
Carbon Disulfide	36000	400	750		310	J	460	
Chlorobenzene	15000	6000	430	U	850	U	480	J
Chloroform	240	100	49	J	850	U	79	J
Methyl Acetate	2200000		610		1500		1400	
Tetrachloroethene	5700	2000	170	J	850	U	590	U
Toluene	52000	100000	1200		9200		5500	J
Total Xylenes	21000	500000	430	U	280	J	590	U
Semivolatile Organic Analysis (UG/KG)								
2,4,5-Trichlorophenol	610000	120000	37000	U	380	J	27000	U
2-Methylnaphthalene	5600	150000	1800	J	5200		1800	J
4-Methylphenol	31000	5000	83000	J	110000	*J		R
bis(2-Ethylhexyl)phthalate	35000	39000	15000	J	2000	U	11000	UJ
Naphthalene	5600	5000	15000	U	760	J	11000	U
Pentachlorophenol	3000	3300	1600	J	4900	U	27000	U
Phenol	3700000	56000	6500	J	5800		11000	U
Pesticide/PCB Analysis (UG/KG)								
alpha-BHC	90	60	4.6		3.4	U	2.2	UJ
Aroclor-1254	220		180		86		42	J
Dioxin Analysis (NG/KG)								
1,2,3,4,6,7,8-HpCDD			1550		12570	*	924	
1,2,3,4,6,7,8-HpCDF			132		421		74.8	
1,2,3,4,7,8,9-HpCDF			7.4		29.1		5.2	U
1,2,3,4,7,8-HxCDD			6.2	EMPC	22.8		3.1	U
1,2,3,4,7,8-HxCDF			6.6		21.6		2.7	U
1,2,3,6,7,8-HxCDD			58		199		32.1	
1,2,3,6,7,8-HxCDF			4.7	JEB	15.1	EB	2.7	U
1,2,3,7,8,9-HxCDD			21.9	EB	74.7	EB	7.8	EMPC
1,2,3,7,8-PeCDD			4.4	JEB	13.5	JEB	3.6	U
1,2,3,7,8-PeCDF			0.7	U	25.3	EMPC	11.7	
2,3,4,6,7,8-HxCDF			7.3		4.7	U	2.9	U
2,3,4,7,8-PeCDF			0.99	J	2.5	J	2.2	U
2,3,7,8-TCDD	3.9		1.2		3.4		1.8	U
2,3,7,8-TCDF			0.68	EMPC	2	U	1.1	U

TABLE 2-8 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 4
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE
PAGE 2 OF 3

Sample Number			MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510	
Sample Location			SL-401		SL-402		SL-403	
Date Sampled			8/30/2001		8/30/2001		8/30/2001	
Interval			5.0-11.0		3.0-11.0		5.0-10.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
OCDD			22680	EB*	94580	EB*	9150	JEB*
OCDF			190	JEB	651	JEB	130	EMPC
Total HpCDD			2770	J	22120	J*	1500	J
Total HpCDF			339	J	1170	J	237	J
Total HxCDD			325	JEB	1130	JEB	140	JEB
Total HxCDF			129	JEB	409	JEB	95.9	JEB
Total PeCDD			45	JEB	230	JEB	8.2	JEB
Total PeCDF			22.5	J	57.4	J	11.7	J
Total TCDD			5	J	16.7	J	1.8	UJ
Total TCDF			9.6	JEB	13.9	JEB	3.2	EMPC
Toxicity Equivalency	1000#		36	J	190	J	15	J
TAL Metal Analysis (MG/KG)								
Aluminum			6770		6130		5770	
Antimony	3.1	8	91.1		207	J	35.8	J
Arsenic	0.39	11	2.6	J	1.2	J	2.7	J
Barium	540	750	35.9		23.0		24.2	
Beryllium	15	0.95	0.25		0.23		0.29	
Calcium			28600	J	50000	J	11900	J
Chromium	12000	1000	10700	J	23700	J	4270	J
Cobalt			5.7		5.3	J	5.0	
Copper			17.4		25.1		13.0	
Iron			9080		9980		8550	
Lead	400	4003	16.9		27.8		10.8	
Magnesium			2990		1320		2280	
Manganese	180		819		2690		472	
Mercury	2.3	13	0.030	J	0.020	UJ	0.020	J
Nickel	160	580	14.8		12.3		15.5	
Potassium			1610	J	657	J	1040	J
Silver	39	45	1.0	U	1.7		1.0	U
Sodium			693		648		98.2	U
Thallium	0.52	10	2.0	J	1.1	UJ	1.1	UJ
Vanadium	55		0.64	U	4.9		2.6	
Zinc	2300	1000	53.5		94.2		40.6	

TABLE 2-8 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 4
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510	
Sample Location			SL-401		SL-402		SL-403	
Date Sampled			8/30/2001		8/30/2001		8/30/2001	
Interval			5.0-11.0		3.0-11.0		5.0-10.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
Miscellaneous Analyses								
Chromium VI (MG/KG)	30		2.9	UJ	2.0	U	2.5	U
Redox Potential (mV)			330.3		326.3		339.2	
Sulfide (MG/KG)			150	J	300	J	40.0	J
Paint Filter (ML/KG)	1 @			NA	13.0			NA

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

R = Rejected

EMPC = Estimated maximum possible concentration

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal. (EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure of the paint filter test

TABLE 2-9
RCRA ANALYSIS OF SLUDGE - AREA 4
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510	
Sample Location		SL-401		SL-402		SL-403	
Date Sampled		8/30/2001		8/30/2001		8/30/2001	
Interval		5.0-11.0		3.0-11.0		5.0-10.0	
QC Identifier		None		None		None	
Project Screening Criteria	TCLP						
TCLP Volatile Organic Analysis (UG/L)							
1,4-Dichlorobenzene	7500	6	J	8	J	2	J
2-Butanone	200000	31		100		10	U
Chlorobenzene	100000	10	U	10	U	6	J
Tetrachloroethene	700	1	J	10		10	U
TCLP Semivolatile Organic Analysis (UG/L)							
2,4,5-Trichlorophenol	400000	3	J	25	U	3	J
4-Methylphenol	200000	4900	*	2100	*	2	J
Pentachlorophenol	100000	10	J	4	J	25	U
TCLP Metal Analysis (UG/L)							
Barium	100000	34.4		55.0		50.2	
Chromium	5000	11.4	J	10.6	J	47.4	J
Miscellaneous Analyses							
Corrosivity/pH (SU)		8.32		7.89		7.68	
Reactive Cyanide (MG/KG)	250 +	0.4	U	0.4	U	0.4	U
Reactive Sulfide (MG/KG)	500 +	40		40	U	40	U

NOTES:

TCLP VOC samples collected from 5-8 feet bgs in SL-401, 4-8 feet bgs in SL-402, 4-8 feet bgs in SL-403

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic. (except as noted by +)

TCLP = 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic

U = Not detected above laboratory detection limits

J = Quantitation approximated

R = Rejected

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-10
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 5
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SL-501-0020		MT-SL-DUP-05		MT-SL-502-0012		MT-SL-503-0012	
Sample Location				SL-501		SL-501		SL-502		SL-503	
Date Sampled				9/4/2001		9/4/2001		9/4/2001		9/4/2001	
Interval				0.0-20.0		0.0-20.0		0.0-12.0		0.0-12.0	
QC Identifier				Field Dup. MT-SL-501-0020		Field Dup. MT-SL-501-0020		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd								
Volatile Organic Analysis (UG/KG)											
NONE DETECTED											
Semivolatile Organic Analysis (UG/KG)											
Di-n-Butylphthalate	610000	1000000		170	U	37	JEB	23	JEB	1800	U
Pesticide/PCB Analysis (UG/KG)											
Aroclor-1254	220			17	U	17	U	17	U	4.0	J
Dioxin Analysis (NG/KG)											
1,2,3,4,6,7,8-HpCDD				13.7	JEB	7.8	JEB	287	JEB	430	JEB
1,2,3,4,6,7,8-HpCDF				1.4	JEB	1.1	JEB	39.9	EB	41.2	EB
1,2,3,4,7,8,9-HpCDF				0.5	U	0.4	U	3.4	J	2.8	J
1,2,3,4,7,8-HxCDD				0.4	U	0.3	U	0.88	J	2.1	J
1,2,3,4,7,8-HxCDF				0.2	U	0.2	U	1.3	J	2.1	J
1,2,3,6,7,8-HxCDD				0.4	U	0.3	U	8.3		15.2	
1,2,3,6,7,8-HxCDF				0.2	U	0.2	U	0.6	J	1.4	J
1,2,3,7,8,9-HxCDD				0.4	U	0.3	U	2.2	J	7.1	
1,2,3,7,8,9-HxCDF				0.3	U	0.2	U	0.76	U	0.74	EMPC
1,2,3,7,8-PeCDD				0.4	U	0.3	U	0.5	U	1.1	J
1,2,3,7,8-PeCDF				0.3	U	0.2	U	0.3	U	0.27	J
2,3,4,6,7,8-HxCDF				0.3	U	0.2	U	1.3	J	2.7	J
2,3,7,8-TCDD	3.9			0.3	U	0.2	U	0.64	J	0.39	J
2,3,7,8-TCDF					R		R	0.36	J	0.57	EMPC
OCDD				129	J	70.8	J	3070	J	3370	J*
OCDF				3.1	J	2.2	J	104		64.8	

TABLE 2-10 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 5
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SL-501-0020		MT-SL-DUP-05		MT-SL-502-0012		MT-SL-503-0012	
Sample Location				SL-501		SL-501		SL-502		SL-503	
Date Sampled				9/4/2001		9/4/2001		9/4/2001		9/4/2001	
Interval				0.0-20.0		0.0-20.0		0.0-12.0		0.0-12.0	
QC Identifier				Field Dup. MT-SL-501-0020		Field Dup. MT-SL-501-0020		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd								
Total HpCDD				24.3	JEB	13	JEB	485	JEB	849	JEB
Total HpCDF				5	JEB	3.3	JEB	164	JEB	115	JEB
Total HxCDD				1.7	J	0.61	EMPC	33.1	J	91.6	J
Total HxCDF				1.1	UJ	0.4	UJ	35.3	J	41.7	J
Total PeCDD				0.4	UJ	1.4	EMPC	2.9	JEB	9.8	JEB
Total PeCDF				0.3	UJ	0.2	UJ	2.5	J	7.7	J
Total TCDD				0.3	UJ	0.2	UJ	0.64	JEB	1	JEB
Total TCDF				0.2	UJ	0.2	UJ	1.4	JEB	0.97	JEB
Toxicity Equivalency	1000#			0.16	J	0.096	J	5.8	J	9.7	J
TAL Metal Analysis (MG/KG)											
Aluminum				3800		5280		3700		4470	
Antimony	3.1	8	1.64	0.74	U	0.74	U	0.74	U	4.3	J
Arsenic	0.39	11	11	6.4		8.8		7.1		7.7	
Barium	540	750		21.4		16.9		16.4	J	18.2	J
Beryllium	15	0.95	0.95	0.24	UJ	0.32	J	0.25	UJ	0.24	UJ
Calcium				945		719		568		2970	
Chromium	12000	1000	33	16.8	J	105	J	146	J	578	J
Cobalt				2.7		3.1		2.5		2.8	
Copper				5.7		5.4		4.4		6.1	
Iron				5040		6120		4740		5760	
Lead	400	4003	51	2.2		3.2		3.8		5.7	
Magnesium				1290		1500		1140		1550	
Manganese	180			93.1		77.6		113	J	145	J
Mercury	2.3	13	0.31	0.020	UJ	0.020	UJ	0.10	J	0.030	J
Nickel	160	580	23	10.2		10.7		6.8		16.1	
Potassium				870	J	729	J	505	J	549	J

TABLE 2-10 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 5
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE
PAGE 3 OF 3

Sample Number				MT-SL-501-0020		MT-SL-DUP-05		MT-SL-502-0012		MT-SL-503-0012	
Sample Location				SL-501		SL-501		SL-502		SL-503	
Date Sampled				9/4/2001		9/4/2001		9/4/2001		9/4/2001	
Interval				0.0-20.0		0.0-20.0		0.0-12.0		0.0-12.0	
QC Identifier				Field Dup. MT-SL-501-0020		Field Dup. MT-SL-501-0020		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd								
TAL Metal Analysis (MG/KG) cont.											
Vanadium	55			7.9		9.6		7.4		10.5	
Zinc	2300	1000		19.2		20.4		14.8	U	42.4	
Miscellaneous Analyses											
Chromium VI (MG/KG)	30			2.1	U	2.1	U	3.0	J	2.4	U
Redox Potential (mV)				515.8		517.8		504.9		489.3	
Sulfide (MG/KG)				5.1	U	5.1	U	5.2	U	5.9	U
Paint Filter (ML/KG)	1 @				NA		NA		NA		NA

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

NH Bkgd = NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5(4)(c), Table 1; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

NA = Not analyzed

EB = Analyte associated with equipment blank contamination

R = Rejected

EMPC = Estimated possible maximum concentration

Samples collected from Area 5 were classified as "sludge" for purposes of analysis. However, visual or 01 factory evidence of tannery waste/sludge was not found.

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal. (EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure of the paint filter test

TABLE 2-11
RCRA ANALYSIS OF SLUDGE - AREA 5
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-501-0020		MT-SL-DUP-05		MT-SL-502-0012		MT-SL-503-0012	
Sample Location			SL-501		SL-501		SL-502		SL-503	
Date Sampled			9/4/2001		9/4/2001		9/4/2001		9/4/2001	
Interval			0.0-20.0		0.0-20.0		0.0-12.0		0.0-12.0	
QC Identifier			Field Dup. MT-SL-501-0020		Field Dup. MT-SL-501-0020		None		None	
Project Screening Criteria	TCLP									
TCLP Volatile Organic Analysis (UG/L)										
NONE DETECTED										
TCLP Semivolatile Organic Analysis (UG/L)										
4-Methylphenol	200000		44			NA	33		25	
TCLP Metal Analysis (UG/L)										
Barium	100000		77.8			NA	65.8		58.4	
Chromium	5000		5.0	U		NA	5.0	U	74.4	
Mercury	200		0.20	U		NA	0.23	J	0.20	U
Miscellaneous Analyses										
Corrosivity/pH (SU)			5.57		5.32		5.37		5.95	
Reactive Cyanide (MG/KG)	250 +		0.44			NA	0.72		0.4	U
Reactive Sulfide (MG/KG)	500 +		39.9	U		NA	40.3	U	39.8	U

NOTES:

TCLP VOC samples collected from 8-12 feet bgs in SL-501, 0-4 feet bgs in SL-502, 8-12 feet bgs in SL-503

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic. (except as noted by +)

U = Not detected above laboratory detection limits

J = Quantitation approximated

NA = Not analyzed

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-12
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 6
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007	
Sample Location			SL-601		SL-602		SL-603	
Date Sampled			9/5/2001		9/5/2001		9/5/2001	
Interval			7.0-11.0		5.0-9.0		0.0-7.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
Volatile Organic Analysis (UG/KG)								
1,2,4-Trichlorobenzene	65000	15000	570	J	220	J	710	U
1,2-Dichlorobenzene	37000	66000	46000	*	17000	*	280	J
1,4-Dichlorobenzene	3400	6000	25000		4300		200	J
2-Butanone		2000	1300	U	610		710	U
Acetone	160000	9000	830	J	280	J	710	U
Carbon Disulfide	36000	400	160	J	530	U	710	U
Chlorobenzene	15000	6000	77000	*	11000		1300	
Ethylbenzene	23000	140000	380	J	120	J	710	U
Methyl Acetate	2200000		1800		410	J	250	J
Toluene	52000	100000	330	J	160	J	710	U
Total Xylenes	21000	500000	2300		740		710	U
Semivolatile Organic Analysis (UG/KG)								
2,4,5-Trichlorophenol	610000	120000	330000	U	70000	J	4600	U
N-Nitroso-diphenylamine	99000		130000	U	7600	J	1900	U
Naphthalene	5600	5000	59000	J	41000	J	1900	U
Pentachlorophenol	3000	3300	330000	U	120000	J	4600	U
Pesticide/PCB Analysis (UG/KG)								
4,4'-DDD	2400	700	34	J	19	J	1.8	UJ
4,4'-DDE	1700	700	36	J	53	J	1.8	UJ
4,4'-DDT	1700	900	3.2	UJ	5.6	J	1.8	J
Aldrin	29	90	11	J	1.7	UJ	0.92	UJ
alpha-Chlordane	1600		21	J	14	J	1.7	J
Dieldrin	30	60	5.8	J	3.3	UJ	1.8	UJ
Endrin Ketone			26	J	18	J	1.8	UJ
gamma-Chlordane	1600		32	*J	57	*J	1.9	J
Heptachlor Epoxide	53	100	2.2	J	4.2	J	0.92	UJ
Dioxin Analysis (NG/KG)								
1,2,3,4,6,7,8-HpCDD			73100	J*	40500	J*	10500	J*
1,2,3,4,6,7,8-HpCDF			14400	JEB*	17200	JEB*	1440	JEB
1,2,3,4,7,8,9-HpCDF			737	JEB	990	JEB	51.8	JEB
1,2,3,4,7,8-HxCDD			269	JEB	163	JEB	42.5	JEB
1,2,3,4,7,8-HxCDF			758	JEB	699	JEB	37.1	JEB
1,2,3,6,7,8-HxCDD			3990	JEB*	4690	JEB*	292	JEB
1,2,3,6,7,8-HxCDF			189	J	229	J	19.9	J
1,2,3,7,8,9-HxCDD			576	JEB	417	JEB	60.5	JEB
1,2,3,7,8-PeCDD			34.7	JEB	25	JEB	7.3	JEB
2,3,4,6,7,8-HxCDF			391	JEB	488	JEB	40.4	JEB
2,3,4,7,8-PeCDF			91.9	JEB	44.9	JEB	3.2	EMPC

TABLE 2-12 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 6
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE
PAGE 2 OF 3

Sample Number			MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007	
Sample Location			SL-601		SL-602		SL-603	
Date Sampled			9/5/2001		9/5/2001		9/5/2001	
Interval			7.0-11.0		5.0-9.0		0.0-7.0	
QC Identifier			None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1						
2,3,7,8-TCDD	3.9		18	J	1240	J*	13.2	J
2,3,7,8-TCDF			26.9	J	12	J	2.1	UJ
OCDD			922000	J*	719000	J*	131000	J*
OCDF			33200	JEB*	28500	JEB*	6250	JEB*
Total HpCDD			144000	J*	80000	J*	18300	J*
Total HpCDF			36900	JEB*	75200	JEB*	5530	JEB*
Total HxCDD			20400	JEB*	19300	JEB*	1650	JEB
Total HxCDF			22200	JEB*	27600	JEB*	1600	JEB
Total PeCDD			2090	JEB*	1830	JEB*	159	JEB
Total PeCDF			1690	JEB*	1400	JEB	111	JEB
Total TCDD			1090	J*	1490	J*	37.1	J
Total TCDF			210	J*	102	J*	21.6	J
Toxicity Equivalency	1000#		1700	J	2600	J	200	J
TAL Metal Analysis (MG/KG)								
Aluminum			8090		10600		6660	
Antimony	3.1	8	446	J	547	J	5.7	J
Arsenic	0.39	11	8.1	J	1.7	J	15.7	
Barium	540	750	104	J	548	J	34.1	J
Beryllium	15	0.95	0.26	UJ	0.34	J	0.41	J
Cadmium	3.7	32	0.74	J	1.1	J	0.60	U
Calcium			21700		17100		1820	
Chromium	12000	1000	53800	J	67800	J	803	J
Cobalt			4.1		5.0		5.3	
Copper			157		114		15.8	
Iron			4990		4650		9950	
Lead	400	4003	61.9		88.3		15.4	
Magnesium			600		820		2290	
Manganese	180		68.4	J	121	J	170	J
Mercury	2.3	13	0.070	J	0.25		0.30	
Nickel	160	580	13.7		15.8		19.6	
Potassium			323	J	422	J	814	J
Sodium			383		213		98.5	U
Thallium	0.52	10	1.9	J	2.2	J	1.1	UJ
Vanadium	55		52.8		68.6		43.5	
Zinc	2300	1000	207		222		43.1	

TABLE 2-12 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 6
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007	
Sample Location				SL-601		SL-602		SL-603	
Date Sampled				9/5/2001		9/5/2001		9/5/2001	
Interval				7.0-11.0		5.0-9.0		0.0-7.0	
QC Identifier				None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1							
Miscellaneous Analyses									
Chromium VI (MG/KG)	30			2.4	U	2.3	U	2.2	U
Redox Potential (mV)				360.4		373		430.8	
Sulfide (MG/KG)				20.0		46.0		8.8	
Paint Filter (ML/KG)	1 @				NA		NA		NA

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

EMPC = Estimated maximum possible concentration

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal. (EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure of the paint filter test

TABLE 2-13
RCRA ANALYSIS OF SLUDGE - AREA 6
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007	
Sample Location		SL-601		SL-602		SL-603	
Date Sampled		9/5/2001		9/5/2001		9/5/2001	
Interval		7.0-11.0		5.0-9.0		0.0-7.0	
QC Identifier		None		None		None	
Project Screening Criteria	TCLP						
TCLP Volatile Organic Analysis (UG/L)							
1,4-Dichlorobenzene	7500	140		9	J	10	U
Chlorobenzene	100000	810	*	4	J	1	J
TCLP Semivolatile Organic Analysis (UG/L)							
2,4,5-Trichlorophenol	400000	25	UJ	160	*J	25	UJ
4-Methylphenol	200000	6	J	55	J	10	UJ
Pentachlorophenol	100000	25	UJ	47	J	25	UJ
TCLP Metal Analysis (UG/L)							
Barium	100000	77.2		98.7		59.0	
Chromium	5000	132		301		9.4	J
Miscellaneous Analyses							
Corrosivity/pH (SU)		7.8		7.19		6.47	
Reactive Cyanide (MG/KG)	250 +	0.4	U	0.4	U	0.4	U
Reactive Sulfide (MG/KG)	500 +	271		39.9	U	40	U

NOTES:

TCLP VOC samples collected from 7-8 feet bgs in SL-601, 8-10 feet in SL-602, 4-6 feet bgs in SL-603

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic. (except as noted by +)

U = Not detected above laboratory detection limits

J = *Quantitation approximated*

UJ = Detection limit approximate

* = From dilution analysis

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-14
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704-0207		MT-SL-DUP-04	
Sample Location			SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled			8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval			2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier			None		None		None		Field Dup. MT-SL-704-0207		Field Dup. MT-SL-704-0207	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
Volatile Organic Analysis (UG/KG)												
1,2-Dichlorobenzene	37000	66000	250	U	250	U	32	J	1200	U	1400	U
Acetone	160000	9000	250	U	250	U	290	U	8000	JEB	1400	UJ
Carbon Disulfide	36000	400	54	J	250	U	290	U	1200	U	1400	U
Chlorobenzene	15000	6000	250	U	250	U	81	J	1200	U	1400	U
Methyl Acetate	2200000		420		250	U	430		7000		10000	
Toluene	52000	100000	56	J	250	U	1700		2000		2100	
Semivolatile Organic Analysis (UG/KG)												
2,4,5-Trichlorophenol	610000	120000	11000	U	10000	U	820	J	43000	J	33000	J
4-Chloro-3-methylphenol			4400	U	4000	U	550	J	68000	U	67000	U
4-Methylphenol	31000	5000		R		R	7400	J	43000	J	59000	J
Benzo(a)pyrene	62	700	660	J	4000	U	5500	U	68000	U	67000	U
Benzo(b)fluoranthene	620	7000	470	J	4000	U	5500	U	68000	U	67000	U
Benzo(k)fluoranthene	6200	7000	790	J	4000	U	5500	U	68000	U	67000	U
bis(2-Ethylhexyl)phthalate	35000	39000	4400	U	8900		5500	U	68000	U	67000	U
Chrysene	62000	70000	590	J	4000	U	5500	U	68000	U	67000	U
Fluoranthene	230000	810000	1100	J	4000	U	5500	U	68000	U	67000	U
Pentachlorophenol	3000	3300	11000	U	10000	U	750	J	45000	J	43000	J
Phenanthrene		480000	620	J	4000	U	5500	U	68000	U	67000	U
Phenol	3700000	56000	4400	U	4000	U	5500	U	39000	JEB	45000	JEB
Pyrene	230000		900	J	4000	U	5500	U	68000	U	67000	U
Pesticide/PCB Analysis (UG/KG)												
4,4'-DDD	2400	700	2.1	U	2.0	U	3.4	J	12	J	3.3	UJ
4,4'-DDE	1700	700	1.5	J	3.2		5.2	J	8.7	J	5.3	J

SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704-0207		MT-SL-DUP-04	
Sample Location			SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled			8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval			2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier			None		None		None		Field Dup. MT-SL-704-0207		Field Dup. MT-SL-704-0207	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
4,4'-DDT	1700	900	2.1	U	2.2		2.7	UJ	3.3	UJ	3.3	UJ
alpha-Chlordane	1600		8.4		29	*	4.6	J	4.3	J	2.1	J
Aroclor-1242	220		21	UJ	280		27	U	33	UJ	33	UJ
Aroclor-1254	220		16	J	78		27	U	33	UJ	33	UJ
beta-BHC	320	60	1.1	U	1.0	U	1.4	UJ	3.5	J	1.7	UJ
delta-BHC			1.1	U	5.2		1.4	UJ	1.7	UJ	1.7	UJ
Dieldrin	30	60	2.1	U	4.4		2.7	UJ	3.3	UJ	3.3	UJ
gamma-Chlordane	1600		10		31	*	6.2	J	5.2	J	4.0	J
Heptachlor Epoxide	53	100	1.5		12		1.4	UJ	4	J	1.7	UJ
Dioxin Analysis (NG/KG)												
1,2,3,4,6,7,8-HpCDD			81800	*	93940	*	25640	*	42060	*	27140	*
1,2,3,4,6,7,8-HpCDF			3220	*	3230	*	1890		7070	*	4500	*
1,2,3,4,7,8,9-HpCDF			148		109		68.4	J	234	J	139	J
1,2,3,4,7,8-HxCDD			54.8		77.1		20.7	J	49.2	J	19.3	J
1,2,3,4,7,8-HxCDF			78.3		76		46.1	J	170	J	75.7	J
1,2,3,6,7,8-HxCDD			948		1200		350		1310	J	549	J
1,2,3,6,7,8-HxCDF			32.3	EB	32.4	EB	16.3	EB	84.9	EB	37.5	EB
1,2,3,7,8,9-HxCDD			211	EB	315	EB	57.1	EB	153	EB	76.4	EB
1,2,3,7,8-PeCDD			13.5	EB	6.6	EB	3.3	JEB	12.1	EB	6.5	EB
1,2,3,7,8-PeCDF			1.2	U	1.1	U	2.9	J	2.6	U	1.3	U
2,3,4,6,7,8-HxCDF			90.5		189		35.9	J	149	J	69	J
2,3,4,7,8-PeCDF			4	J	6.9		5.3		8.4	J	3.6	J
2,3,7,8-TCDD	3.9		21.7		15.5		18.2	J	268	J	83.6	J
2,3,7,8-TCDF			2.8	EMPC	9.9		1.6		4.5		2.8	EMPC
OCDD			722660	EB*	719310	EB*	287900	EB*	717200	EB*	485720	EB*

TABLE 2-14 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704-0207		MT-SL-DUP-04	
Sample Location			SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled			8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval			2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier			None		None		None		Field Dup. MT-SL-704-0207		Field Dup. MT-SL-704-0207	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
OCDF			6000	JEB*	6820	JEB*	5200	JEB*	6360	JEB*	5940	JEB*
Total HpCDD			149650	J*	161180	J*	47190	J*	89010	J*	55340	J*
Total HpCDF			13140	J*	13810	J*	8670	J*	22660	J*	17780	J*
Total HxCDD			10640	JEB*	8220	JEB*	3090	JEB	5040	JEB	2350	JEB
Total HxCDF			2960	JEB*	3300	JEB*	2390	JEB	6530	JEB*	3180	JEB*
Total PeCDD			1040	JEB	1160	JEB	602	JEB	335	JEB	191	JEB
Total PeCDF			237	J	306	J	193	J	270	J	189	J
Total TCDD			102	J	88.1	J	97.9	J	279	J	89	UJ
Total TCDF			40.8	JEB	56.9	JEB	23	JEB	108	JEB	40	JEB
Toxicity Equivalency	1000#		1100	J	1300	J	380	J	1000	J	540	J
TAL Metal Analysis (MG/KG)												
Aluminum			4290		5800		2790		2420		2620	
Antimony	3.1	8	19.5	J	44.4	J	41.7	J	247	J	243	J
Arsenic	0.39	11	3.6	J	7.8	J	1.4	J	12.0	J	3.6	J
Barium	540	750	198	J	657	J	1480	J	252	J	631	J
Beryllium	15	0.95	0.26	UJ	0.35	J	0.22	UJ	0.17	UJ	0.14	UJ
Cadmium	3.7	32	3.9		16.8		0.60	U	0.60	U	0.60	U
Calcium			4980		22300		1710		2420		1500	
Chromium	12000	1000	2420	J	5280	J	5090	J	29400		29700	
Cobalt			2.9		5.6	J	2.8		2.1		2.0	
Copper			33.4		108		274		58.0		38.7	
Iron			7750		25500		10400		3480		4370	
Lead	400	4003	85.1		427		180		31.0		39.6	
Magnesium			1140		2000		610		351		155	
Manganese	180		93.5	J	207	J	45.3	J	34.6	J	15.9	J

TABLE 2-14 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN SLUDGE - AREA 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number			MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704-0207		MT-SL-DUP-04	
Sample Location			SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled			8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval			2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier			None		None		None		Field Dup. MT-SL-704-0207		Field Dup. MT-SL-704-0207	
Project Screening Criteria	EPA Region IX PRG	NH S-1										
Mercury	2.3	13	1.2		4.5		0.55		0.20		0.22	
Nickel	160	580	12.8		24.5		12.2		7.5		12.2	
Potassium			431	J	728	J	226	J	84.1	J	65.4	J
Sodium			124	J	150	J	105	J	313		321	
Thallium	0.52	10	1.1	UJ	1.1	UJ	1.1	UJ	1.6	J	1.3	J
Vanadium	55		4.7		6.7		44.0		9.1		19.6	
Zinc	2300	1000	112		330		172		76.4		121	
Miscellaneous Analyses												
Chromium VI (MG/KG)	30		2.3	U	2.4	UJ	2.4	UJ	2.2	UJ	2.1	U
Redox Potential (mV)			341.6		376.3		344.6		347.1		353.5	
Sulfide (MG/KG)			5.8	U	6.0	U	48.0		310		290	
Paint Filter (ML/KG)	1 @			NA		NA		NA		NA		NA

NOTES:

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

NA = Not analyzed

* = From dilution analysis

EB = Analyte associated with equipment blank contamination

EMPC = Estimated maximum possible concentration

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal. (EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

@ = Paint filter test criteria: 40 CFR 264.314 and EPA SW-846. Detection of any liquid indicates presence of free liquid in the sample and failure of the paint filter test.

TABLE 2-15
RCRA ANALYSIS OF SLUDGE - AREA 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704-0207		MT-SL-DUP-04	
Sample Location		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier		None		None		None		Field Dup. MT-SL-704-0207		Field Dup. MT-SL-704-0207	
Project Screening Criteria	RCRA										
TCLP Volatile Organic Analysis (UG/L)											
2-Butanone	200000	15		10	U	10	U	10	U	10	U
TCLP Semivolatile Organic Analysis (UG/L)											
2,4,5-Trichlorophenol	400000	25	U	25	U	18	J	110	J		NA
2,4,6-Trichlorophenol	2000	10	U	10	U	5	J		R		NA
4-Methylphenol	200000	10	U	10	U	670	J*	4500	J		NA
Pentachlorophenol	100000	2	J	25	U	4	J		R		NA
TCLP Metal Analysis (UG/L)											
Barium	100000	146		90.0		169		124			NA
Chromium	5000	37.8		8.7	J	61.5		598			NA
Lead	5000	4.3	J	7.3	J	4.1	J	3.0	U		NA
Mercury	200	0.20	U	0.35	J	0.20	U	0.20	U		NA
Miscellaneous Analyses											
Corrosivity/pH (SU)		8.11		7.43		8.22		7.99		8.09	
Reactive Cyanide (MG/KG)	250 +	0.4	U	0.4	U	0.4	U	0.4	U		NA
Reactive Sulfide (MG/KG)	500 +	40.4	U	40.2	U	39.8	U	40.2	U		NA

<u>NOTES</u>:

TCLP VOC samples collected from 4-8 feet bgs in SL-701, 8-12 feet bgs in SL-702, 4-8 feet bgs in SL-703, 2-4 feet bgs in SL-704

TCLP = Toxicity Characteristic Leaching Procedure: 40 CFR 261, Subpart C, Table 1--Maximum Concentration of Contaminants for the Toxicity Characteristic. (except as noted by +)

U = Not detected above laboratory detection limits

J = Quantitation approximated

NA = Not analyzed

* = From dilution analysis

R = Rejected

+ = EPA interim guidance level (July 1985) withdrawn April 1998 (U.S. EPA, April 1998b)

TABLE 2-16
SUMMARY OF CONTAMINANTS DETECTED IN OVERLYING SOILS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SO-A2-OVCOMP		MT-SO-A3-OVCOMP		MT-SO-A4-OVCOMP		MT-SO-A6-OVCOMP		MT-SO-A7-OVCOMP	
Sample Location				SO-A2		SO-A3		SO-A4		SO-A6		SO-A7	
Date Sampled				8/29/2001		8/30/2001		8/30/2001		9/5/2001		8/31/2001	
QC Identifier				None		None		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd										
Volatile Organic Analysis (UG/KG)													
Chlorobenzene				190	U	200	U	240	U	25	J	260	U
Chloroform	240	100		25	J	200	U	32	J	180	U	260	U
Methyl Acetate	2200000			44	J	200	U	130	J	180	U	260	U
Toluene	52000	100000		19	J	200	U	240	U	180	U	260	U
Semivolatile Organic Analysis (UG/KG)													
NONE DETECTED													
Pesticide/PCB Analysis (UG/KG)													
alpha-Chlordane	1600			2.7	EB	0.89	U	1.8	U	0.88	UJ	2.1	
Aroclor-1254	220			37	U	17	U	39		17	UJ	5.7	J
Endrin Ketone				3.7	U	1.7	U	6.3		1.7	UJ	1.8	U
gamma-Chlordane	1600			2.5		0.89	U	1.8	U	0.88	UJ	2.7	
Dioxin Analysis (NG/KG)													
1,2,3,4,6,7,8-HpCDD				3340	*	2100	*	765		4350	J*	9910	*
1,2,3,4,6,7,8-HpCDF				894		343		108		633	JEB	609	
1,2,3,4,7,8,9-HpCDF				31		13.8		6.5		18.5	EMPC	20.2	
1,2,3,4,7,8-HxCDD				8.8		18.3		3.2	J	9.4	JEB	11.9	
1,2,3,4,7,8-HxCDF				13.9		9.8		4.1	J	22.1	JEB	12.1	
1,2,3,6,7,8-HxCDD				123		160		30.2		160	JEB	156	
1,2,3,6,7,8-HxCDF				10.6		8.9	EB	2.5	JEB	13	EMPC	7.1	EB
1,2,3,7,8,9-HxCDD				26.6		67.6	EB	7.8	EB	26.5	JEB	37.9	EB
1,2,3,7,8,9-HxCDF				0.5	U	4.3	EMPC	3.5	JEB	10.8	EMPC	0.2	U
1,2,3,7,8-PeCDD				3.2	J	15.9	EB	2.2	JEB	2.6	EMPC	2.6	JEB
1,2,3,7,8-PeCDF				0.69	J	1	J	1.1	J	0.4	UJ	0.2	U
2,3,4,6,7,8-HxCDF				28		16.2		5.1		22.2	JEB	23.1	
2,3,4,7,8-PeCDF				1.4	JEB	1.9	J	1.1	J	1.7	JEB	1.6	J
2,3,7,8-TCDD	3.9			4.4		3.7		2.3		25.2	J	2.4	

TABLE 2-16 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN OVERLYING SOILS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SO-A2-OVCOMP		MT-SO-A3-OVCOMP		MT-SO-A4-OVCOMP		MT-SO-A6-OVCOMP		MT-SO-A7-OVCOMP	
Sample Location				SO-A2		SO-A3		SO-A4		SO-A6		SO-A7	
Date Sampled				8/29/2001		8/30/2001		8/30/2001		9/5/2001		8/31/2001	
QC Identifier				None		None		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd										
2,3,7,8-TCDF				0.99	J	0.69	J	1.4		0.87	UJ	1.5	
OCDD				51900	*	22290	EB*	4550	EB*	56600	J*	114850	JEB*
OCDF				1230		431	JEB	174	JEB	616	JEB	958	JEB
Total HpCDD				6240	J*	4090	J*	1380	J	7870	J*	18220	J*
Total HpCDF				2800	J	831	J	361		1990	JEB	1730	J
Total HxCDD				746	J	943	JEB	138	JEB	1260	JEB	987	J
Total HxCDF				928	J	318	JEB	140	JEB	920	JEB	573	JEB
Total PeCDD				102	JEB	250	JEB	24	JEB	176	JEB	105	JEB
Total PeCDF				42.4	J	52.4	J	9.7	J	61.5	JEB	42.7	J
Total TCDD				19.8	J	44.4	J	2.3	J	51.4	J	5.7	J
Total TCDF				12.3	J	17.9	JEB	6.4	JEB	9.7	J	15.5	JEB
Toxicity Equivalency	1000#			77	J	76	J	20	J	110	J	150	J
TAL Metal Analysis (MG/KG)													
Aluminum				4050		3120		5010		6120		4190	
Antimony	3.1	8	1.64	9.2		2.3		22.3	J	3.4	J	4.4	J
Arsenic	0.39	11	11	4.5		5.5		1.6	J	9.9		7.2	
Barium	540	750		45.9		14.9		20.7		24.2		48.5	
Beryllium	15	0.95	0.95	0.21		0.20		0.26		0.34	J	0.27	UJ
Calcium				4040		2320		1450		565		988	
Chromium	12000	1000	33	1080		316		2670		480		563	
Cobalt				2.5		2.8		3.5		4.9		2.6	
Copper				10.8		5.8		9.0		8.9		13.1	
Iron				4780		3680		5570		8020		4460	
Lead	400	4003	51	18.5		4.0		10.2		6.3		24.7	
Magnesium				1100		961		1460		2540		1090	
Manganese	180			72.5		83.8		185		101		72.4	
Mercury	2.3	13	0.31	0.93	J	0.030	J	0.090	J	0.17		0.57	

TABLE 2-16 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN OVERLYING SOILS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number					MT-SO-A2-OVCOMP		MT-SO-A3-OVCOMP		MT-SO-A4-OVCOMP		MT-SO-A6-OVCOMP		MT-SO-A7-OVCOMP	
Sample Location					SO-A2		SO-A3		SO-A4		SO-A6		SO-A7	
Date Sampled					8/29/2001		8/30/2001		8/30/2001		9/5/2001		8/31/2001	
QC Identifier					None		None		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd											
Nickel	160	580	23		6.5		7.7		9.9		17.0		15.4	
Potassium					406	J	514	J	649	J	1040	J	373	J
Vanadium	55				4.8		5.7		3.6		14.4		10.6	
Zinc	2300	1000	98		40.0		14.5		23.3		25.7		45.1	
Miscellaneous Analyses														
Chromium VI (MG/KG)	30				2.2	U	2.1	U	2.2	U	28.0		2.2	UJ
Corrosivity/pH (SU)					8.01		7.75		6.4		5.55		6.43	
Redox Potential (mV)					353.2		387.8		442.1		476.7		408.9	
Sulfide (MG/KG)					39.0		5.2	U	5.5	U	5.2	U	5.4	U

NOTES:

Area 2 composite consists of overlying soil from SL-201, SL-202, SL-203, SL-204, SL-205
Area 3 composite consists of overlying soil from SL-301, SL-302, SL-303
Area 4 composite consists of overlying soil from SL-401, SL-402, SL-403
Area 6 composite consists of overlying soil from SL-601, SL-602
Area 7 composite consists of overlying soil from SL-701, SL-703, SL-704
EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)
NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.
NH Bkgd = NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5(4)(c), Table 1; January 1998, revised April 2001.
Black background = Criteria exceeded
U = Analyte not detected above laboratory detection limits
J = Quantitation approximate
UJ = Detection limit approximate
* = From dilution analysis
EB = Analyte associated with equipment blank contamination
R = Rejected
EMPC = Estimated maximum possible concentration
# = The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal.
(EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

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TABLE 2-17
SUMMARY OF CONTAMINANTS DETECTED IN UNDERLYING SOILS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SO-A2-UNCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-UNCOMP	
Sample Location				SO-A2		SO-A3		SO-A4		SO-A6		SO-A7	
Date Sampled				8/29/2001		8/30/2001		8/30/2001		9/5/2001		8/31/2001	
QC Identifier				None		None		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd										
Volatile Organic Analysis (UG/KG)													
Chloroform	240	100		33	J	210	U	170	U	210	U	240	UJ
Methyl Acetate	22000000			250	U	210	U	170	U	210	U	560	J
Toluene	520000	100000		250	U	210	U	170	U	210	U	650	J
Semivolatile Organic Analysis (UG/KG)													
4-Methylphenol	310000	5000			R		R	860	J	180	U	1200	J
Pentachlorophenol	3000	3300		980		120	J	450	U	450	U	2300	U
Phenol	37000000	56000		180	U	200	U	180	U	180	U	390	JEB
Pesticide/PCB Analysis (UG/KG)													
NONE DETECTED													
Dioxin Analysis (NG/KG)													
1,2,3,4,6,7,8-HpCDD				41		42.2		8.6		513	J	714	
1,2,3,4,6,7,8-HpCDF				3.4	U	5		2.5	J	79.5	JEB	131	
1,2,3,4,7,8,9-HpCDF				0.4	U	0.6	U	1.7	J	4.9	EMPC	4.8	J
1,2,3,4,7,8-HxCDD				0.3	U	0.4	U	0.96	J	0.8	UJ	0.71	J
1,2,3,4,7,8-HxCDF				0.27	U	0.3	U	1.2	J	1.4	JEB	1.6	J
1,2,3,6,7,8-HxCDD				1.8	U	3.1	J	1.4	J	10.3	JEB	16	
1,2,3,6,7,8-HxCDF				0.11	EMPC	0.3	U	1.2	JEB	0.5	UJ	1.1	JEB
1,2,3,7,8,9-HxCDD				0.68	J	1.6	JEB	2.3	JEB	2.8	JEB	3.5	JEB
1,2,3,7,8,9-HxCDF				0.2	U	0.4	U	3	JEB	0.6	UJ	0.2	U
1,2,3,7,8-PeCDD				0.23	EMPC	0.54	EMPC	1.7	JEB	0.6	UJ	0.2	U
1,2,3,7,8-PeCDF				0.2	U	0.3	U	1.6	J	0.5	UJ	0.2	U
2,3,4,6,7,8-HxCDF				0.2	U	0.3	U	1.2	J	4	JEB	2.6	J
2,3,4,7,8-PeCDF				0.2	U	0.3	U	1.1	J	0.4	UJ	0.1	U
2,3,7,8-TCDD	3.9			0.2	U	0.3	U	0.66	EMPC	0.48	EMPC	0.41	J
2,3,7,8-TCDF					R	0.2	U	0.73	J	0.3	UJ	0.29	J
OCDD				371		425	JEB	67.4	JEB	7090	J*	5240	EB*

TABLE 2-17 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN UNDERLYING SOILS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SO-A2-UNCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-UNCOMP	
Sample Location				SO-A2		SO-A3		SO-A4		SO-A6		SO-A7	
Date Sampled				8/29/2001		8/30/2001		8/30/2001		9/5/2001		8/31/2001	
QC Identifier				None		None		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd										
OCDF				3.5	U	6.3	EMPC	6.6	JEB	817	JEB	545	JEB
Total HpCDD				74.1	UJ	80.8	J	14.1	J	1020	J	1280	J
Total HpCDF				20	J	12.8	J	6	J	404	JEB	528	J
Total HxCDD				8.3	EMPC	17.3	JEB	4.6	JEB	92.8	JEB	81.6	JEB
Total HxCDF				6	EMPC	5.6	JEB	7.1	JEB	74.6	JEB	106	JEB
Total PeCDD				1	EMPC	2.9	JEB	1.7	JEB	5.5	JEB	7	JEB
Total PeCDF				3.8	J	0.3	UJ	2.7	J	3.9	JEB	8.6	J
Total TCDD				0.2	UJ	0.56	EMPC	0.66	EMPC	0.48	EMPC	0.66	J
Total TCDF				0.63	EMPC	0.51	JEB	0.73	JEB	0.97	UJ	3	JEB
Toxicity Equivalency	1000#			0.76	J	1.5	J	4.3	J	9.1	J	12	J
TAL Metal Analysis (MG/KG)													
Aluminum				4120		2000		6050		4100		8400	
Antimony	3.1	8	1.64	0.74	U	0.74	U	0.74	U	0.74	U	1.2	J
Arsenic	0.39	11	11	13.9		6.3		5.8		7.2		8.2	
Barium	540	750		27.8		12.9		26.6		15.2		24.2	
Beryllium	15	0.95	0.95	0.22		0.13		0.17		0.25	UJ	0.41	J
Calcium				1520		560		1130		667		735	
Chromium	12000	1000	33	17.4		12.8		26.8		81.2		174	
Cobalt				5.5		1.8		5.4		2.5		3.4	
Copper				11.2		5.4		9.8		5.8		15.9	
Iron				6300		3580		9060		6120		6710	
Lead	400	4003	51	5.8		2.5		4.2		3.3		7.3	
Magnesium				2350		828		3530		1380		1440	
Manganese	180			141		33.4		106		59.2		58.7	
Mercury		13	0.31	0.020	UJ	0.020	UJ	0.040	J	0.060	J	0.050	J
Nickel	160	580	23	20.0		6.5		17.6		8.9		11.0	
Potassium				1360	J	438	J	2180	J	695	J	397	J

TABLE 2-17 (cont.)
SUMMARY OF CONTAMINANTS DETECTED IN UNDERLYING SOILS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Sample Number				MT-SO-A2-UNCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-UNCOMP	
Sample Location				SO-A2		SO-A3		SO-A4		SO-A6		SO-A7	
Date Sampled				8/29/2001		8/30/2001		8/30/2001		9/5/2001		8/31/2001	
QC Identifier				None		None		None		None		None	
Project Screening Criteria	EPA Region IX PRG	NH S-1	NH Bkgd										
Sodium				522		98.5	U	98.5	U	98.6	U	97.9	U
Vanadium	55			10.3		4.7		14.5		10.2		11.8	
Zinc	2300	1000	98	19.2		12.0		24.4		16.1	U	38.6	
Miscellaneous Analysis													
Chromium VI (MG/KG)	30			2.2	U	2.1	U	2.1	U	2.1	U	2.2	UJ
Corrosivity/pH (SU)				8.82		7.78		8.29		5.39		8.06	
Redox Potential (mV)				395.3		391.5		356.7		285		346.3	
Sulfide (MG/KG)				5.5	U	5.2	U	85.0		5.4	U	5.6	U

NOTES:

Area 2 composite consists of underlying soil from SL-202, SL-204, SL-205

Area 3 composite consists of underlying soil from SL-301, SL-302, SL-303

Area 4 composite consists of underlying soil from SL-402, SL-403

Area 6 composite consists of underlying soil from SL-601, SL-602, SL-603

Area 7 composite consists of underlying soil from SL-701, SL-702, SL-703, SL-704

EPA Region IX PRG = US EPA Region IX Preliminary Remediation Goals for Residential Soil. PRG values for non-carcinogens have been multiplied by 0.1 to adjust to a hazard index of 0.1 for consistency with human health risk evaluation. (see text section 2.4 for details.)

NH S-1 = NHDES Risk Characterization and Management Policy Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001.

NH Bkgd = NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5(4)(c), Table 1; January 1998, revised April 2001.

Black background = Criteria exceeded

U = Analyte not detected above laboratory detection limits

J = Quantitation approximate

UJ = Detection limit approximate

EB = Analyte associated with equipment blank contamination

R = Rejected

= The EPA Region 9 PRG for dioxins is 3.9 ng/kg. However, current EPA policy recommends use of 1 ppb (1000 ng/kg) as a cleanup goal. (EPA OSWER Directive 9200.4-26: Approach for addressing Dioxin in Soil at CERCLA and RCRA Sites (U.S. EPA, 1998))

TABLE 2-18
PERCENT SOLIDS STATISTICS SUMMARY
SLUDGE AND SOIL SAMPLES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Matrix	Disposal Area	Minimum % Solids	Maximum % Solids	Average % Solids
Sludge	Area 1	13.1	35.0	25.7
Sludge	Area 2	54.0	94.2	73.3
Sludge	Area 3	83.0	94.0	90.7
Sludge	Area 4	36.4	79.9	57.5
Sludge +	Area 5	84.6	99.0	95.4
Sludge	Area 6	27.3	91.3	51.6
Sludge	Area 7	30.0	89.4	62.1
Soil	Area 2	85.0	92.2	89.7
Soil	Area 3	83.0	97.0	92.3
Soil	Area 4	85.0	95.0	93.0
Soil	Area 6	93.3	97.0	95.4
Soil	Area 7	84.3	94.8	90.5

NOTES:

These statistics were calculated from all sludge and soil samples analyzed for the EE/CA Field Investigation.

+ = Classified as sludge for purposes of chemical analysis; but no visual evidence of sludge/waste was observed in any borings or test pits in Area 5. The material observed in borings and test pits was poorly graded fine sand.

TABLE 2-19
SUMMARY OF COMPOUNDS EXCEEDING SCREENING CRITERIA IN SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7
Volatile Organic Compounds (UG/KG)							
1,2-Dichlorobenzene						X	
1,4-Dichlorobenzene						X	
2-Butanone	X						
Carbon Disulfide	X	X		X			
Chlorobenzene						X	
Semivolatile Organic Compounds (UG/KG)							
2-Methylnaphthalene	X						
4-Methylphenol	X	X		X			X
Benzo(a)pyrene							X
Naphthalene		X	X			X	
Pentachlorophenol	X	X	X			X	X
Phenol		X					
Pesticides/PCBs (UG/KG)							
Aldrin		X					
Aroclor-1242							X
Heptachlor Epoxide		X					
Dioxins (NG/KG)							
2,3,7,8-TCDD	X	X	X			X	X
Toxicity Equivalency	X	X				X	X
Metals (MG/KG)							
Antimony	X	X	X	X	X	X	X
Arsenic	X	X	X	X	X	X	X
Barium						X	X
Cadmium							X
Chromium	X	X	X	X		X	X
Lead							X
Manganese	X			X			X
Mercury							X
Thallium				X		X	X
Vanadium						X	
Chromium VI (MG/KG)							
RCRA Analyses							
Paint Filter (ML/KG)				X			
Reactive Sulfide (MG/KG)	X						

TABLE 2-20
ESTIMATED SLUDGE/WASTE AND OVERLYING SOIL VOLUMES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Disposal Area	Estimated Area of Sludge/Waste (SF)	Estimated Thickness of Sludge/Waste (FT)	Estimated Volume of Sludge/Waste (CF)	Estimated Volume of Sludge/Waste (CY)	Estimated Thickness of Overlying Soil (FT)	Estimated Volume of Overlying Soil (CF)	Estimated Volume of Overlying Soil (CY)
1	40,000	17	680,000	25,185	NA	NA	NA
2	80,000	10	800,000	29,630	3	240,000	8,889
3	2,000	5	10,000	370	2	4,000	148
4	3,000	9	27,000	1,000	2	6,000	222
5	NA	NA	NA	NA	NA	NA	NA
6	3,500	5	17,500	648	2	7,000	259
7	8,000	12	96,000	3,556	0	0	0
			TOTAL VOLUME (CY):	60,389			9,519

Notes:
See Section 2.1.3 for assumptions made in the area/thickness/volume estimations for sludge/waste and overlying soil.
Overlying soil estimates evaluate only overlying soil considered practical to separate from underlying sludge/waste during excavation.
SF = Square Feet
FT = Feet
CF = Cubic Feet
CY = Cubic Yards
NA = Not Applicable. Field observations and chemical analysis indicate no sludge or tannery waste present, or no overlying soil.

TABLE 2-21
SELECTION OF EXPOSURE PATHWAYS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Sludge	Surface[1] Sludge Area 1	Trespasser	Adolescent	Ingestion	Quant	Adolescents are expected to visit the wet areas along the edges of Area 1 for recreational purposes and therefore be exposed to sludge in areas covered by less than one foot of water through inadvertent contact.
					Dermal	Quant	Adolescents are expected to visit the wet areas along the edges of Area 1 for recreational purposes and therefore be exposed to sludge in areas covered by less than one foot of water through inadvertent contact.
					Inhalation	None	Wet conditions preclude the inhalation of fugitive dust pathway.
	Soil/Sludge	Surface[2] Soil/Sludge Areas 2 through 7	Trespasser	Adolescent	Ingestion	Quant	Adolescents are expected to visit Areas 2 through 7 for recreational purposes and therefore be exposed to surface sludge/soil in relatively dry areas through inadvertent contact.
					Dermal	Quant	Adolescents are expected to visit Areas 2 through 7 for recreational purposes and therefore be exposed to surface sludge/soil in relatively dry areas through inadvertent contact.
					Inhalation	Quant	There is evidence of dirt biking activity in Areas 2 through 7. Therefore, adolescents may be exposed to surface sludge/soil in relatively dry areas through inhalation of fugitive dust.
Future	Soil/Sludge	Surface[2] Soil/Sludge Areas 2 through 7	Resident	Adult/Child	Ingestion	Quant	Future residential exposure at Areas 1 through 7 is evaluated. Adults and children ages 0-30 years may be exposed to contaminated soil on-site through inadvertent contact.
					Dermal	Quant	Future residential exposure at Areas 1 through 7 is evaluated. Adults and children ages 0-30 years may be exposed to contaminated soil on-site through inadvertent contact.
					Inhalation	None	Under a future residential land-use scenario, it is likely that grass-cover will minimize inhalation of fugitive dust.
	Soil/Sludge	"All"[3] Soil/Sludge Areas 1 through 7	Resident	Adult/Child	Ingestion	Quant	Future residential exposure at Areas 1 through 7 is evaluated. Adults and children ages 0-30 years may be exposed to contaminated soil on-site through inadvertent contact.
					Dermal	Quant	Future residential exposure at Areas 1 through 7 is evaluated. Adults and children ages 0-30 years may be exposed to contaminated soil on-site through inadvertent contact.
					Inhalation	None	Under a future residential land-use scenario, it is likely that grass-cover will minimize inhalation of fugitive dust.

NOTES:

[1] Sludge samples from Area 1 were composites of material obtained from depths of 0 to 10-12 feet below ground surface (bgs).

[2] Surface soil/sludge samples from Areas 2 through 7 include all samples that originate at the surface of these disposal areas. Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

[3] Soil/sludge samples from Areas 1 through 7 include all samples obtained from these areas that start at a depth between 0 and 10 feet bgs. Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 2-22.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SURFACE* SLUDGE AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sludge
Exposure Medium: Sludge
Exposure Point: Surface* Sludge Area 1

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
95-50-1	1,2-Dichlorobenzene	440	J	2100		ug/kg	MT-SL-103-0010-AVG	4/4	0 - 0	2100		90000 nc_1			NO	BSL
106-46-7	1,4-Dichlorobenzene	150	J	250		ug/kg	MT-SL-103-0010-AVG	2/4	1200 - 1200	250		3400 ca			NO	BSL
78-93-3	2-Butanone	1600		2200		ug/kg	MT-SL-101-0010	3/4	1300 - 1300	2200		730000 nc			NO	BSL
67-64-1	Acetone	1300		1900	EB	ug/kg	MT-SL-102-0012	4/4	0 - 0	1900		160000 nc			NO	BSL
75-15-0	Carbon Disulfide	1500		6100		ug/kg	MT-SL-102-0012	4/4	0 - 0	6100		36000 nc			NO	BSL
79-20-9	Methyl Acetate	2800		8900		ug/kg	MT-SL-102-0012	4/4	0 - 0	8900		2200000 nc			NO	BSL
95-95-4	2,4,5-Trichlorophenol	5000	J	22000	J	ug/kg	MT-SL-102-0012, MT-SL-103-0010-AVG	3/4	85000 - 85000	22000		610000 nc			NO	BSL
91-57-6	2-Methylnaphthalene	21000	J	21000	J	ug/kg	MT-SL-102-0012	1/4	16000 - 34000	21000		5600 nc			YES	ASL
106-44-5	4-Methylphenol	550000		1300000		ug/kg	MT-SL-102-0012	4/4	0 - 0	1300000		31000 nc			YES	ASL
87-86-5	Pentachlorophenol	9100	J	32000		ug/kg	MT-SL-103-0010-AVG	3/4	160000 - 160000	32000		3000 ca			YES	ASL
108-95-2	Phenol	6300	J	23000	J	ug/kg	MT-SL-102-0012	4/4	0 - 0	23000		3700000 nc			NO	BSL
72-54-8	4,4'-DDD	5.9	J	5.9	J	ug/kg	MT-SL-104-0010	1/4	3.3 - 3.3	5.9		2400 ca			NO	BSL
72-55-9	4,4'-DDE	4.8	J	10	J	ug/kg	MT-SL-101-0010	4/4	0 - 0	10		1700 ca			NO	BSL
50-29-3	4,4'-DDT	4.4	J	4.4	J	ug/kg	MT-SL-101-0010	1/4	3.3 - 3.3	4.4		1700 ca*			NO	BSL
309-00-2	Aldrin	6.1	J	6.1	J	ug/kg	MT-SL-104-0010	1/4	1.7 - 1.7	6.1		29 ca*			NO	BSL
319-84-6	alpha-BHC	4.9	J	24	J	ug/kg	MT-SL-104-0010	3/4	1.7 - 1.7	24		90 ca			NO	BSL
5103-71-9	alpha-Chlordane	3.5	J	62	J	ug/kg	MT-SL-104-0010	4/4	0 - 0	62		1600 ca			NO	BSL
319-85-7	beta-BHC	4.1		4.1		ug/kg	MT-SL-103-0010-AVG	1/4	1.7 - 1.7	4.1		320 ca			NO	BSL
60-57-1	Dieldrin	7	J	7	J	ug/kg	MT-SL-104-0010	1/4	3.3 - 3.3	7		30 ca			NO	BSL
5103-74-2	gamma-Chlordane	3.3	J	48	J	ug/kg	MT-SL-104-0010	4/4	0 - 0	48		1600 ca			NO	BSL
76-44-8	Heptachlor	28	J	56	J	ug/kg	MT-SL-104-0010	2/4	1.7 - 1.7	56		110 ca			NO	BSL
35822-46-9	1,2,3,4,6,7,8-HpCDD	2580	JEB	54600		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	54600					NO	NTX
67562-39-4	1,2,3,4,6,7,8-HpCDF	1130	JEB	4740		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	4740					NO	NTX
55673-89-7	1,2,3,4,7,8,9-HpCDF	53.2	JEB	408		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	408					NO	NTX
39227-28-6	1,2,3,4,7,8-HxCDD	40.4	JEB	390		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	390					NO	NTX
70648-26-9	1,2,3,4,7,8-HxCDF	55.2	JEB	319		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	319					NO	NTX
57653-85-7	1,2,3,6,7,8-HxCDD	421	JEB	2460		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	2460					NO	NTX
57117-44-9	1,2,3,6,7,8-HxCDF	39.5	J	196		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	196					NO	NTX
19408-74-3	1,2,3,7,8,9-HxCDD	135	JEB	1530	JEB	ng/kg	MT-SL-101-0010	4/4	0 - 0	1530					NO	NTX
40321-76-4	1,2,3,7,8-PeCDD	26.5	JEB	395	JEB	ng/kg	MT-SL-101-0010	4/4	0 - 0	395					NO	NTX
57117-41-6	1,2,3,7,8-PeCDF	89.3	EMPC	148		ng/kg	MT-SL-103-0010-AVG	3/4	0.8 - 0.8	148					NO	NTX
60851-34-5	2,3,4,6,7,8-HxCDF	48.4	JEB	228		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	228					NO	NTX
57117-31-4	2,3,4,7,8-PeCDF	5.7	JEB	24.3	JEB	ng/kg	MT-SL-101-0010	4/4	0 - 0	24.3					NO	NTX
1746-01-6	2,3,7,8-TCDD	7.3	J	103		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	103		3.9 ca			YES	ASL
51207-31-9	2,3,7,8-TCDF	3.7	J	13.9	J	ng/kg	MT-SL-101-0010	4/4	0 - 0	13.9					NO	NTX
3268-87-9	OCDD	19200	JEB	406000		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	406000					NO	NTX
39001-02-0	OCDF	870	JEB	4900		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	4900					NO	NTX
37871-00-4	Total HpCDD	4440	JEB	108000		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	108000					NO	NTX
38998-75-3	Total HpCDF	2010	JEB	11500		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	11500					NO	NTX
34465-46-8	Total HxCDD	2110	JEB	15000	JEB	ng/kg	MT-SL-101-0010	4/4	0 - 0	15000					NO	NTX
55684-94-1	Total HxCDF	651	JEB	4640		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	4640					NO	NTX
36088-22-9	Total PeCDD	142	JEB	5100	JEB	ng/kg	MT-SL-101-0010	4/4	0 - 0	5100					NO	NTX
30402-15-4	Total PeCDF	153	JEB	1040		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	1040					NO	NTX

TABLE 2-22.1 (CONT.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SURFACE* SLUDGE AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sludge
Exposure Medium: Sludge
Exposure Point: Surface* Sludge Area 1

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
41903-57-5	Total TCDD	50.7	J	1550		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	1550					NO	NTX
55722-27-5	Total TCDF	63.7	J	470	J	ng/kg	MT-SL-101-0010	4/4	0 - 0	470					NO	NTX
Dioxin TEQ	Toxicity Equivalency	150	J	1600		ng/kg	MT-SL-103-0010-AVG	4/4	0 - 0	1600		3.9 ca			YES	ASL
7429-90-5	Aluminum	4540		8770		mg/kg	MT-SL-104-0010	4/4	0 - 0	8770					NO	EPA I
7440-36-0	Antimony	4		4		mg/kg	MT-SL-103-0010-AVG	1/3	0.74 - 0.74	4		3.1 nc			YES	ASL
7440-38-2	Arsenic	3.1		7.6	J	mg/kg	MT-SL-104-0010	4/4	0 - 0	7.6		0.39 ca*			YES	ASL
7440-39-3	Barium	26.3		45.7		mg/kg	MT-SL-104-0010	4/4	0 - 0	45.7		540 nc			NO	BSL
7440-41-7	Beryllium	0.08		0.24		mg/kg	MT-SL-104-0010	4/4	0 - 0	0.24		15 nc			NO	BSL
7440-70-2	Calcium	75000	J	156000		mg/kg	MT-SL-103-0010-AVG	4/4	0 - 0	156000					NO	NUT
7440-47-3	Chromium	18200		25200		mg/kg	MT-SL-104-0010	4/4	0 - 0	25200		12000 ca			YES	ASL
7440-48-4	Cobalt	4.9		7.4	J	mg/kg	MT-SL-104-0010	4/4	0 - 0	7.4					NO	EPA I
7440-50-8	Copper	23.7		34.7		mg/kg	MT-SL-104-0010	4/4	0 - 0	34.7					NO	EPA I
7439-89-6	Iron	5570		10700		mg/kg	MT-SL-102-0012	4/4	0 - 0	10700					NO	EPA I
7439-92-1	Lead	43.5		60.4		mg/kg	MT-SL-103-0010-AVG	4/4	0 - 0	60.4		400 nc			NO	BSL
7439-95-4	Magnesium	787		1470		mg/kg	MT-SL-104-0010	4/4	0 - 0	1470					NO	NUT
7439-96-5	Manganese	3990		13300		mg/kg	MT-SL-102-0012	4/4	0 - 0	13300		180 nc			YES	ASL
7440-02-0	Nickel	3.4		10.1	J	mg/kg	MT-SL-104-0010	4/4	0 - 0	10.1		160 nc			NO	BSL
7440-09-7	Potassium	451		892	J	mg/kg	MT-SL-104-0010	4/4	0 - 0	892					NO	NUT
7782-49-2	Selenium	1.3		1.3		mg/kg	MT-SL-103-0010-AVG	1/4	1 - 1	1.3		39 nc			NO	BSL
7440-22-4	Silver	1.8	J	6.2	J	mg/kg	MT-SL-102-0012	2/4	1 - 1	6.2		39 nc			NO	BSL
7440-23-5	Sodium	8160		11300		mg/kg	MT-SL-102-0012	4/4	0 - 0	11300					NO	NUT
7440-62-2	Vanadium	20.6		34		mg/kg	MT-SL-104-0010	4/4	0 - 0	34		55 nc			NO	BSL
7440-66-6	Zinc	128		183		mg/kg	MT-SL-104-0010	4/4	0 - 0	183		2300 nc			NO	BSL
18496-25-8	Sulfide	49	J	280	J	mg/kg	MT-SL-104-0010	3/4	16.6 - 16.6	280					NO	NTX

NOTES:

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to supporting information for background discussion.
Background values are the maximum of off-site background concentrations.

(3) Region IX PRG residential soil November 2000. Region IX PRGs for non-carcinogens have been adjusted by a factor of 0.1 to correspond to an HI of 0.1

(4) Rationale Codes Selection Reason:
- Infrequent Detection but Associated Historically (HIST)
- Frequent Detection (FD)
- Toxicity Information Available (TX)
- Above Screening Levels (ASL)

Deletion Reason:
- Infrequent Detection (IFD)
- Background Levels (BKG)
- No Toxicity Information (NTX)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- EPA Region I does not advocate quantitative risk evaluation of this contaminant.(EPA I)

Definitions:
- N/A = Not Applicable
- SQL = Sample Quantitation Limit
- COPC = Chemical of Potential Concern
- ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
- MCL = Federal Maximum Contaminant Level
- SMCL = Secondary Maximum Contaminant Level
- J = Estimated Value
- ca = Carcinogenic
- ca* = Carcinogenic where nc <100X ca
- ca** = Carcinogenic where nc <10X ca
- nc = Non-Carcinogenic
- EB = present in equipment blank
- nc_1 = Region IX PRG for this non-carcinogen was based on a ceiling limit or saturation. The value shown is 1/10 of the Region IX risk-based PRG.

*The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

TABLE 2-22.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SURFACE* SOIL/SLUDGE ONLY AREAS 2 TO 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Surface * Soil/Sludge Only Areas 2 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
95-50-1	1,2-Dichlorobenzene	280	J	280	J	ug/kg	MT-SL-603-0007	1/10	180 - 290	280		90000 nc_1			NO	BSL
106-46-7	1,4-Dichlorobenzene	200	J	200	J	ug/kg	MT-SL-603-0007	1/10	180 - 290	200		3400 ca			NO	BSL
108-90-7	Chlorobenzene	25	J	1300		ug/kg	MT-SL-603-0007	2/10	190 - 290	1300		15000 nc			NO	BSL
67-66-3	Chloroform	25	J	32	J	ug/kg	MT-SO-A4-OVCOMP	2/10	180 - 710	32		240 ca**			NO	BSL
79-20-9	Methyl Acetate	44	J	250	J	ug/kg	MT-SL-603-0007	3/10	180 - 290	250		2200000 nc			NO	BSL
108-88-3	Toluene	19	J	19	J	ug/kg	MT-SO-A2-OVCOMP	1/10	180 - 710	19		59000 nc_1			NO	BSL
117-81-7	bis(2-Ethylhexyl)phthalate	8900		8900		ug/kg	MT-SL-702-0011	1/10	170 - 1900	8900		35000 ca*			NO	BSL
84-74-2	Di-n-Butylphthalate	23	JEB	61		ug/kg	MT-SL-501-0020-AVG	2/10	180 - 4000	61		610000 nc			NO	BSL
72-55-9	4,4'-DDE	3.2		3.2		ug/kg	MT-SL-702-0011	1/10	1.7 - 3.7	3.2		1700 ca			NO	BSL
50-29-3	4,4'-DDT	1.8	J	2.2		ug/kg	MT-SL-702-0011	2/10	1.7 - 3.7	2.2		1700 ca*			NO	BSL
5103-71-9	alpha-Chlordane	1.7	J	29		ug/kg	MT-SL-702-0011	4/10	0.87 - 1.8	29		1600 ca			NO	BSL
53469-21-9	Aroclor-1242	280		280		ug/kg	MT-SL-702-0011	1/10	17 - 37	280		220 ca			YES	ASL
11097-69-1	Aroclor-1254	4	J	78		ug/kg	MT-SL-702-0011	4/10	17 - 37	78		220 ca**			NO	BSL
319-86-8	delta-BHC	5.2		5.2		ug/kg	MT-SL-702-0011	1/10	0.87 - 1.9	5.2		440 ca*			NO	BSL
60-57-1	Dieldrin	4.4		4.4		ug/kg	MT-SL-702-0011	1/10	1.7 - 3.7	4.4		30 ca			NO	BSL
72-20-8	Endrin	5.8		5.8		ug/kg	MT-SL-702-0011	1/10	1.7 - 3.7	5.8		1800 nc			NO	BSL
53494-70-5	Endrin Ketone	6.3		6.3		ug/kg	MT-SO-A4-OVCOMP	1/10	1.7 - 3.7	6.3		1800 nc			NO	BSL
5103-74-2	gamma-Chlordane	1.9	J	31		ug/kg	MT-SL-702-0011	4/10	0.87 - 1.8	31		1600 ca			NO	BSL
1024-57-3	Heptachlor Epoxide	12		12		ug/kg	MT-SL-702-0011	1/10	0.87 - 1.9	12		53 ca*			NO	BSL
35822-46-9	1,2,3,4,6,7,8-HpCDD	10.8		93940		ng/kg	MT-SL-702-0011	10/10	0 - 0	93940					NO	NTX
67562-39-4	1,2,3,4,6,7,8-HpCDF	1.2		3230		ng/kg	MT-SL-702-0011	10/10	0 - 0	3230					NO	NTX
55673-89-7	1,2,3,4,7,8,9-HpCDF	2.8	J	109		ng/kg	MT-SL-702-0011	9/10	0.45 - 0.45	109					NO	NTX
39227-28-6	1,2,3,4,7,8-HxCDD	0.88	J	77.1		ng/kg	MT-SL-702-0011	9/10	0.35 - 0.35	77.1					NO	NTX
70648-26-9	1,2,3,4,7,8-HxCDF	1.3	J	76		ng/kg	MT-SL-702-0011	9/10	0.2 - 0.2	76					NO	NTX
57653-85-7	1,2,3,6,7,8-HxCDD	8.3		1200		ng/kg	MT-SL-702-0011	9/10	0.35 - 0.35	1200					NO	NTX
57117-44-9	1,2,3,6,7,8-HxCDF	0.6	J	32.4	EB	ng/kg	MT-SL-702-0011	9/10	0.2 - 0.2	32.4					NO	NTX
19408-74-3	1,2,3,7,8,9-HxCDD	2.2	J	315	EB	ng/kg	MT-SL-702-0011	9/10	0.35 - 0.35	315					NO	NTX
72918-21-9	1,2,3,7,8,9-HxCDF	0.74	EMPC	10.8	EMPC	ng/kg	MT-SO-A6-OVCOMP	4/10	0.2 - 1.8	10.8					NO	NTX
40321-76-4	1,2,3,7,8-PeCDD	1.1	J	15.9	EB	ng/kg	MT-SO-A3-OVCOMP	8/10	0.35 - 0.5	15.9					NO	NTX
57117-41-6	1,2,3,7,8-PeCDF	0.27	J	1.1	J	ng/kg	MT-SO-A4-OVCOMP	4/10	0.2 - 1.1	1.1					NO	NTX
60851-34-5	2,3,4,6,7,8-HxCDF	1.3	J	189		ng/kg	MT-SL-702-0011	9/10	0.25 - 0.25	189					NO	NTX
57117-31-4	2,3,4,7,8-PeCDF	1.1	J	6.9		ng/kg	MT-SL-702-0011	7/10	0.2 - 0.3	6.9					NO	NTX
1746-01-6	2,3,7,8-TCDD	0.39	J	25.2	J	ng/kg	MT-SO-A6-OVCOMP	9/10	0.25 - 0.25	25.2		3.9 ca			YES	ASL
51207-31-9	2,3,7,8-TCDF	0.36	J	9.9		ng/kg	MT-SL-702-0011	7/9	0.87 - 2.1	9.9					NO	NTX
3268-87-9	OCDD	99.9		719310	EB	ng/kg	MT-SL-702-0011	10/10	0 - 0	719310					NO	NTX
39001-02-0	OCDF	2.6		6820	JEB	ng/kg	MT-SL-702-0011	10/10	0 - 0	6820					NO	NTX
37871-00-4	Total HpCDD	18.6		161180	J	ng/kg	MT-SL-702-0011	10/10	0 - 0	161180					NO	NTX
38998-75-3	Total HpCDF	4.2		13810	J	ng/kg	MT-SL-702-0011	10/10	0 - 0	13810					NO	NTX
34465-46-8	Total HxCDD	1.2		8220	JEB	ng/kg	MT-SL-702-0011	10/10	0 - 0	8220					NO	NTX
55684-94-1	Total HxCDF	35.3	J	3300	JEB	ng/kg	MT-SL-702-0011	9/10	0.75 - 0.75	3300					NO	NTX
36088-22-9	Total PeCDD	0.8		1160	JEB	ng/kg	MT-SL-702-0011	10/10	0 - 0	1160					NO	NTX
30402-15-4	Total PeCDF	2.5	J	306	J	ng/kg	MT-SL-702-0011	9/10	0.25 - 0.25	306					NO	NTX
41903-57-5	Total TCDD	0.64	JEB	88.1	J	ng/kg	MT-SL-702-0011	9/10	0.25 - 0.25	88.1					NO	NTX

TABLE 2-22.2 (CONT.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SURFACE* SOIL/SLUDGE ONLY AREAS 2 TO 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Surface * Soil/Sludge Only Areas 2 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
55722-27-5	Total TCDF	0.97	JEB	56.9	JEB	ng/kg	MT-SL-702-0011	9/10	0.2 - 0.2	56.9					NO	NTX
Dioxin TEQ	Toxicity Equivalency	0.13		1300	J	ng/kg	MT-SL-702-0011	10/10	0 - 0	1300		3.9 ca			YES	ASL
7429-90-5	Aluminum	3120		6660		mg/kg	MT-SL-603-0007	10/10	0 - 0	6660					NO	EPA I
7440-36-0	Antimony	2.3		44.4	J	mg/kg	MT-SL-702-0011	8/10	0.74 - 0.74	44.4		3.1 nc			YES	ASL
7440-38-2	Arsenic	1.6	J	15.7		mg/kg	MT-SL-603-0007	10/10	0 - 0	15.7		0.39 ca*			YES	ASL
7440-39-3	Barium	14.9		657	J	mg/kg	MT-SL-702-0011	10/10	0 - 0	657		540 nc			YES	ASL
7440-41-7	Beryllium	0.2		0.41	J	mg/kg	MT-SL-603-0007	7/10	0.24 - 0.27	0.41		15 nc			NO	BSL
7440-43-9	Cadmium	16.8		16.8		mg/kg	MT-SL-702-0011	1/10	0.6 - 0.6	16.8		3.7 nc			YES	ASL
7440-70-2	Calcium	565		22300		mg/kg	MT-SL-702-0011	10/10	0 - 0	22300					NO	NUT
7440-47-3	Chromium	60.9		5280	J	mg/kg	MT-SL-702-0011	10/10	0 - 0	5280		12000 ca			NO	BSL
7440-48-4	Cobalt	2.5		5.6	J	mg/kg	MT-SL-702-0011	10/10	0 - 0	5.6					NO	EPA I
7440-50-8	Copper	4.4		108		mg/kg	MT-SL-702-0011	10/10	0 - 0	108					NO	EPA I
7439-89-6	Iron	3680		25500		mg/kg	MT-SL-702-0011	10/10	0 - 0	25500					NO	EPA I
7439-92-1	Lead	2.7		427		mg/kg	MT-SL-702-0011	10/10	0 - 0	427		400 nc			YES	ASL
7439-95-4	Magnesium	961		2540		mg/kg	MT-SO-A6-OVCOMP	10/10	0 - 0	2540					NO	NUT
7439-96-5	Manganese	72.4		207	J	mg/kg	MT-SL-702-0011	10/10	0 - 0	207		180 nc			YES	ASL
7439-97-6	Mercury	0.03	J	4.5		mg/kg	MT-SL-702-0011	9/10	0.02 - 0.02	4.5		2.3 nc			YES	ASL
7440-02-0	Nickel	6.5		24.5		mg/kg	MT-SL-702-0011	10/10	0 - 0	24.5		160 nc			NO	BSL
7440-09-7	*Potassium*	373	*J*	*1040*	*J*	mg/kg	*MT-SO-A6-OVCOMP*	*10/10*	*0 - 0*	*1040*					NO	NUT
7440-23-5	Sodium	150	J	150	J	mg/kg	MT-SL-702-0011	1/10	97.9 - 98.6	150					NO	NUT
7440-62-2	Vanadium	3.6		43.5		mg/kg	MT-SL-603-0007	10/10	0 - 0	43.5		55 nc			NO	BSL
7440-66-6	Zinc	14.5		330		mg/kg	MT-SL-702-0011	9/10	14.8 - 14.8	330		2300 nc			NO	BSL
18540-29-9	Chromium VI	3	J	28		mg/kg	MT-SO-A6-OVCOMP	2/10	2.1 - 2.4	28		30 ca**			NO	BSL
18496-25-8	Sulfide	8.8		39		mg/kg	MT-SO-A2-OVCOMP	2/10	5.1 - 6	39					NO	NTX

NOTES:
(1) Minimum/maximum detected concentration.
(2) N/A - Refer to supporting information for background discussion.
Background values are the maximum of off-site background concentrations.
(3) Region IX PRG residential soil November 2000. Region IX PRGs for non-carcinogens have been adjusted by a factor of 0.1 to correspond to an HI of 0.1
(4) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
EPA Region I does not advocate quantitative risk evaluation of this contaminant.(EPA I)

Definitions:
N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
ca = Carcinogenic
ca* = Carcinogenic where nc <100X ca
ca** = Carcinogenic where nc <10X ca
nc = Non-Carcinogenic
EB = present in equipment blank
nc_1 = Region IX PRG for this non-carcinogen was based on a ceiling limit or saturation.
The value shown is 1/10 of the Region IX risk-based PRG.

*Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-22.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
120-82-1	1,2,4-Trichlorobenzene	35	J	570	J	ug/kg	MT-SL-601-0711	5/33	170 - 1300	570		65000 nc			NO	BSL
95-50-1	1,2-Dichlorobenzene	32	J	46000		ug/kg	MT-SL-601-0711	16/33	180 - 1300	46000		90000 nc_1			NO	BSL
106-46-7	1,4-Dichlorobenzene	15	J	25000		ug/kg	MT-SL-601-0711	12/33	180 - 1300	25000		3400 ca			YES	ASL
78-93-3	2-Butanone	510		2200		ug/kg	MT-SL-101-0010	5/33	170 - 1300	2200		730000 nc			NO	BSL
67-64-1	Acetone	210		4300		ug/kg	MT-SL-704-0207-AVG	12/33	170 - 710	4300		160000 nc			NO	BSL
75-15-0	Carbon Disulfide	54	J	6100		ug/kg	MT-SL-102-0012	14/33	180 - 1300	6100		36000 nc			NO	BSL
108-90-7	Chlorobenzene	25	J	77000		ug/kg	MT-SL-601-0711	7/33	170 - 1300	77000		15000 nc			YES	ASL
67-66-3	Chloroform	19	J	79	J	ug/kg	MT-SL-403-0510	9/33	180 - 1300	79		240 ca**			NO	BSL
100-41-4	Ethylbenzene	120	J	380	J	ug/kg	MT-SL-601-0711	2/33	170 - 1300	380		150000 nc_1			NO	BSL
79-20-9	Methyl Acetate	44	J	8900		ug/kg	MT-SL-102-0012	20/33	180 - 330	8900		2200000 nc			NO	BSL
127-18-4	Tetrachloroethene	170	J	170	J	ug/kg	MT-SL-401-0511	1/33	170 - 1300	170		5700 ca*			NO	BSL
108-88-3	Toluene	19	J	9200		ug/kg	MT-SL-402-0311	11/33	170 - 1300	9200		59000 nc_1			NO	BSL
1330-20-7	Total Xylenes	280	J	2300		ug/kg	MT-SL-601-0711	3/29	170 - 1300	2300		140000 nc_1			NO	BSL
95-95-4	2,4,5-Trichlorophenol	380	J	70000	J	ug/kg	MT-SL-602-0509	9/33	440 - 330000	70000		610000 nc			NO	BSL
91-58-7	2-Chloronaphthalene	1700	J	5200	J	ug/kg	MT-SL-201-0616	2/33	170 - 130000	5200		390000 nc			NO	BSL
91-57-6	2-Methylnaphthalene	1800	J	21000	J	ug/kg	MT-SL-102-0012	5/33	170 - 130000	21000		5600 nc			YES	ASL
59-50-7	4-Chloro-3-methylphenol	550	J	550	J	ug/kg	MT-SL-703-0215	1/33	170 - 130000	550		31000 ca			NO	BSL
106-44-5	4-Methylphenol	1200	J	1300000		ug/kg	MT-SL-102-0012	11/16	180 - 130000	1300000		31000 nc			YES	ASL
50-32-8	Benzo(a)pyrene	660	J	660	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	660		62 ca			YES	ASL
205-99-2	Benzo(b)fluoranthene	470	J	470	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	470		620 ca			NO	BSL
207-08-9	Benzo(k)fluoranthene	790	J	790	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	790		6200 ca			NO	BSL
117-81-7	bis(2-Ethylhexyl)phthalate	8900		15000	J	ug/kg	MT-SL-401-0511	2/33	170 - 130000	15000		35000 ca*			NO	BSL
218-01-9	Chrysene	590	J	590	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	590		62000 ca			NO	BSL
84-74-2	Di-n-Butylphthalate	23	JEB	61		ug/kg	MT-SL-501-0020-AVG	2/33	180 - 130000	61		610000 nc			NO	BSL
206-44-0	Fluoranthene	1100	J	1100	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	1100		230000 nc			NO	BSL
86-30-6	N-Nitroso-diphenylamine	7600	J	7600	J	ug/kg	MT-SL-602-0509	1/33	170 - 130000	7600		99000 ca			NO	BSL
91-20-3	Naphthalene	760	J	61000		ug/kg	MT-SL-202-0717-AVG	7/33	170 - 68000	61000		5600 nc			YES	ASL
87-86-5	Pentachlorophenol	120	J	120000	J	ug/kg	MT-SL-602-0509	12/33	440 - 330000	120000		3000 ca			YES	ASL
85-01-8	Phenanthrene	620	J	620	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	620		2200000 nc			NO	BSL
108-95-2	Phenol	390	JEB	52000		ug/kg	MT-SL-202-0717-AVG	9/33	170 - 130000	52000		3700000 nc			NO	BSL
129-00-0	Pyrene	900	J	900	J	ug/kg	MT-SL-701-0217	1/33	170 - 130000	900		230000 nc			NO	BSL
72-54-8	4,4'-DDD	3.4	J	34	J	ug/kg	MT-SL-601-0711	6/33	1.7 - 17	34		2400 ca			NO	BSL
72-55-9	4,4'-DDE	1.5	J	53	J	ug/kg	MT-SL-602-0509	15/33	1.7 - 6.5	53		1700 ca			NO	BSL
50-29-3	4,4'-DDT	1.8	J	5.6	J	ug/kg	MT-SL-602-0509	4/33	1.7 - 17	5.6		1700 ca*			NO	BSL
309-00-2	Aldrin	6.1	J	29		ug/kg	MT-SL-202-0717-AVG	3/33	0.87 - 3.4	29		29 ca*			NO	BSL
319-84-6	alpha-BHC	4.6		24	J	ug/kg	MT-SL-104-0010	4/33	0.87 - 8.9	24		90 ca			NO	BSL
5103-71-9	alpha-Chlordane	1.6		340		ug/kg	MT-SL-202-0717-AVG	19/33	0.87 - 3.4	340		1600 ca			NO	BSL
53469-21-9	Aroclor-1242	280		280		ug/kg	MT-SL-702-0011	1/33	17 - 170	280		220 ca			YES	ASL
11097-69-1	Aroclor-1254	4	J	180		ug/kg	MT-SL-401-0511	11/33	17 - 61	180		220 ca**			NO	BSL

TABLE 2-22.3 (CONT.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Måximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
319-85-7	beta-BHC	2.2		18		ug/kg	MT-SL-203-0619	5/33	0.87 - 3.4	18		320 ca			NO	BSL
319-86-8	delta-BHC	3.2		18		ug/kg	MT-SL-202-0717-AVG	3/33	0.87 - 3.4	18		440 ca*			NO	BSL
60-57-1	Dieldrin	4.4		12		ug/kg	MT-SL-202-0717-AVG	4/33	1.7 - 6.5	12		30 ca			NO	BSL
72-20-8	Endrin	5.8		5.9	J	ug/kg	MT-SL-601-0711	2/33	1.7 - 17	5.9		1800 nc			NO	BSL
53494-70-5	Endrin Ketone	5.8		26	J	ug/kg	MT-SL-601-0711	4/33	1.7 - 17	26		1800 nc			NO	BSL
5103-74-2	gamma-Chlordane	1.7		500		ug/kg	MT-SL-202-0717-AVG	18/33	0.87 - 3.4	500		1600 ca			NO	BSL
76-44-8	Heptachlor	28	J	56	J	ug/kg	MT-SL-104-0010	2/33	0.87 - 8.9	56		110 ca			NO	BSL
1024-57-3	Heptachlor Epoxide	1.5		48		ug/kg	MT-SL-202-0717-AVG	6/33	0.87 - 3.4	48		53 ca*			NO	BSL
35822-46-9	1,2,3,4,6,7,8-HpCDD	10.8		93940		ng/kg	MT-SL-702-0011	33/33	0 - 0	93940					NO	NTX
67562-39-4	1,2,3,4,6,7,8-HpCDF	1.2		17200	JEB	ng/kg	MT-SL-602-0509	33/33	0 - 0	17200					NO	NTX
55673-89-7	1,2,3,4,7,8,9-HpCDF	2.8	J	990	JEB	ng/kg	MT-SL-602-0509	30/33	0.45 - 5.2	990					NO	NTX
39227-28-6	1,2,3,4,7,8-HxCDD	0.71	J	390		ng/kg	MT-SL-103-0010-AVG	29/33	0.35 - 3.1	390					NO	NTX
70648-26-9	1,2,3,4,7,8-HxCDF	1.3	J	758	JEB	ng/kg	MT-SL-601-0711	30/33	0.2 - 2.7	758					NO	NTX
57653-85-7	1,2,3,6,7,8-HxCDD	3.1	J	4690	JEB	ng/kg	MT-SL-602-0509	32/33	0.35 - 0.35	4690					NO	NTX
57117-44-9	1,2,3,6,7,8-HxCDF	0.6	J	229	J	ng/kg	MT-SL-602-0509	29/33	0.2 - 2.7	229					NO	NTX
19408-74-3	1,2,3,7,8,9-HxCDD	1.6	JEB	1530	JEB	ng/kg	MT-SL-101-0010	32/33	0.35 - 0.35	1530					NO	NTX
72918-21-9	1,2,3,7,8,9-HxCDF	0.74	EMPC	10.8	EMPC	ng/kg	MT-SO-A6-OVCOMP	5/33	0.1 - 5.7	10.8					NO	NTX
40321-76-4	1,2,3,7,8-PeCDD	0.54	EMPC	395	JEB	ng/kg	MT-SL-101-0010	28/33	0.2 - 3.6	395					NO	NTX
57117-41-6	1,2,3,7,8-PeCDF	0.27	J	148		ng/kg	MT-SL-103-0010-AVG	13/33	0.09 - 2.4	148					NO	NTX
60851-34-5	2,3,4,6,7,8-HxCDF	1.3	J	488	JEB	ng/kg	MT-SL-602-0509	29/33	0.25 - 4.7	488					NO	NTX
57117-31-4	2,3,4,7,8-PeCDF	0.25	EMPC	91.9	JEB	ng/kg	MT-SL-601-0711	25/33	0.1 - 2.2	91.9					NO	NTX
1746-01-6	2,3,7,8-TCDD	0.39	J	1240	J	ng/kg	MT-SL-602-0509	30/33	0.25 - 1.8	1240		3.9 ca			YES	ASL
51207-31-9	2,3,7,8-TCDF	0.24	EMPC	26.9	J	ng/kg	MT-SL-601-0711	25/32	0.2 - 2.1	26.9					NO	NTX
3268-87-9	OCDD	99.9		922000	J	ng/kg	MT-SL-601-0711	33/33	0 - 0	922000					NO	NTX
39001-02-0	OCDF	2.6		33200	JEB	ng/kg	MT-SL-601-0711	33/33	0 - 0	33200					NO	NTX
37871-00-4	Total HpCDD	18.6		161180	J	ng/kg	MT-SL-702-0011	33/33	0 - 0	161180					NO	NTX
38998-75-3	Total HpCDF	4.2		75200	JEB	ng/kg	MT-SL-602-0509	33/33	0 - 0	75200					NO	NTX
34465-46-8	Total HxCDD	1.2		20400	JEB	ng/kg	MT-SL-601-0711	33/33	0 - 0	20400					NO	NTX
55684-94-1	Total HxCDF	5.6	JEB	27600	JEB	ng/kg	MT-SL-602-0509	32/33	0.75 - 0.75	27600					NO	NTX
36088-22-9	Total PeCDD	0.8		5100	JEB	ng/kg	MT-SL-101-0010	33/33	0 - 0	5100					NO	NTX
30402-15-4	Total PeCDF	2.5	J	1690	JEB	ng/kg	MT-SL-601-0711	31/33	0.25 - 0.3	1690					NO	NTX
41903-57-5	Total TCDD	0.48	EMPC	1550		ng/kg	MT-SL-103-0010-AVG	31/33	0.25 - 1.8	1550					NO	NTX
55722-27-5	Total TCDF	0.51	JEB	470	J	ng/kg	MT-SL-101-0010	30/33	0.2 - 1.4	470					NO	NTX
Dioxin TEQ	Toxicity Equivalency	0.13		2600	J	ng/kg	MT-SL-602-0509	33/33	0 - 0	2600		3.9 ca			YES	ASL
7429-90-5	Aluminum	2000		10600		mg/kg	MT-SL-602-0509	33/33	0 - 0	10600					NO	EPA I
7440-36-0	Antimony	1.2	J	547	J	mg/kg	MT-SL-602-0509	25/32	0.74 - 0.74	547		3.1 nc			YES	ASL
7440-38-2	Arsenic	1.2	J	15.7		mg/kg	MT-SL-603-0007	32/33	1 - 1	15.7		0.39 ca*			YES	ASL
7440-39-3	Barium	12.9		1480	J	mg/kg	MT-SL-703-0215	33/33	0 - 0	1480		540 nc			YES	ASL
7440-41-7	Beryllium	0.08		0.41	J	mg/kg	MT-SL-204-0618, MT-SL-603-0007, MT-SO-A7-UNCOMP	25/33	0.16 - 0.27	0.41		15 nc			NO	BSL

TABLE 2-22.3 (CONT.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7440-43-9	Cadmium	0.74	J	16.8		mg/kg	MT-SL-702-0011	4/33	0.52 - 0.68	16.8		3.7 nc			YES	ASL
7440-70-2	Calcium	560		156000		mg/kg	MT-SL-103-0010-AVG	33/33	0 - 0	156000					NO	NUT
7440-47-3	Chromium	12.8		67800	J	mg/kg	MT-SL-602-0509	33/33	0 - 0	67800		12000 ca			YES	ASL
7440-48-4	Cobalt	1.8		7.4	J	mg/kg	MT-SL-104-0010	33/33	0 - 0	7.4					NO	EPA I
7440-50-8	Copper	4.4		274		mg/kg	MT-SL-703-0215	33/33	0 - 0	274					NO	EPA I
7439-89-6	Iron	3370		25500		mg/kg	MT-SL-702-0011	33/33	0 - 0	25500					NO	EPA I
7439-92-1	Lead	2.5		427		mg/kg	MT-SL-702-0011	33/33	0 - 0	427		400 nc			YES	ASL
7439-95-4	Magnesium	253		4010		mg/kg	MT-SL-201-0616	33/33	0 - 0	4010					NO	NUT
7439-96-5	Manganese	25.2		13300		mg/kg	MT-SL-102-0012	33/33	0 - 0	13300		180 nc			YES	ASL
7439-97-6	Mercury	0.02	J	4.5		mg/kg	MT-SL-702-0011	26/31	0.02 - 0.02	4.5		2.3 nc			YES	ASL
7440-02-0	Nickel	3.4		24.5		mg/kg	MT-SL-702-0011	33/33	0 - 0	24.5		160 nc			NO	BSL
7440-09-7	Potassium	74.7		2410	J	mg/kg	MT-SL-201-0616	33/33	0 - 0	2410					NO	NUT
7782-49-2	Selenium	1.3		1.3		mg/kg	MT-SL-103-0010-AVG	1/33	0.87 - 1.1	1.3		39 nc			NO	BSL
7440-22-4	Silver	1.7		6.2	J	mg/kg	MT-SL-102-0012	3/33	0.87 - 1.1	6.2		39 nc			NO	BSL
7440-23-5	Sodium	103	J	11300		mg/kg	MT-SL-102-0012	17/33	85.3 - 98.6	11300					NO	NUT
7440-28-0	Thallium	1.4		2.2	J	mg/kg	MT-SL-602-0509	4/33	0.99 - 2	2.2		0.52 nc			YES	ASL
7440-62-2	Vanadium	2.6		68.6		mg/kg	MT-SL-602-0509	31/33	0.64 - 0.64	68.6		55 nc			YES	ASL
7440-66-6	Zinc	12		330		mg/kg	MT-SL-702-0011	31/33	14.8 - 16.1	330		2300 nc			NO	BSL
18540-29-9	Chromium VI	3	J	28		mg/kg	MT-SO-A6-OVCOMP	2/33	2 - 10.9	28		30 ca**			NO	BSL
18496-25-8	Sulfide	8.8		300	J	mg/kg	MT-SL-402-0311, MT-SL-704-0207-AVG	20/33	5.1 - 16.6	300					NO	NTX

NOTES:
(1) Minimum/maximum detected concentration.
(2) N/A - Refer to supporting information for background discussion.
Background values are the maximum of off-site background concentrations.
(3) Region IX PRG residential soil November 2000. Region IX PRGs for non-carcinogens have been adjusted by a factor of 0.1 to correspond to an HI of
(4) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
EPA Region I does not advocate quantitative risk evaluation of this contaminant (EPA I)

Definitions:
N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
ca = Carcinogenic
ca* = Carcinogenic where nc <100X ca
ca** = Carcinogenic where nc <10X ca
nc = Non-Carcinogenic
EB = present in equipment blank
nc_1 = Region IX PRG for this non-carcinogen was based on a ceiling limit or saturation.
The value shown is 1/10 of the Region IX risk-based PRG.

*Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 2-23.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SURFACE* SLUDGE AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Sludge
Exposure Point: Surface* Sludge Area 1

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
2-Methylnaphthalene	ug/kg	16000	NA	21000	J	ug/kg	21000	Max	W-Test(4)
4-Methylphenol	ug/kg	800000	NA	1300000		ug/kg	1300000	Max	W-Test(4)
Pentachlorophenol	ug/kg	34000	NA	32000		ug/kg	32000	Max	W-Test(4)
Toxicity Equivalency	ng/kg	855	NA	1600	J	ng/kg	1600	Max	W-Test(4)
Antimony	mg/kg	1.6	NA	4.0		mg/kg	4.0	Max	W-Test(4)
Arsenic	mg/kg	5.6	NA	7.6	J	mg/kg	7.6	Max	W-Test(4)
Chromium	mg/kg	20400	NA	25200		mg/kg	25200	Max	W-Test(4)
Manganese	mg/kg	7970	NA	13300		mg/kg	13300	Max	W-Test(4)

NOTES:
For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average of the duplicate results was used in the calculation.
W-Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W-Test indicates data are lognormally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
(3) Shapiro-Wilk W-Test indicates data are normally distributed.
(4) < 11 sample results. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
*The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.
These exposure point concentrations are used to evaluate trespasser exposures to sludge in Area 1.

TABLE 2-23.2

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

SURFACE* SOIL/SLUDGE ONLY AREAS 2 TO 7

FINAL ENGINEERING EVALUATION/COST ANALYSIS

MOHAWK TANNERY SITE

NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future*
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Surface * Soil/Sludge Only Areas 2 to 7

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aroclor-1242	ug/kg	38	NA	280		ug/kg	280	Max	W-Test(4)
Toxicity Equivalency	ng/kg	195	NA	1300	J	ng/kg	1300	Max	W-Test(4)
Antimony	mg/kg	9.7	NA	44	J	mg/kg	44	Max	W-Test(4)
Arsenic	mg/kg	7.5	NA	16		mg/kg	16	Max	W-Test(4)
Barium	mg/kg	89.9	NA	657	J	mg/kg	657	Max	W-Test(4)
Cadmium	mg/kg	2	NA	17		mg/kg	17	Max	W-Test(4)
Lead	mg/kg	51.8	NA	427		mg/kg	427	Max	W-Test(4)
Manganese	mg/kg	124	NA	207	J	mg/kg	207	Max	W-Test(4)
Mercury	mg/kg	0.67	NA	4.5		mg/kg	4.5	Max	W-Test(4)

NOTES:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average of the duplicate results was used in the calculation.

W-Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W-Test indicates data are lognormally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
(3) Shapiro-Wilk W-Test indicates data are normally distributed.
(4) < 11 sample results. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.

**These exposure point concentrations are used to evaluate two scenarios: current/future trespasser and future residential exposures to surface soil/sludge in Areas 2 through 7. Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.*

TABLE 2-23.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
1,4-Dichlorobenzene	ug/kg	1100	2400	25000		ug/kg	1000	95% UCL-T	W-Test(1)
2-Methylnaphthalene	ug/kg	7900	12000	21000	J	ug/kg	21000	Max	W-Test(2)
4-Methylphenol	ug/kg	220000	390000	1300000	*	ug/kg	1300000	Max	W-Test(2)
Benzo(a)pyrene	ug/kg	8500	13000	660	J	ug/kg	660	Max	W-Test(2)
Naphthalene	ug/kg	10000	15000	61000		ug/kg	61000	Max	W-Test(2)
Pentachlorophenol	ug/kg	20000	30000	120000	J	ug/kg	120000	95% UCL-T	W-Test(1)
Aroclor-1242	ug/kg	25	39	280		ug/kg	28	95% UCL-T	W-Test(1)
Toxicity Equivalency	ng/kg	512	717	2600	J	ng/kg	2600	Max	W-Test(2)
Antimony	mg/kg	58.4	96.6	547	J	mg/kg	506	95% UCL-T	W-Test(1)
Arsenic	mg/kg	6	6.9	16		mg/kg	8.6	95% UCL-T	W-Test(1)
Barium	mg/kg	126	210	1480	J	mg/kg	154	95% UCL-T	W-Test(1)
Cadmium	mg/kg	0.95	1.8	17		mg/kg	0.78	95% UCL-T	W-Test(1)
Chromium	mg/kg	9310	14000	67800	J	mg/kg	67800	Max	W-Test(2)
Lead	mg/kg	40.1	63.1	427		mg/kg	67.6	95% UCL-T	W-Test(1)
Manganese	mg/kg	1170	2020	13300		mg/kg	1810	95% UCL-T	W-Test(1)
Mercury	mg/kg	0.33	0.58	4.5		mg/kg	0.76	95% UCL-T	W-Test(1)
Thallium	mg/kg	0.73	0.86	2.2	J	mg/kg	0.81	95% UCL-T	W-Test(1)
Vanadium	mg/kg	15.4	20.1	69		mg/kg	32.1	95% UCL-T	W-Test(1)

NOTES:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average of the duplicate results was used in the calculation.

W-Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T), Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W-Test indicates data are lognormally distributed.

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.

(3) Shapiro-Wilk W-Test indicates data are normally distributed.

*Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

These exposure point concentrations are used to evaluate residential exposures to "all" soil/sludge in Areas 1 through 7.

TABLE 2-24.1
VALUES USED FOR DAILY INTAKE CALCULATIONS - ADOLESCENT TRESPASSER CONTACT WITH WET SLUDGE AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Sludge
Exposure Point: Surface* Sludge in Area 1
Receptor Population: Trespasser
Receptor Age: Adolescent (9-18 Years old)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sludge	mg/kg	See Table 2-23.1	See Table 2-23.1	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Sludge	mg/day	100	EPA, 1997	CS x Oral Exposure Factor
	FI	Fraction Ingested	dimensionless	1	(1)	Oral exposure Factor =
	OABS	Oral Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.1	See Table 2-25.1	(IR-S x FI x OABS x EF x ED x CF1)/(BW x AT)
	EF	Exposure Frequency	days/year	26	(1)	assumes 1 day/week during warmer months
	ED	Exposure Duration	years	10	EPA, 1997	
	CF1	Conversion Factor	kg/mg	1E-06	--	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Sludge	mg/kg	See Table 2-23.1	See Table 2-23.1	CDI (mg/kg-day) =
	CF1	Conversion Factor	kg/mg	1E-06	--	CS x Dermal Exposure Factor
	SA	Skin Surface Area Available for Contact	cm2/day	4,650	EPA, 1997	
	SSAF	Sludge to Skin Adherence Factor	mg/cm2	231	EPA, 2001	
	DABS	Dermal Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.1	See Table 2-25.1	Dermal exposure Factor =
	EF	Exposure Frequency	days/year	26	(1)	(SA x SSAF x EF x ED x DABS x CF)/(BW x AT)
	ED	Exposure Duration	years	10	EPA, 1997	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	

NOTES:

(1) Professional Judgement.

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA, 1997: Exposure Factors Handbook. Volume I, Aug. 1997, EPA/600/P-25/002FA

EPA, 2001. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. December 2001.

Surface Area is based on hands, lower arms, lower legs, and feet.

Skin-to-soil Adherence Factor is based on 95th percentile for Children in Mud. Exhibit 3.3 (EPA, 2001).

The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

These exposure assumptions are used to evaluate trespasser exposures to sludge in Area 1

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TABLE 2-24.2
VALUES USED FOR DAILY INTAKE CALCULATIONS - ADOLESCENT TRESPASSER CONTACT WITH DRY SURFACE SOIL/SLUDGE AREAS 2-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Surface* Soil/Sludge in Areas 2 through 7
Receptor Population: Trespasser
Receptor Age: Adolescent (9-18 Years old)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2	See Table 2-23.2	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil/Sludge	mg/day	100	EPA, 1997	CS x Oral Exposure Factor
	FI	Fraction Ingested	dimensionless	1	(1)	Oral exposure Factor =
	OABS	Oral Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2a	See Table 2-25.2a	(IR-S x FI x OABS x EF x ED x CF1)/(BW x AT)
	EF	Exposure Frequency	days/year	26	(1)	assumes 1 day/week during warmer months
	ED	Exposure Duration	years	10	EPA, 1997	
	CF1	Conversion Factor	kg/mg	1E-06	--	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2	See Table 2-23.2	CDI (mg/kg-day) =
	CF1	Conversion Factor	kg/mg	1E-06	--	CS x Dermal Exposure Factor
	SA	Skin Surface Area Available for Contact	cm2/day	4,650	EPA, 1997	
	SSAF	Sludge to Skin Adherence Factor	mg/cm2	0.4	EPA, 2001	
	DABS	Dermal Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2a	See Table 2-25.2a	Dermal Exposure Factor =
	EF	Exposure Frequency	days/year	26	(1)	(SA x SSAF x EF x ED x DABS x CF)/(BW x AT)
	ED	Exposure Duration	years	10	EPA, 1997	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	
Inhalation of Dust	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2	See Table 2-23.2	CDI (mg/kg-day) =
	PEF	*Particulate Emission Factor*	m3/kg	1.32E+09	EPA, 1996	CS x Inhalation Exposure Factor
	Inh R	Inhalation Rate	m3/hr	1.2	EPA, 1997	(BW x AT)
	ET	Exposure Time	hr/day	4	(1)	Inhalation Exposure Factor =
	EF	Exposure Frequency	days/year	26	EPA, 2001	((I/PEF) x InhR x ET x EF x ED)/(BW x AT)
	ED	Exposure Duration	years	10	EPA, 1997	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	

NOTES:

(1) Professional Judgement.

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1997: Exposure Factors Handbook. Volume I, Aug. 1997, EPA/600/P-25/002FA.

EPA, 2001: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. December 2001.

Surface Area is based on hands, lower arms, lower legs, and feet.

Skin-to-soil Adherence Factor is based on 95th percentile for children playing in dry soil. Exhibit 3.3 (EPA, 2001).

*Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

These exposure assumptions are used to evaluate trespasser exposures to surface soil/sludge in Areas 2 through 7.

TABLE 2-24.3
VALUES USED FOR DAILY INTAKE CALCULATIONS - FUTURE RESIDENT CONTACT WITH SOIL/SLUDGE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Soil/Sludge *
Receptor Population: Resident
Receptor Age: Adult/Child (1-31 Years old)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2 & 2-23.3	See Table 2-23.2 & 2-23.3	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S_a	Adult Ingestion Rate of Soil/Sludge	mg/day	100	EPA, 1997	CS x Oral Exposure Factor
	IR-S_c	Child Ingestion Rate of Soil/Sludge	mg/day	200	EPA, 1997	
	FI	Fraction Ingested	dimensionless	1	(1)	
	OABS	Oral Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2b & 2-25.3	See Table 2-25.2b & 2-25.3	Oral exposure Factor =(Age-Adjusted Ingestion Rate x FI x EF x OABS x CF)/AT
	EF	Exposure Frequency	days/year	150	EPA, 1994	
	ED_a	Adult Exposure Duration	years	24	EPA, 1997	Age-Adjusted Ingestion Rate =((IR-Sa x ED_c)/BW_c) + ((IR-Sa x ED_a)/BW_a)
	ED_c	Child Exposure Duration	years	6	EPA, 1997	
	CF1	Conversion Factor	kg/mg	1E-06	--	
	BW_a	Adult Body Weight	kg	70	EPA, 1997	
	BW_c	Child Body Weight	kg	15	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2 & 2-23.3	See Table 2-23.2 & 2-23.3	CDI (mg/kg-day) =
	CF1	Conversion Factor	kg/mg	1E-06	--	CS x Dermal Exposure Factor
	SA_a	Adult Skin Surface Area Available for Contact	cm2/day	5,700	EPA, 2001	
	SA_c	Child Skin Surface Area Available for Contact	cm2/day	2,800	EPA, 2001	
	$SSAF_a$	Adult Soil to Skin Adherence Factor	mg/cm2	0.07	EPA, 2001	Dermal exposure Factor =(Age-Adjusted Dermal Contact Rate x EF x DABS x CF)/AT
	$SSAF_c$	Child Soil to Skin Adherence Factor	mg/cm2	0.2	EPA, 2001	
	DABS	Dermal Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2b & 2-25.3	See Table 2-25.2b & 2-25.3	Age-Adjusted Dermal Contact Rate =((SA_c x $SSAF_c$ x ED_c)/BW_c) + ((SAa x SSAFa x ED_a)/BW_a)
	EF	Exposure Frequency	days/year	150	EPA, 1994	
	ED_a	Adult Exposure Duration	years	24	EPA, 1997	
	ED_c	Child Exposure Duration	years	6	EPA, 1997	
	BW_a	Adult Body Weight	kg	70	EPA, 1997	
	BW_c	Child Body Weight	kg	15	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	

NOTES:

(1) Professional Judgement.

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1994: USEPA Region I Waste Management Division, USEPA Risk Update. No. 2, Aug. 1994.

EPA, 1997: Exposure Factors Handbook. Volume I, Aug. 1997, EPA/600/P-25/002FA.

EPA, 2001: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. December 2001.

Adult Skin-to-soil Adherence Factor is based on 50th percentile for gardening, a high-end activity. Exhibit 3.3 (EPA, 2001).

Child Skin-to-soil Adherence Factor is based on 50th percentile for children playing in wet soil, a high-end activity. Exhibit 3.3 (EPA, 2001).

Adult Surface Area is based on head, hands, lower arms, and lower legs.

Child Surface Area is based on head, hands, lower arms, lower legs, and feet.

*These exposure assumptions are used to evaluate residential exposures to two different exposure points: "all" soil/sludge in Areas 1 through 7 and residential exposures to surface soil/sludge in Areas 2 through 7. Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs. Similarly, since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 2-25.1
NONCANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
4-Methylphenol	1300	Max		*		0.1	1.42E-07	1.53E-04	5.00E-03	1.00E+00	5.00E-03	3.70E-02	3.98E+01	3.98E+01
2-Methylnaphthalene	21	Max		*		0.13	1.42E-07	1.99E-04	2.00E-02	1.00E+00	2.00E-02	1.50E-04	2.09E-01	2.09E-01
Pentachlorophenol	32	Max		*		0.25	1.42E-07	3.83E-04	3.00E-02	1.00E+00	3.00E-02	1.52E-04	4.08E-01	4.08E-01
Dioxin TEQ	0.0016	Max		0.5	6	0.03	7.12E-08	4.59E-05		1.00E+00				
Antimony	4	Max		*			1.42E-07		4.00E-04	1.50E-01	6.00E-05	9.50E-03		9.50E-03
Arsenic	7.6	Max		1	7	0.03	1.42E-07	4.59E-05	3.00E-04	1.00E+00	3.00E-04	3.61E-03	1.16E+00	1.17E+00
Chromium	25200	Max		*			1.42E-07		1.50E+00	1.30E-02	1.95E-02	1.84E-01		1.84E-01
Manganese	13300	Max		*			1.42E-07		7.00E-02	4.00E-02	2.80E-03	6.77E-01		6.77E-01
														4.25E+01

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time

= (100 mg/d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time

= (4650 cm^2 * 231 mg/cm^2-ev * 1 ev/d * 26 d/y * 10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

TABLE 2-25.2a
NONCANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	RfDinhal mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Inhalation Hazard Index	Total Hazard Index
Aroclor 1242	0.28	Max		*		0.14	1.42E-07	3.71E-07	5.18E-18	2.00E-05	1.00E+00	2.00E-05		1.99E-03	5.19E-03		7.19E-03
Dioxin TEQ	0.0013	Max		0.5	6	0.03	7.12E-08	7.95E-08	5.18E-18		1.00E+00						
Antimony	44.4	Max		*			1.42E-07		5.18E-18	4.00E-04	1.50E-01	6.00E-05		1.05E-01			1.05E-01
Arsenic	15.7	Max		1	7	0.03	1.42E-07	7.95E-08	5.18E-18	3.00E-04	1.00E+00	3.00E-04		7.46E-03	4.16E-03		1.16E-02
Barium	657	Max		*			1.42E-07		5.18E-18	7.00E-02	7.00E-02	4.90E-03	1.40E-04	1.91E-02		2.43E-11	1.91E-02
Cadmium	16.8	Max		*		0.001	1.42E-07	2.65E-09	5.18E-18	5.00E-04	2.50E-02	1.25E-05		1.91E-01	3.56E-03		1.95E-01
Lead	427	Max		*			1.42E-07		5.18E-18								
Manganese	207	Max		*			1.42E-07		5.18E-18	7.00E-02	4.00E-02	2.80E-03	1.40E-05	1.05E-02		7.66E-11	1.05E-02
Mercury	4.5	Max		*			1.42E-07		5.18E-18	3.00E-04	1.00E+00	3.00E-04	8.60E-05	2.14E-03		2.71E-13	2.14E-03
																	3.51E-01

NOTES:

*Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS$_{oral}$*Conversion Factor/BW*Averaging Time*
= (100 mg/d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS$_{dermal}$*Conversion Factor/BW*Averaging Time
= (4650 cm^2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y * 10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)
= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 10 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-25.2b
NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
Aroclor 1242	0.28	Max		*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	7.67E-02	3.01E-02	1.07E-01
Dioxin TEQ	0.0013	Max		0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	44.4	Max		*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	4.05E+00		4.05E+00
Arsenic	15.7	Max		1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	2.87E-01	2.41E-02	3.11E-01
Barium	657	Max		*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	7.35E-01		7.35E-01
Cadmium	16.8	Max		*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	7.36E+00	2.06E-02	7.39E+00
Lead	427	Max		*			5.48E-06							
Manganese	207	Max		*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	4.05E-01		4.05E-01
Mercury	4.5	Max		*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	8.22E-02		8.22E-02
														1.31E+01

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time
= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS $_{oral}$ * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time
= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS $_{dermal}$ * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study
HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.
** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-25.3
NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL SOIL/SLUDGE AREAS 1-7**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
1,4-Dichlorobenzene	1	95%UCL		*		0.1	5.48E-06	1.53E-06	3.00E-02	1.00E+00	3.00E-02	1.83E-04	5.11E-05	2.34E-04
Chlorobenzene	1.7	95%UCL		*		0.1	5.48E-06	1.53E-06	2.00E-02	1.00E+00	2.00E-02	4.66E-04	1.30E-04	5.96E-04
4-Methylphenol	1300	Max		*		0.1	5.48E-06	1.53E-06	5.00E-03	1.00E+00	5.00E-03	1.42E+00	3.99E-01	1.82E+00
Benzo(a)Pyrene	0.66	Max		*		0.13	5.48E-06	1.99E-06		1.00E+00				
2-Methylnaphthalene	21	Max		*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	5.75E-03	2.09E-03	7.85E-03
Naphthalene	61	Max		*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	1.67E-02	6.08E-03	2.28E-02
Pentachlorophenol	120	95%UCL		*		0.25	5.48E-06	3.84E-06	3.00E-02	1.00E+00	3.00E-02	2.19E-02	1.53E-02	3.73E-02
Total Aroclors	0.028	95%UCL		*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	7.67E-03	3.01E-03	1.07E-02
Dioxin TEQ	0.0026	Max		0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	506	95%UCL		*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	4.62E+01		4.62E+01
Arsenic	8.6	95%UCL		1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	1.57E-01	1.32E-02	1.70E-01
Barium	154	95%UCL		*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	1.72E-01		1.72E-01
Cadmium	0.78	95%UCL		*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	3.42E-01	9.57E-04	3.43E-01
Chromium	67800	Max		*			5.48E-06		1.50E+00	1.30E-02	1.95E-02	1.91E+01		1.91E+01
Lead	67.6	95%UCL		*			5.48E-06							
Manganese	1810	95%UCL		*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	3.54E+00		3.54E+00
Mercury	0.76	95%UCL		*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	1.39E-02		1.39E-02
Thallium	0.81	95%UCL		*			5.48E-06		6.60E-05	1.00E+00	6.60E-05	6.72E-02		6.72E-02
Vanadium	32.1	95%UCL		*			5.48E-06		7.00E-03	2.60E-02	1.82E-04	9.66E-01		9.66E-01
														7.24E+01

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time
= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS_{oral} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time
= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS_{dermal} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

*HI = (EPC * Exposure Factor)/RfD*

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

TABLE 2-26.1
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
4-Methylphenol	1300	Max		*		0.1	2.04E-08	2.19E-05		1.00E+00				
2-Methylnaphthalene	21	Max		*		0.13	2.04E-08	2.84E-05		1.00E+00				
Pentachlorophenol	32	Max		*		0.25	2.04E-08	5.47E-05	1.20E-01	1.00E+00	1.20E-01	7.82E-08	2.10E-04	2.10E-04
Dioxin TEQ	0.0016	Max		0.5	6	0.03	1.02E-08	6.56E-06	1.50E+05	1.00E+00	1.50E+05	2.44E-06	1.57E-03	1.58E-03
Antimony	4	Max		*			2.04E-08			1.50E-01				
Arsenic	7.6	Max		1	7	0.03	2.04E-08	6.56E-06	1.50E+00	1.00E+00	1.50E+00	2.32E-07	7.48E-05	7.50E-05
Chromium	25200	Max		*			2.04E-08			1.30E-02				
Manganese	13300	Max		*			2.04E-08			4.00E-02				
														1.86E-03

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time
= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS_{oral} * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time
= (4650 cm2 * 231 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS_{dermal} * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

TABLE 2-26.2a
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	CSFinhal mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	2.04E-08	5.30E-08	7.40E-19	2.00E+00	1.00E+00	2.00E+00	2.00E+00	1.14E-08	2.97E-08	4.14E-19	4.11E-08
Dioxin TEQ	0.0013	Max		0.5	6	0.03	1.02E-08	1.14E-08	7.40E-19	1.50E+05	1.00E+00	1.50E+05	1.50E+05	1.98E-06	2.21E-06	1.44E-16	4.20E-06
Antimony	44.4	Max		*			2.04E-08		7.40E-19		1.50E-01						
Arsenic	15.7	Max		1	7	0.03	2.04E-08	1.14E-08	7.40E-19	1.50E+00	1.00E+00	1.50E+00	1.50E+01	4.79E-07	2.67E-07	1.74E-16	7.47E-07
Barium	657	Max		*			2.04E-08		7.40E-19		7.00E-02						
Cadmium	16.8	Max		*		0.001	2.04E-08	3.79E-10	7.40E-19		2.50E-02		6.30E+00			7.83E-17	7.83E-17
Lead	427	Max		*			2.04E-08		7.40E-19								
Manganese	207	Max		*			2.04E-08		7.40E-19		4.00E-02						
Mercury	4.5	Max		*			2.04E-08		7.40E-19		1.00E+00						
																	4.99E-06

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time
= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS_{oral} * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time
= (4650 cm2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS_{dermal} * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)
= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-26.2b
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-07	1.66E-07	5.40E-07
Dioxin TEQ	0.0013	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	6.53E-05	1.24E-05	7.76E-05
Antimony	44.4	Max		*			6.69E-07			1.50E-01				
Arsenic	15.7	Max		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	1.58E-05	1.49E-06	1.73E-05
Barium	657	Max		*			6.69E-07			7.00E-02				
Cadmium	16.8	Max		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Lead	427	Max		*			6.69E-07							
Manganese	207	Max		*			6.69E-07			4.00E-02				
Mercury	4.5	Max		*			6.69E-07			1.00E+00				
														9.54E-05

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.

2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.

3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.

4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.

6 Personal communication with A. Burke.

7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE 2-26.3
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL SOIL/SLUDGE AREAS 1-7**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
1,4-Dichlorobenzene	1	95%UCL		*		0.1	6.69E-07	2.11E-07	2.40E-02	1.00E+00	2.40E-02	1.61E-08	5.07E-09	2.11E-08
Chlorobenzene	1.7	95%UCL		*		0.1	6.69E-07	2.11E-07		1.00E+00				
4-Methylphenol	1300	Max		*		0.1	6.69E-07	2.11E-07		1.00E+00				
Benzo(a)Pyrene	0.66	Max		*		0.13	6.69E-07	2.75E-07	7.30E+00	1.00E+00	7.30E+00	3.22E-06	1.32E-06	4.55E-06
2-Methylnaphthalene	21	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Naphthalene	61	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Pentachlorophenol	120	95%UCL		*		0.25	6.69E-07	5.28E-07	1.20E-01	1.00E+00	1.20E-01	9.64E-06	7.61E-06	1.72E-05
Aroclor 1242	0.028	95%UCL		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-08	1.66E-08	5.40E-08
Dioxin TEQ	0.0026	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	1.31E-04	2.47E-05	1.55E-04
Antimony	506	95%UCL		*			6.69E-07			1.50E-01				
Arsenic	8.6	95%UCL		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	8.63E-06	8.18E-07	9.45E-06
Barium	154	95%UCL		*			6.69E-07			7.00E-02				
Cadmium	0.78	95%UCL		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Chromium	67800	Max		*			6.69E-07			1.30E-02				
Lead	67.6	95%UCL		*			6.69E-07							
Manganese	1810	95%UCL		*			6.69E-07			4.00E-02				
Mercury	0.76	95%UCL		*			6.69E-07			1.00E+00				
Thallium	0.81	95%UCL		*			6.69E-07			1.00E+00				
Vanadium	32.1	95%UCL		*			6.69E-07			2.60E-02				
														1.87E-04

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.
** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

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TABLE 2-27
SUMMARY OF RECEPTOR RISKS AND HAZARDS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Area	High Lead (1)	Scenario/Receptor	Media CR>1E-04 or HI>1	Total Cancer Risks	Major contributors to cancer risk above 1E-04 (individual cancer risk>1E-06)	Total Noncancer Hazard Index	Major contributors to noncancer Hazard Index (HI>1.0)
Area 1 Surface* sludge	NO	Current/Future Adolescent Trespasser	YES	1.86E-03	Dioxin TEQ, Pentachlorophenol, Arsenic	42.5	4-Methylphenol, Arsenic
Areas 2 through 7 Surface* soil/sludge	YES	Current/Future Adolescent Trespasser	NO	4.99E-06	NA	0.351	NA
Areas 2 through 7 Surface* soil/sludge	YES	Future Lifetime Resident	YES	9.54E-05	NA	13.1	Antimony, Cadmium
Areas 1 through 7 "All"* soil/sludge	YES	Future Lifetime Resident	YES	1.87E-04	Dioxin TEQ, Pentachlorophenol, Arsenic, Benzo(a)pyrene	72.4	4-Methylphenol, Antimony, Cadmium, Manganese

Notes:

(1) Maximum Lead > 400mg/kg

*The surface sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs. Since very few samples were collected from only surface materials (0 to 2 feet bgs) in any area and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface datasets include any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs. Similarly, since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

NA- Not Applicable

TABLE 2-28
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Only Areas 2 to 7
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1,2-Dichlorobenzene	280	J	280	J	ug/kg	MT-SL-603-0007	1/10	NA	NA	YES	NTX
1,4-Dichlorobenzene	200	J	200	J	ug/kg	MT-SL-603-0007	1/10	20000	0.01	NO	BSL
Chlorobenzene	25	J	1300		ug/kg	MT-SL-603-0007	2/10	40000	0.03	NO	BSL
Chloroform	25	J	32	J	ug/kg	MT-SO-A4-OVCOMP	2/10	55000	0.00	NO	BSL
Methyl Acetate	44	J	250	J	ug/kg	MT-SL-603-0007	3/10	NA	NA	YES	NTX
Toluene	19	J	19	J	ug/kg	MT-SO-A2-OVCOMP	1/10	51500	0.00	NO	BSL
bis(2-Ethylhexyl)phthalate	8900		8900		ug/kg	MT-SL-702-0011	1/10	910	9.78	YES	ASL
Di-n-Butylphthalate	23	JEB	61		ug/kg	MT-SL-501-0020-AVG	2/10	90	0.68	NO	BSL
4,4'-DDE	3.2		3.2		ug/kg	MT-SL-702-0011	1/10	2	1.60	YES	ASL
4,4'-DDT	1.8	J	2.2		ug/kg	MT-SL-702-0011	2/10	2	1.10	YES	ASL
alpha-Chlordane	1.7	J	29	*	ug/kg	MT-SL-702-0011	4/10	1800	0.02	NO	BSL
Aroclor-1242	280		280		ug/kg	MT-SL-702-0011	1/10	371	0.75	NO	BSL
Aroclor-1254	4	J	78		ug/kg	MT-SL-702-0011	4/10	371	0.21	NO	BSL
delta-BHC	5.2		5.2		ug/kg	MT-SL-702-0011	1/10	70	0.07	NO	BSL
Dieldrin	4.4		4.4		ug/kg	MT-SL-702-0011	1/10	64	0.07	NO	BSL
Endrin	5.8		5.8		ug/kg	MT-SL-702-0011	1/10	8	0.73	NO	BSL
Endrin Ketone	6.3		6.3		ug/kg	MT-SO-A4-OVCOMP	1/10	8	0.79	NO	BSL
gamma-Chlordane	1.9	J	31	*	ug/kg	MT-SL-702-0011	4/10	1800	0.02	NO	BSL
Heptachlor Epoxide	12		12		ug/kg	MT-SL-702-0011	1/10	476	0.03	NO	BSL
1,2,3,4,6,7,8-HpCDD	10.8		93940	*	ng/kg	MT-SL-702-0011	10/10	315	298	YES	ASL
1,2,3,4,6,7,8-HpCDF	1.2		3230	*	ng/kg	MT-SL-702-0011	10/10	315	10.25	YES	ASL
1,2,3,4,7,8,9-HpCDF	2.8	J	109		ng/kg	MT-SL-702-0011	9/10	315	0.35	NO	BSL
1,2,3,4,7,8-HxCDD	0.88	J	77.1		ng/kg	MT-SL-702-0011	9/10	31.5	2.45	YES	ASL
1,2,3,4,7,8-HxCDF	1.3	J	76		ng/kg	MT-SL-702-0011	9/10	31.5	2.41	YES	ASL

TABLE 2-28 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Only Areas 2 to 7
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum [1] Concentration	Minimum Qualifier	Maximum [1] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening [2] Toxicity Value	Maximum HQ	COPC Flag	Rationale for [3] Contaminant Deletion or Selection
1,2,3,6,7,8-HxCDD	8.3		1200		ng/kg	MT-SL-702-0011	9/10	31.5	38.10	YES	ASL
1,2,3,6,7,8-HxCDF	0.6	J	32.4	EB	ng/kg	MT-SL-702-0011	9/10	31.5	1.03	YES	ASL
1,2,3,7,8,9-HxCDD	2.2	J	315	EB	ng/kg	MT-SL-702-0011	9/10	31.5	10.00	YES	ASL
1,2,3,7,8,9-HxCDF	0.74	EMPC	10.8	EMPC	ng/kg	MT-SO-A6-OVCOMP	4/10	31.5	0.34	NO	BSL
1,2,3,7,8-PeCDD	1.1	J	15.9	EB	ng/kg	MT-SO-A3-OVCOMP	8/10	3.15	5.05	YES	ASL
1,2,3,7,8-PeCDF	0.27	J	1.1	J	ng/kg	MT-SO-A4-OVCOMP	4/10	63	0.02	NO	BSL
2,3,4,6,7,8-HxCDF	1.3	J	189		ng/kg	MT-SL-702-0011	9/10	31.5	6.00	YES	ASL
2,3,4,7,8-PeCDF	1.1	J	6.9		ng/kg	MT-SL-702-0011	7/10	6.3	1.10	YES	ASL
2,3,7,8-TCDD	0.39	J	25.2	J	ng/kg	MT-SO-A6-OVCOMP	9/10	3.15	8.00	YES	ASL
2,3,7,8-TCDF	0.36	J	9.9		ng/kg	MT-SL-702-0011	7/9	840	0.01	NO	BSL
OCDD	99.9		719310	EB*	ng/kg	MT-SL-702-0011	10/10	31500	22.84	YES	ASL
OCDF	2.6		6820	JEB*	ng/kg	MT-SL-702-0011	10/10	31500	0.22	NO	BSL
Aluminum	3120		6660		mg/kg	MT-SL-603-0007	10/10	3.825	1741	YES	ASL
Antimony	2.3		44.4	J	mg/kg	MT-SL-702-0011	8/10	0.248	179	YES	ASL
Arsenic	1.6	J	15.7		mg/kg	MT-SL-603-0007	10/10	9.9	1.59	YES	ASL
Barium	14.9		657	J	mg/kg	MT-SL-702-0011	10/10	283	2.32	YES	ASL
Beryllium	0.2		0.41	J	mg/kg	MT-SL-603-0007	7/10	2.42	0.17	NO	BSL
Cadmium	16.8		16.8		mg/kg	MT-SL-702-0011	1/10	4	4.20	YES	ASL
Calcium	565		22300		mg/kg	MT-SL-702-0011	10/10	NA	NA	NO	NUT
Chromium	60.9		5280	J	mg/kg	MT-SL-702-0011	10/10	10	528	YES	ASL
Cobalt	2.5		5.6	J	mg/kg	MT-SL-702-0011	10/10	1000	0.01	NO	BSL
Copper	4.4		108		mg/kg	MT-SL-702-0011	10/10	50	2.16	YES	ASL
Iron	3680		25500		mg/kg	MT-SL-702-0011	10/10	200	128	YES	ASL

TABLE 2-28 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Only Areas 2 to 7
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
Lead	2.7		427		mg/kg	MT-SL-702-0011	10/10	40.5	10.54	YES	ASL
Magnesium	961		2540		mg/kg	MT-SO-A6-OVCOMP	10/10	NA	NA	NO	NUT
Manganese	72.4		207	J	mg/kg	MT-SL-702-0011	10/10	100	2.07	YES	ASL
Mercury	0.03	J	4.5		mg/kg	MT-SL-702-0011	9/10	0.00051	8824	YES	ASL
Nickel	6.5		24.5		mg/kg	MT-SL-702-0011	10/10	30	0.82	NO	BSL
Potassium	373	J	1040	J	mg/kg	MT-SO-A6-OVCOMP	10/10	NA	NA	NO	NUT
Sodium	150	J	150	J	mg/kg	MT-SL-702-0011	1/10	NA	NA	NO	NUT
Vanadium	3.6		43.5		mg/kg	MT-SL-603-0007	10/10	2	21.75	YES	ASL
Zinc	14.5		330		mg/kg	MT-SL-702-0011	9/10	8.5	38.82	YES	ASL
Chromium VI	3	J	28		mg/kg	MT-SO-A6-OVCOMP	2/10	30	0.93	NO	BSL

NOTES:

(1) Minimum/maximum detected concentration.
(2) Selection of screening values presented on Table 2-31.
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
Not a Toxicological Concern (NT)

Definitions: NA = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
EB = present in equipment blank
HQ = Hazard Quotient
EMPC = Estimated maximum possible concentration
* = From dilution analysis

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TABLE 2-29
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sludge Area 1
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1,2-Dichlorobenzene	440	J	2100		ug/kg	MT-SL-103-0010-AVG	4/4	340	6.2	YES	ASL
1,4-Dichlorobenzene	150	J	250		ug/kg	MT-SL-103-0010-AVG	2/4	350	0.71	NO	BSL
2-Butanone	1600		2200		ug/kg	MT-SL-101-0010	3/4	40500	0.05	NO	BSL
Acetone	1300		1900	EB	ug/kg	MT-SL-102-0012	4/4	4340	0.44	NO	BSL
Carbon Disulfide	1500		6100		ug/kg	MT-SL-102-0012	4/4	2.66	2293	YES	ASL
Methyl Acetate	2800		8900		ug/kg	MT-SL-102-0012	4/4	NA	NA	YES	NTX
2,4,5-Trichlorophenol	5000	J	22000	, J	ug/kg	MT-SL-102-0012, MT-SL-103-0010	3/4	NA	NA	YES	NTX
2-Methylnaphthalene	21000	J	21000	J	ug/kg	MT-SL-102-0012	1/4	70	300	YES	ASL
4-Methylphenol	550000		1300000	*	ug/kg	MT-SL-102-0012	4/4	37.6	34574	YES	ASL
Pentachlorophenol	9100	J	32000		ug/kg	MT-SL-103-0010-AVG	3/4	879	36	YES	ASL
Phenol	6300	J	23000	J	ug/kg	MT-SL-102-0012	4/4	318	72	YES	ASL
4,4'-DDD	5.9	J	5.9	J	ug/kg	MT-SL-104-0010	1/4	2	3.0	YES	ASL
4,4'-DDE	4.8	J	10	J	ug/kg	MT-SL-101-0010	4/4	2	5.0	YES	ASL
4,4'-DDT	4.4	J	4.4	J	ug/kg	MT-SL-101-0010	1/4	1.58	2.8	YES	ASL
Aldrin	6.1	J	6.1	J	ug/kg	MT-SL-104-0010	1/4	2	3.1	YES	ASL
alpha-BHC	4.9	J	24	J	ug/kg	MT-SL-104-0010	3/4	6	4.0	YES	ASL
alpha-Chlordane	3.5	J	62	*J	ug/kg	MT-SL-104-0010	4/4	7	8.9	YES	ASL
beta-BHC	4.1		4.1		ug/kg	MT-SL-103-0010-AVG	1/4	5	0.82	NO	BSL
Dieldrin	7	J	7	J	ug/kg	MT-SL-104-0010	1/4	64	0.11	NO	BSL
gamma-Chlordane	3.3	J	48	*J	ug/kg	MT-SL-104-0010	4/4	7	6.9	YES	ASL
Heptachlor	28	*J	56	*J	ug/kg	MT-SL-104-0010	2/4	5	11	YES	ASL
1,2,3,4,6,7,8-HpCDD	2580	JEB*	54600		ng/kg	MT-SL-103-0010-AVG	4/4	250	218	YES	ASL
1,2,3,4,6,7,8-HpCDF	1130	JEB	4740		ng/kg	MT-SL-103-0010-AVG	4/4	250	19	YES	ASL
1,2,3,4,7,8,9-HpCDF	53.2	JEB	408		ng/kg	MT-SL-103-0010-AVG	4/4	250	1.6	YES	ASL

TABLE 2-29 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sludge Area 1
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1,2,3,4,7,8-HxCDD	40.4	JEB	390		ng/kg	MT-SL-103-0010-AVG	4/4	25	16	YES	ASL
1,2,3,4,7,8-HxCDF	55.2	JEB	319		ng/kg	MT-SL-103-0010-AVG	4/4	25	13	YES	ASL
1,2,3,6,7,8-HxCDD	421	JEB	2460		ng/kg	MT-SL-103-0010-AVG	4/4	25	98	YES	ASL
1,2,3,6,7,8-HxCDF	39.5	J	196		ng/kg	MT-SL-103-0010-AVG	4/4	25	7.8	YES	ASL
1,2,3,7,8,9-HxCDD	135	JEB	1530	JEB	ng/kg	MT-SL-101-0010	4/4	25	61	YES	ASL
1,2,3,7,8-PeCDD	26.5	JEB	395	JEB	ng/kg	MT-SL-101-0010	4/4	2.5	158	YES	ASL
1,2,3,7,8-PeCDF	89.3	EMPC	148		ng/kg	MT-SL-103-0010-AVG	3/4	50	3.0	YES	ASL
2,3,4,6,7,8-HxCDF	48.4	JEB	228		ng/kg	MT-SL-103-0010-AVG	4/4	25	9.1	YES	ASL
2,3,4,7,8-PeCDF	5.7	JEB	24.3	JEB	ng/kg	MT-SL-101-0010	4/4	5	4.9	YES	ASL
2,3,7,8-TCDD	7.3	J	103		ng/kg	MT-SL-103-0010-AVG	4/4	2.5	41	YES	ASL
2,3,7,8-TCDF	3.7	J	13.9	J	ng/kg	MT-SL-101-0010	4/4	25	0.56	NO	BSL
OCDD	19200	JEB*	406000		ng/kg	MT-SL-103-0010-AVG	4/4	25000	16	YES	ASL
OCDF	870	JEB	4900		ng/kg	MT-SL-103-0010-AVG	4/4	25000	0.20	NO	BSL
Aluminum	4540		8770		mg/kg	MT-SL-104-0010	4/4	3.825	2293	YES	ASL
Antimony	4		4		mg/kg	MT-SL-103-0010-AVG	1/3	0.248	16	YES	ASL
Arsenic	3.1		7.6	J	mg/kg	MT-SL-104-0010	4/4	0.25	30	YES	ASL
Barium	26.3		45.7		mg/kg	MT-SL-104-0010	4/4	17.2	2.7	YES	ASL
Beryllium	0.08		0.24		mg/kg	MT-SL-104-0010	4/4	2.42	0.10	NO	BSL
Calcium	75000	J	156000		mg/kg	MT-SL-103-0010-AVG	4/4	NA	NA	NO	NUT
Chromium	18200		25200		mg/kg	MT-SL-104-0010	4/4	0.83	30361	YES	ASL
Cobalt	4.9		7.4	J	mg/kg	MT-SL-104-0010	4/4	NA	NA	YES	NTX
Copper	23.7		34.7		mg/kg	MT-SL-104-0010	4/4	34	1.02	YES	ASL

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TABLE 2-29 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sludge Area 1
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
Iron	5570		10700		mg/kg	MT-SL-102-0012	4/4	20000	0.54	NO	BSL
Lead	43.5		60.4		mg/kg	MT-SL-103-0010-AVG	4/4	0.94	64	YES	ASL
Magnesium	787		1470		mg/kg	MT-SL-104-0010	4/4	460	3.2	NO	NUT
Manganese	3990		13300		mg/kg	MT-SL-102-0012	4/4	322	41	YES	ASL
Nickel	3.4		10.1	J	mg/kg	MT-SL-104-0010	4/4	20.9	0.48	NO	BSL
Potassium	451		892	J	mg/kg	MT-SL-104-0010	4/4	NA	NA	NO	NUT
Selenium	1.3		1.3		mg/kg	MT-SL-103-0010-AVG	1/4	0.331	3.9	YES	ASL
Silver	1.8	J	6.2	J	mg/kg	MT-SL-102-0012	2/4	1	6.2	YES	ASL
Sodium	8160		11300		mg/kg	MT-SL-102-0012	4/4	NA	NA	NO	NUT
Vanadium	20.6		34		mg/kg	MT-SL-104-0010	4/4	0.714	48	YES	ASL
Zinc	128		183		mg/kg	MT-SL-104-0010	4/4	12	15	YES	ASL

NOTES:

(1) Minimum/maximum detected concentration.

(2) Selection of screening values presented on Table 2-32.

(2) Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
Not a Toxicological Concern (NT)

Definitions: NA = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
EB = present in equipment blank
HQ = Hazard Quotient
EMPC = Estimated maximum possible concentration
* = From dilution analysis

TABLE 2-30
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Area 1 Surface Water
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Detection Frequency	Screening (2) Toxicity Value		Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
Acetone	8.1	J,L	17	J	ug/L	2/2	1500	*	0.01	NO	BSL
Carbon Disulfide	5	L	5	L	ug/L	1/2	0.92	*	5.43	YES	ASL
2-Methylphenol	0.8	L	0.8	L	ug/L	1/2	13	*	0.06	NO	BSL
4-Methylphenol	11		11		ug/L	1/2	NA		NA	YES	NTX
Phenol	2	L	2	L	ug/L	1/2	110	*	0.02	NO	BSL
Pyrene	0.9	L	0.9	L	ug/L	1/2	NA		NA	YES	NTX
Aluminum	6.7		9.6		ug/L	2/2	87		0.11	NO	BSL
Arsenic	0.62		2.6		ug/L	2/2	150		0.02	NO	BSL
Barium	1.1		2.5		ug/L	2/2	4	*	0.63	NO	BSL
Calcium	52		82		mg/L	2/2	NA		NA	NO	NUT
Chromium	6		22		ug/L	2/2	11		2.00	YES	ASL
Cobalt	0.39		0.5		ug/L	2/2	23	*	0.02	NO	BSL
Copper	0.82		1.1		ug/L	2/2	9		0.12	NO	BSL
Iron	79		277		ug/L	2/2	1000		0.28	NO	BSL
Lead	0.22		0.22		ug/L	1/2	2.5		0.09	NO	BSL
Magnesium	0.57		1.6		mg/L	2/2	NA		NA	NO	NUT
Molybdenum	0.91		0.91		ug/L	1/2	370	*	0.00	NO	BSL
Manganese	1465		4990		ug/L	2/2	120	*	41.58	YES	ASL
Nickel	3		4.7		ug/L	2/2	52		0.09	NO	BSL
Selenium	1.9		10	J	ug/L	2/2	5		2.00	YES	ASL
Vanadium	0.21		0.49		ug/L	2/2	20	*	0.02	NO	BSL

NOTES:

(1) Minimum/maximum detected concentration. Metals results presented are dissolved metals.
(2) Water quality criteria from EPA (1999). If marked with asterisk, from ORNL (1996)
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)

Definitions: NA = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
L = Low Bias
HQ = Hazard Quotient

TABLE 2-31
SURFACE SOIL SCREENING LEVELS (AREAS 2 - 7)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE]

Parameter	Area						Effects Data						
	2	3	4	5	6	7	ORNL[1] inverte-brates	ORNL[2] plants	ORNL[3] wildlife (in food)	ORNL[4] wildlife PRG	TEF for mam-mals[5]	Best wildlife value	Lowest overall value[6]
Volatile Organic Compounds (ug/kg)													
1,2-Dichlorobenzene					X								NA
1,4-Dichlorobenzene					X		20000						20000
Chlorobenzene					X		40000						40000
Chloroform	X		X						55000			55000	55000
Methyl Acetate	X		X		X								NA
Toluene	X							200000	51500			51500	51500
Semi-volatile Organic Compounds (ug/kg)													
bis(2-Ethylhexyl)phthalate						X			910			910	910
Di-n-Butylphthalate				X				200000	90			90	90
Pesticides and PCBs (ug/kg)													
4,4'-DDE						X			2			2	2
4,4'-DDT					X	X			2			2	2
alpha-Chlordane	X				X	X			1800			1800	1800
Aroclor-1242						X		40000	329	371		371	371
Aroclor-1254			X	X		X		40000	111	371		371	371
delta-BHC						X			70			70	70
Dieldrin						X			64			64	64
Endrin						X			8			8	8
Endrin Ketone			X						8			8	8
gamma-Chlordane	X				X	X			1800			1800	1800
Heptachlor Epoxide						X			476			476	476
Dioxins and Furans (ng/kg)													
1,2,3,4,6,7,8-HpCDD	X	X	X	X	X	X			30	315	0.01	315	315
1,2,3,4,6,7,8-HpCDF	X	X	X	X	X	X			30	315	0.01	315	315
1,2,3,4,7,8,9-HpCDF	X	X	X	X	X	X			30	315	0.01	315	315
1,2,3,4,7,8-HxCDD	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,4,7,8-HxCDF	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,6,7,8-HxCDD	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,6,7,8-HxCDF	X	X	X	X	X	X			590	31.5	0.1	31.5	31.5
1,2,3,7,8,9-HxCDD	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,7,8,9-HxCDF		X	X	X	X				3	31.5	0.1	31.5	31.5
1,2,3,7,8-PeCDD	X	X	X	X	X	X			0.3	3.15	1	3.15	3.15
1,2,3,7,8-PeCDF	X	X	X	X					590	63	0.05	63	63
2,3,4,6,7,8-HxCDF	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
2,3,4,7,8-PeCDF	X	X	X		X	X			60	6.3	0.5	6.3	6.3
2,3,7,8-TCDD	X	X	X	X	X	X			0.3	3.15	1	3.15	3.15
2,3,7,8-TCDF	X	X	X	X		X			0.8	840	0.1	840	840
OCDD	X	X	X	X	X	X			3000	31500	0.0001	31500	31500
OCDF	X	X	X	X	X	X			3000	31500	0.0001	31500	31500

TABLE 2-31 (cont.)
SURFACE SOIL SCREENING LEVELS (AREAS 2 - 7)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Area						Effects Data						
	2	3	4	5	6	7	ORNL[1] inverte-brates	ORNL[2] plants	ORNL[3] wildlife (in food)	ORNL[4] wildlife PRG	TEF for mam-mals[5]	Best wildlife value	Lowest overall value[6]
Metals (mg/kg)													
Aluminum	X	X	X	X	X	X	600	50	3.825			3.825	3.825
Antimony	X	X	X	X	X	X		5	0.248			0.248	0.248
Arsenic	X	X	X	X	X	X	60	10	0.25	9.9		9.9	9.9
Barium	X	X	X	X	X	X	3000	500	17.2	283		283	283
Beryllium	X	X	X	X	X	X		10	2.42			2.42	2.42
Cadmium						X	20	4	1.2	4.2		4.2	4
Calcium	X	X	X	X	X	X							NA
Chromium	X	X	X	X	X	X	10		0.83	16.1		16.1	10
Cobalt	X	X	X	X	X	X	1000						1000
Copper	X	X	X	X	X	X	50	100	38.9	370		370	50
Iron	X	X	X	X	X	X	200						200
Lead	X	X	X	X	X	X	500	50	0.94	40.5		40.5	40.5
Magnesium	X	X	X	X	X	X							NA
Manganese	X	X	X	X	X	X	100	500	322			322	100
Mercury	X	X	X	X	X	X	0.1	0.3	0.005	0.00051		0.00051	0.00051
Nickel	X	X	X	X	X	X	90	30	64.1	121		121	30
Potassium	X	X	X	X	X	X							NA
Sodium						X							NA
Vanadium	X	X	X	X	X	X	20	2	0.714	55		55	2
Zinc	X	X	X	X	X	X	100	50	12	8.5		8.5	8.5
Chromium VI				X	X		0.4		12			12	0.4

NOTES:
[1]Efroymson, et al. (1997a)
[2]Efroymson, et al. (1997b)
[3]Sample et al. (1996). Most dioxin/furans adjusted by TEFs for mammals applied to value for TCDD
[4]Efroymson, et al. (1997c). Most dioxin/furans adjusted by TEFs for mammals applied to value for TCDD
[5]van den Berg, 1998
[6]among invertebrate, plant, and best wildlife values

TABLE 2-32
SEDIMENT SCREENING LEVELS (AREA 1)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Effects Data										
	EPA (1993a) SQC (@ 1% OC)	Long et al. (1995) ER-L	OMEE (1993) LEL	EPA (1996) Ecotox	Calcu-lated with EqP[1]	EPA (1993b) aquatic life[2]	ORNL[3] wildlife (in food)	EPA (1993b) semi-aquatic wildlife[4]	TEF for Fish[5]	TEF for Mam-mals[5]	Lowest Screening Value
Volatile Organic Compounds (ug/kg)											
1,2-Dichlorobenzene				340							340
1,4-Dichlorobenzene				350							350
2-Butanone					40500						40500
Acetone					4340		36600				4340
Carbon Disulfide					2.66						2.66
Methyl Acetate											NA
Semi-Volatile Organic Compounds (ug/kg)											
2,4,5-Trichlorophenol											NA
2-Methylnaphthalene		70									70
4-Methylphenol					37.6						37.6
Pentachlorophenol					11900		879				879
Phenol					318						318
Pesticides (ug/kg)											
4,4'-DDD			8				2				2
4,4'-DDE		2.2					2				2
4,4'-DDT		1.58					2				1.58
Aldrin			2				733				2
alpha-BHC			6				70				6
alpha-Chlordane			7				1800				7
beta-BHC			5				1470				5
Dieldrin	110						64				64
gamma-Chlordane			7				1800				7
Heptachlor			5				476				5
Dioxins and Furans (ng/kg)											
1,2,3,4,6,7,8-HpCDD						60000		250	0.001	0.01	250
1,2,3,4,6,7,8-HpCDF						6000		250	0.01	0.01	250
1,2,3,4,7,8,9-HpCDF						6000		250	0.01	0.01	250
1,2,3,4,7,8-HxCDD						120		25	0.5	0.1	25
1,2,3,4,7,8-HxCDF						600		25	0.1	0.1	25
1,2,3,6,7,8-HxCDD						6000		25	0.01	0.1	25
1,2,3,6,7,8-HxCDF						600		25	0.1	0.1	25
1,2,3,7,8,9-HxCDD						6000		25	0.01	0.1	25
1,2,3,7,8-PeCDD						60		2.5	1	1	2.5
1,2,3,7,8-PeCDF						1200		50	0.05	0.05	50
2,3,4,6,7,8-HxCDF						600		25	0.1	0.1	25
2,3,4,7,8-PeCDF						120		5	0.5	0.5	5
2,3,7,8-TCDD						60		2.5	1	1	2.5
2,3,7,8-TCDF						1200		25	0.05	0.1	25
OCDD						600000		25000	1E-04	1E-04	25000
OCDF						600000		25000	1E-04	1E-04	25000

TABLE 2-32 (cont.)
SEDIMENT SCREENING LEVELS (AREA 1)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Effects Data										
	EPA (1993a) SQC (@ 1% OC)	Long et al. (1995) ER-L	OMEE (1993) LEL	EPA (1996) Ecotox	Calculated with EqP[1]	EPA (1993b) aquatic life[2]	ORNL[3] wildlife (in food)	EPA (1993b) semi-aquatic wildlife[4]	TEF for Fish[5]	TEF for Mammals[5]	Lowest Screening Value
Metals and Inorganic Compounds (mg/kg)											
Aluminum							3.825				3.825
Antimony							0.248				0.248
Arsenic		8.2					0.25				0.25
Barium							17.2				17.2
Beryllium							2.42				2.42
Calcium											NA
Chromium		81					0.83				0.83
Cobalt											NA
Copper		34					38.9				34
Iron			20000								20000
Lead		46.7					0.94				0.94
Magnesium			460								460
Manganese							322				322
Nickel		20.9					64.1				20.9
Potassium											NA
Selenium							0.331				0.331
Silver		1									1
Sodium											NA
Vanadium							0.714				0.714
Zinc		150					12				12
Sulfide											NA

[1]EPA's (1993c) equilibrium partitioning (EqP) and a complementary approach explained in text and presented on Table 2-33.
[2]Dioxin/furans adjusted by TEFs for fish applied to value for TCDD
[3]Sample et al. (1996)
[4]Dioxin/furans adjusted by TEFs for mammals applied to value for TCDD
[5]van den Berg, 1998
The first five columns of effects data are in order of preference, from left to right.

TABLE 2-33
SEDIMENT SCREENING LEVELS FOR ORGANIC COMPOUNDS
FROM EQUILIBRIUM PARTITIONING AND WATER-TO-SEDIMENT ASSIGNATION
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Chemical	$log_{10}K_{ow}$[1]	K_{ow}	K_{oc}	WQG (mg/L)	SQG_{EP} (mg/kg)	$SQG_{w\text{-}s}$ (mg/kg)
Pentachlorophenol	5.12	131,826	107,954	0.011	11.9*	0.0318
4-Methylphenol	1.95	89.1	82.6	0.013	0.0107	.0376*
Carbon Disulfide	1.94	87.1	80.8	0.000920	0.000743	0.00266*
Phenol	1.46	28.8	27.3	0.11	0.0300	0.318*
2-Butanone	0.29	1.95	1.93	14	0.270	40.5*
Acetone	-0.24	0.575	0.58	1.5	0.00872	4.34*

NOTES:

[1]K_{ow}s obtained from HSDB at http://toxnet.nlm.nih.gov/

WQG = water quality quideline (either chronic ambient water quality criteria or secondary chronic values from ORNL [Suter and Tsao, 1996], except pentachlorophenol, which is a CAWQC from EPA [1999], calculated using pH=7.5, the median value for sludge in Area 1. Also, the SCV for 2-methylphenol was used for 4-methylphenol.)

SQG_{EP} = sediment quality guideline from equilibrium partitioning

$SQG_{w\text{-}s}$ = sediment quality guideline from water-to-sediment assignation

* Selected screening value (used on Table 2-32). Explanation of rationale for selection presented in text.

TABLE 2-34
NH RCMP BACKGROUND CONCENTRATIONS OF METALS IN SOIL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Metal	NH RCMP Background Concentration
Aluminum	--
Antimony	1.64
Arsenic	11
Barium	--
Beryllium	0.95
Cadmium	1.9
Calcium	--
Chromium	33
Cobalt	--
Copper	--
Iron	--
Lead	51
Magnesium	--
Manganese	--
Mercury	0.31
Nickel	23
Potassium	--
Sodium	--
Vanadium	--
Zinc	98
Chromium VI	--

NOTES:

NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5(4)(c), Table 1; January 1998, revised April 2001.

-- Background concentration not established for this metal.

TABLE 3-1
SELECTION OF PRELIMINARY REMEDIATION GOALS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Contaminants of Concern[1]	Units	PRG[1] based on CR=10-6	PRG[1] based on CR=10-5	PRG[1] based on CR=10-4	PRG[1] based on HI=0.1	PRG[1] based on HI=1.0	NH RCMP Background Soil Conc.[2]	NH S-1[3]	Proposed PRG[4]
Benzo(a)Pyrene	ug/kg	145	1450	14500				700	145
Pentachlorophenol	ug/kg	6958	69580	695800				3300	6958
4-Methylphenol	ug/kg				71289	712890		5000	712891
Dioxin TEQ	ng/kg	16.7*	167*	1670*					1000+
Antimony	mg/kg				7.3	73	1.64	8	73
Arsenic	mg/kg	0.91	9.1	91	5.1	51	11	11	51
Barium	mg/kg				1278	12780		750	12780
Cadmium	mg/kg				8.2	82	1.9	32	82
Chromium#	mg/kg				27375	273750	33	1000	273750
Manganese	mg/kg				1278	12775			12775
Vanadium	mg/kg				128	1278			1278

PRG = Preliminary Remediation Goal
CR = Cancer Risk
HI = Hazard Index

1 The COCs and risk-based PRGs were determined based on the Streamlined Human Health Risk Evaluation presented in Section 2.4. The COCs include all compounds that have a cancer risk greater than 1.0E-06 or a non-cancer HI greater than 1.0 for any exposure scenario. The risk-based PRGs were calculated based on the future residential exposure scenario. See Section 3.2 and 3.2 for additional details.

2 NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5, Table 1; January 1998, revised April 2001.

3 NHDES RCMP Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001. The NH S-1 standards are presented here for reference; however they were not used in selecting the proposed PRGs because they are non-promulgated criteria used as default standards in cases where a site-specific risk assessment has not been performed. Because a site-specific risk evaluation was conducted for this site, the calculated risk-based PRGs are used in place of the S-1 standards.

4 The proposed PRGs for all contaminants except dioxin TEQ are the lower of the site-specific PRGs calculated for a cancer risk of 1.0E-6 and hazard index of 1.0. If the selected risk-based value is below the NH RCMP background soil concentration, then the background concentration is selected as the proposed value.

\+ The proposed PRG for dioxin TEQ is EPA's recommended cleanup goal for residential settings (EPA OSWER Directive 9200.4-26: Approach for Addressing Dioxins in Soil at CERCLA and RCRA Sites, U.S. EPA, 1998). This value is proposed for use pending completion of EPA's comprehensive reassessment of the toxicity of dioxin.

* The identified PRGs for dioxin TEQs were calculated using the currently available cancer slope factor (CSF) from IRIS (2002). If the CSF proposed in EPA's recently prepared Draft Dioxin Reassessment (1.0E+6) were used to calculate the PRGs the values would be: 2.5 ng/kg for CR=10-6, 25 ng/kg for CR=10-5, and 250 ng/kg for CR=10-4.

\# The PRGs for chromium are based on trivalent chromium because hexavalent chromium was detected at the site only sporadically and at low concentrations (below screening levels).

TABLE 4-1
REMOVAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Environmental Media	Removal Action Objectives	General Response Actions	Technology Types	Process Options
Sludge/Soil	Protection of Human Health Prevent, to the extent practicable, direct contact with, ingestion of, and inhalation of contaminants in tannery sludge and associated soil at concentrations exceeding PRGs. Protection of the Environment Prevent, to the extent practicable, ecological receptor exposure to contaminants exceeding PRGs in tannery sludge and associated soil. Prevent, to the extent practicable, migration of contaminants exceeding PRGs from tannery sludge and associated soil to site groundwater and the Nashua River. Site Restoration Address tannery sludge and associated soil with contaminants exceeding PRGs to restore the site to its intended use for residential purposes.	• Limited Action	• Limited Action Technologies - Access restrictions - Environmental Monitoring - Institutional controls	- fencing - groundwater , surface water, and sediment monitoring - deed restrictions, zoning ordinances
		• Containment	• Containment Technologies: - Horizontal barriers - Vertical barriers	- low permeability cap, permeable cover - slurry wall, grout injection, sheet piling
		• In-Situ Treatment	• In-Situ Technologies: - Thermal Treatment - Physical/Chemical Treatment - Biological treatment	- vitrification, thermal desorption - solidification/stabilization, soil flushing - aerobic biodegradation, anaerobic biodegradation
		• Ex-Situ Treatment	• Ex-situ Treatment Technologies: - Immobilization - Thermal treatment - Physical/Chemical Treatment - Biological treatment	- solidification/stabilization - vitrification, thermal desorption, incineration - soil washing, solvent extraction - aerobic biodegradation, anaerobic biodegradation
		• Disposal	• Disposal Technologies: - Landfill - Land disposal/backfill	- off-site landfill, on-site landfill - on-site disposal/backfill of treated sludge/soil

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TABLE 4-2
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Limited Action	Access Restrictions	Fencing	Installation and/or repair of site fencing to restrict access to contaminated areas.	Eliminated as a primary technology because it would not be effective in protecting ecological receptors or environment. However, may be used with other technologies such as on-site landfill to prevent access to a particular area of the site.
	Environmental Monitoring	Environmental Monitoring	Monitoring of groundwater, surface water, and sediment to determine whether contaminants are migrating from site sludge/soil.	Eliminated as a primary technology because it would not be effective in achieving any RAOs. However, may be used to monitor the effectiveness of other technologies such as on-site landfilling.
	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as excavation or residential development could be restricted under property deeds.	Eliminated. Would not prevent direct contact with overlying soil and/or sludge. Would not protect ecological receptors or the environment or promote restoration of site to residential use.
		Zoning Ordinances	Administrative action by municipality to change permitted use of land to prevent particular types of development such as residential use. Typically applicable to an area, not an individual parcel.	Eliminated. Would not prevent direct contact with overlying soil and/or sludge. Would not protect ecological receptors or the environment or promote restoration of site to residential use.

TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment	Horizontal Barriers	Low permeability cap	Clay, asphalt, concrete, or multi-media cover over areas of contamination to prevent direct contact and minimize leaching of contaminants from the sludge/waste into groundwater and subsequent discharge to the Nashua River.	Eliminated. Not effective for preventing the release of contaminants to environment due to sludge/waste located below the water table in Areas 1 and 2. May not be viable in floodplain area (Area 2); would alter flood capacity.
		Permeable cover	Crushed stone or vegetative cover to prevent direct contact and minimize erosion and surface migration of sludge/waste contaminants.	Eliminated. Not effective for preventing the release of contaminants to environment because infiltration not restricted and sludge/waste located below the water table in Areas 1 and 2. May not be viable in floodplain area (Area 2); would alter flood capacity.
	Vertical Barriers	Slurry Walls	Trench filled with clay or cement slurry to form low permeability wall to restrict horizontal migration of sludge/waste contaminants.	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.
		Grout Injection	Use of pressure-injected cement grout to form impermeable or semi-permeable barrier to restrict horizontal migration of sludge/waste contaminants.	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.

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TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment (cont'd)	Vertical Barriers (cont'd)	Sheet Piling	Steel or precast concrete sheet piles used to form barrier to restrict horizontal migration of contaminants	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.
In-Situ Treatment	Thermal Treatment	In-Situ Vitrification	An electrical network is used to melt contaminated soils in-place. Metals are immobilized within a vitreous mass, organics are destroyed by pyrolysis.	Eliminated. Not suitable due to high moisture content of sludge and presence of saturated sludge. Would require excessive energy consumption (and cost) to be effective.
		In-Situ Thermal Desorption	Use of electrically heated in-situ blanket and/or well system to volatilize and oxidize organic contaminants.	Eliminated. Not applicable to inorganic site contaminants of concern. Effectiveness for organics is limited by presence of fine-grained constituents, which increase reaction time due to binding of contaminants.
	Physical/ Chemical Treatment	In-Situ Solidification/ Stabilization	Mixing equipment is used to apply treatment reagents to contaminated soils. Contaminants are physically and/or chemically immobilized in a cement-like mass.	Eliminated. Not applicable to organic site contaminants of concern. Solidification/ stabilization of sludge below the water table would be difficult to implement effectively. May not be viable in floodplain area (Area 2); would alter flood capacity.

TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
In-Situ Treatment (cont'd)	Physical/ Chemical Treatment (cont.)	Soil Flushing	In-situ process which employs a water-based extraction fluid and an injection/extraction well system to flush contaminants.	Eliminated. Less effective in low permeability materials such as site sludge. Not suitable in Areas 1, 2, and 3 due to site hydrogeology (proximity to river). May be difficult to control and direct flow of extraction fluid.
	Biological Treatment	In-Situ Enhanced Bioremediation	Indigenous or inoculated microorganisms (e.g., fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants found in soil/sludge, converting them to less harmful end products. Water, nutrients, and/or electron receptors (such as oxygen or nitrate) may be added to enhance degradation. Biodegradation may be aerobic or anaerobic depending on contaminants present and soil/sludge matrix.	Eliminated. Not applicable to inorganic site contaminants of concern. Bioremediation of organic site contaminants may be possible, but process would likely be difficult to enhance and control due to low permeability sludge matrix and close proximity to river.
Ex-Situ Treatment	Immobilization	Solidification/ Stabilization	Mixing of excavated contaminated materials with treatment reagents to physically and/or chemically bind and decrease the mobility of contaminants. Common treatment reagents include cement, pozzolanic materials, thermoplastics, polymers, and asphalt.	Potentially applicable for secondary treatment of residuals from thermal treatment of sludge/soil. Eliminated as a primary treatment option due to inability to effectively treat organic site contaminants of concern.
	Thermal Treatment	Vitrification	Melting of wastes to entrain contaminants in a stable vitreous residual.	Eliminated. Not suitable due to high moisture content of site sludge. Not applicable to wastes containing >25% moisture content (causes excessive fuel consumption).

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont'd)	Thermal Treatment (cont.)	Thermal Desorption	Contaminated soils are treated at elevated temperatures to volatilize organics, which are subsequently removed and captured or destroyed.	Eliminated. Effectiveness is reduced by binding of contaminants to fine particles in sludge. Not applicable to inorganic site contaminants of concern. Applicability to dioxin waste is limited.
		Incineration	Contaminated soils are heated extremely high temperatures where organic compounds are destroyed through oxidation.	Eliminated as on-site treatment alternative. Not implementable in densely developed residential area. Retained as an off-site treatment alternative.
	Physical/ Chemical Treatment	Soil Washing	Water-based process in which soils are separated into coarse and fine fractions to reduce the volume of materials requiring intensive treatment or disposal.	Eliminated. Complex waste mixtures (e.g., metals with organics) make soil washing difficult and costly. Abundance of fine particles in sludge (onto which contaminants tend to bind) would hinder volume reduction during sludge separation, rendering soil washing ineffective.
		Solvent Extraction	Desorption of contaminants through washing with a solvent solution.	Eliminated. Complex waste mixtures (e.g., metals with organics) make formulating an effective washing fluid difficult and costly. Effectiveness reduced by binding of contaminants to fine particles.

TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont'd)	Biological Treatment	Slurry Phase Biological Treatment	Sludge is combined with water and other additives to create a slurry that is mixed into a bioreactor to keep solids suspended and microorganisms in contact with the sludge contaminants. Oxygen, nutrients, and microorganisms may be added to the bioreactor to optimize the rate of biodegredation. Upon completion of the process, the slurry is dewatered and the treated solids are disposed of.	Eliminated. Not applicable to inorganic site contaminants of concern. Adundance of fine constituents in site sludge would make mixing and aeration difficult and not cost-effective.
Disposal	Landfill	Off-Site Landfill	Transport and disposal of untreated or treated sludge/waste off-site to an approved hazardous waste or solid waste landfill.	Retained.
		On-Site Landfill	Disposal of sludge/waste in a specially constructed hazardous waste or solid waste landfill on-site.	Retained.
	Land Disposal/ Backfill	On-Site Disposal	On-site use of treated soil/sludge as fill material.	Eliminated. Not feasible for materials that are treated off-site.

TABLE 4-3
KEY FEATURES OF PROPOSED REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Project Key Feature	Alternative							
	1A	1B	1C	2A	2B	2C	3-US	3-CAN
PRE-DESIGN INVESTIGATION								
Treatability Study to determine optimal design for odor control system	X	X	X	X	X	X	X	X
Treatability Study to determine optimal mixture of moisture control agents	X	X	X	X	X	X	X	X
SITE PREPARATION								
Clear and Grub all work areas	X	X	X	X	X	X	X	X
Establish Erosion and Sedimentation Controls	X	X	X	X	X	X	X	X
Construct/Improve temporary site access road and on-site haul roads	X	X	X	X	X	X	X	X
Demolish/remove clarifier building and concrete slabs/structures in Area 6	X	X	X	X	X	X	X	X
Construct overlying soil stockpiling area	X	X	X	X	X	X	X	X
Construct sludge/waste stockpiling area	X	X	X	X	X	X	X	X
Construct vehicle/equipment and personnel decontamination areas	X	X	X	X	X	X	X	X
Prepare in-situ dewatering system	X	X	X	X	X	X	X	X
Clear and grade location of on-site landfill				X	X	X		
Construct landfill liner system				X	X	X		
EXCAVATION AND DISPOSAL								
Excavate and Stockpile overlying soil for use as backfill	X	X	X	X	X	X	X	X
Dewater Area 1 Lagoon	X	X	X	X	X	X	X	X
Excavate sludge/waste and stockpile for pre-treatment	X	X	X	X	X	X*	X	X
Excavate sludge/waste, haul and dump into on-site landfill				X	X	X*		
Dewater excavation areas and sludge stockpiles, if necessary	X	X	X	X	X	X	X	X
Perform odor control during excavation and handling of sludge	X	X	X	X	X	X	X	X
Perform air monitoring during site work	X	X	X	X	X	X	X	X
Dispose of sludge/waste at off-site RCRA D facility	X	X	X					
Dispose of Area 1 sludge at RCRA C facility		X						
Dispose of Area 1 sludge at Canadian landfill facility			X			X		
Transport sludge/waste to American incineration facility							X	
Transport sludge/waste to Canadian off-site incineration facility								X
SITE RESTORATION								
Backfill excavations with overlying soil and clean fill from an off-site source	X	X	X	X	X	X	X	X
Place and compact backfill to final grade	X	X	X	X	X	X	X	X
Vegetate all disturbed areas by hydroseeding	X	X	X	X	X	X	X	X
Construct landfill cover system				X	X	X		
Install fencing at perimeter of landfill and secure all access points				X	X	X		
POST-REMOVAL SITE CONTROL								
Quarterly site inspections for 5 years (erosion controls and vegetation)	X	X	X	X	X	X	X	X
Post-Closure Care Plan for operation and maintenance of landfill				X	X	X		

Notes:

Alternative 1: Excavation and Off-Site Disposal

Alternative 2: Excavation and Consolidation into On-Site Landfill

--Alts. 1 & 2: A: All waste non-hazardous; B: Area 1 waste hazardous; C: Area 1 waste hazardous, land-ban applicable

Alternative 3: Excavation, Off-Site Treatment and Disposal - A: United States, B: Canada

* Under Alternative 2C, Area 1 sludge would be disposed off-site at Canadian landfill, all other sludge/waste would be placed into the on-site landfill

TABLE 5-1
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 μg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 μg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 5-1 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

TABLE 5-2
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate*	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

TABLE 5-2 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 1 will comply with the substantive requirements of this regulation. Alternative 1 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alteration of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.08 and 353.09)	Relevant and Appropriate*	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

TABLE 5-3
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 – EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 1 would comply.
State Regulatory Requirements	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including *excavation, construction, and bulk hauling.*	Alternative 1 would comply with this ARAR since fugitive dust emissions would be controlled and monitored *during remedial activities.*
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 5-3 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 – EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements (Cont'd)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid wastes that are subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 1 will comply with the substantive provisions of these regulations.
	New Hampshire General Requirements for Owners and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate*	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	If the excavated waste is characterized as hazardous, Alternative 1 will comply with the substantive provisions of these regulations.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate*	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

TABLE 5-4
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 µg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 µg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 5-4 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

TABLE 5-5
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (41 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.

TABLE 5-5 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
Federal Regulatory Requirements (cont.)	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate*	A hazardous waste treatment, storage or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout. The on-site landfill would not be constructed in the 100-year floodplain so as not to create a risk of contaminant migration through washout.
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 2 will comply with the substantive requirements of this regulation. Alternative 2 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alternation of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.09 and 353.10)	Relevant and Appropriate*	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout. The on-site landfill will not be located within the 100-year flood plain.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

TABLE 5-6
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE EE/CA
Federal Regulatory Requirements	RCRA – Waste-Specific Prohibitions-Dioxin-Containing Wastes (40 CFR 268.31)	Applicable*	This regulation, applicable to hazardous wastes only, establishes restrictions on land disposal of certain wastes.	A contingency alternative (Alternative 2C) was analyzed to evaluate the potential implications of the land disposal ban.
	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 2 would comply.
State Regulatory Requirements	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 2 will comply with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including excavation, construction, and bulk hauling.	Fugitive dust emissions would be controlled during remedial activities.
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 5-6 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE EE/CA
State Regulatory Requirements (cont.)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid waste that is subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire General Requirements for Owner and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate*	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	The design of the on-site landfill, excavation plan, and other engineering controls necessary to implement Alternative 2 would comply with this ARAR.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate*	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.

TABLE 5-6 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE EE/CA
State Regulatory Requirements (cont.)	New Hampshire Landfill Requirements (Env-Wm 2500)	Relevant and Appropriate	These regulations establish the design requirements for municipal solid waste landfills that are constructed in the State of New Hampshire.	The on-site landfill would be designed according to the requirements outlined in 40 CFR 258 and this state regulation.
	New Hampshire Groundwater Protection Rules, Water Quality Sampling, Analysis, and Reporting; Groundwater Monitoring Wells (Env-Ws 410.30 and 410. 31)	Applicable	These rules establish the requirements for sampling and monitoring groundwater, and specify monitoring well design and installation.	Sampling and monitoring of groundwater monitoring wells under the post-closure care program would be conducted according to these requirements.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-7
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 µg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 µg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 5-7 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

TABLE 5-8
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate*	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

TABLE 5-8 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 3 will comply with the substantive requirements of this regulation. Alternative 3 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alteration of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.08 and 353.09)	Relevant and Appropriate*	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-9
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 3 would comply.
State Regulatory Requirements	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including excavation, construction, and bulk hauling.	Alternative 3 would comply with this ARAR since fugitive dust emissions would be controlled and monitored during remedial activities.
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 5-9 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements (Cont'd)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid wastes that are subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 3 will comply with the substantive provisions of these regulations.
	New Hampshire General Requirements for Owners and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate*	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	If the excavated waste is characterized as hazardous, Alternative 3 will comply with the substantive provisions of these regulations.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate*	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-10
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS			
Overall Protection of Human Health and the Environment	Would meet NTCRA removal action objectives and be consistent with long-term remedial actions.	Would meet NTCRA removal action objectives, but would be less acceptable than Alternatives 1 and 3 in meeting the future residential use RAO.	Same as Alternative 1.
	Would prevent direct contact with and ingestion of contaminated sludge/waste, prevent contaminant leaching to groundwater, and reduce erosion and off-site migration of contamination.	Same as Alternative 1 provided that the landfill is properly operated and maintained and is not allowed to erode or degrade.	Same as Alternative 1.
	No unacceptable short-term impacts would be anticipated.	Same as Alternative 1.	Same as Alternative 1.
Compliance with ARARs	Discharge of dewatering effluent to the Nashua sewer system would be implemented to comply with all federal, state and local requirements.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with federal and state floodplain regulations.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state testing and waste identification regulations.	Same as Alternative 1.	Same as Alternative 1.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Compliance with ARARs (cont.)	Would comply with state regulations for generators of hazardous waste.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with federal and state regulations for solid and hazardous waste storage facilities.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state air pollution control regulations.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state solid waste regulations.	Same as Alternative 1.	Same as Alternative 1.
Long-term Effectiveness and Permanence	No residual risks, above selected PRGs, would remain at the site.	Residual risk would exist in the form of contaminated sludge/waste in the on-site landfill. If degradation or failure of the engineered landfill liner system were to occur, contaminants could pose a threat to the environment and human and ecological receptors.	Same as Alternative 1.

TABLE 5-10 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
COST			
Capital Costs	Alternative 1A: $14,939,000 Alternative 1B: $20,428,000 Alternative 1C: $22,819,000	Alternative 2A: $5,572,000 Alternative 2B: $5,572,000 Alternative 2C: $18,428,000	Alternative 3-US: $69,715,000 Alternative 3-CAN: $50,152,000
Annual PRSC Costs	Years 1-2: $4,000 Years 3-30: $0	Years 1-2: $155,275 Years 3-5: $60,075 Years 6-30: $37,275	Years 1-2: $4,000 Years 3-30: $0
Total Present Worth Costs	Alternative 1A: $14,946,000 Alternative 1B: $20,435,000 Alternative 1C: $22,826,000	Alternative 2A: $6,300,000 Alternative 2B: $6,300,000 Alternative 2C: $19,156,000	Alternative 3-US: $69,722,000 Alternative 3-CAN: $50,160,000

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY (cont.)			
Availability of Services and Materials	Qualified contractors for all on-site activities would be available for competitive bidding.	Same as Alternative 1.	Same as Alternative 1.
	Qualified national off-site disposal facilities (RCRA D, RCRA C, and in Canada) capable and willing to receive dioxin-containing waste have been identified during preparation of the EE/CA. Final acceptability of site sludge/waste at any facility would be contingent on the results of waste characterization samples collected during the removal action.	No off-site disposal of sludge/waste would be necessary under Alternatives 2A and 2B. Qualified Canadian facilities have been identified that would be capable of receiving dioxin-containing waste should Alternative 2C be implemented.	Qualified national and international off-site incineration facilities capable and willing to receive dioxin-bearing wastes have been identified during preparation of the EE/CA. Fewer facilities are available than for Alternative 1, particularly in United States. Final acceptability of site sludge/waste at any facility would be contingent on the results of waste characterization samples collected during the removal action.
State Acceptance	To be addressed after close of public comment period.	Same as Alternative 1.	Same as Alternative 1.
Community Acceptance	To be addressed after close of public comment period.	Same as Alternative 1.	Same as Alternative 1.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY (cont.)			
Administrative Feasibility	No permits for on-site work needed.	Approval process for the construction of the on-site landfill may be difficult and time-consuming.	Same as Alternative 1.
	Alternative 1A: Administrative feasibility for off-site disposal of non-hazardous waste would be high. Alternative 1B: Off-site disposal of Area 1 sludge at a RCRA C facility would not provide any additional administrative feasibility issues beyond those for Alternative 1A. Alternative 1C: Administrative issues related to the disposal of Area 1 sludge at a Canadian landfill would be slightly more difficult than those for Alternatives 1A and 1B.	Alternatives 2A and 2B: Since no off-site disposal of sludge/waste would be performed under Alternatives 2A and 2B, no administrative action would be required for disposal. Alternative 2C: Administrative issues related to the off-site disposal of Area 1 sludge at a Canadian landfill would make Alternative 2C more difficult to implement from an administrative standpoint.	Alternative 3-US: Administrative actions required for off-site treatment and disposal of non-hazardous or hazardous waste at an American facility would not be difficult. Alternative 3-CAN: Administrative actions required for the off-site treatment and disposal of sludge/waste at a Canadian incinerator would be more difficult to implement than for Alternative 3-US.
	Administrative approval and analytical data required for discharge of dewatering effluent to the city sewer system.	Same as Alternative 1.	Same as Alternative 1.
	Would require coordination with NHDES and the City of Nashua for construction of the site access road and for traffic controls on Broad Street.	Same as Alternative 1.	Same as Alternative 1.

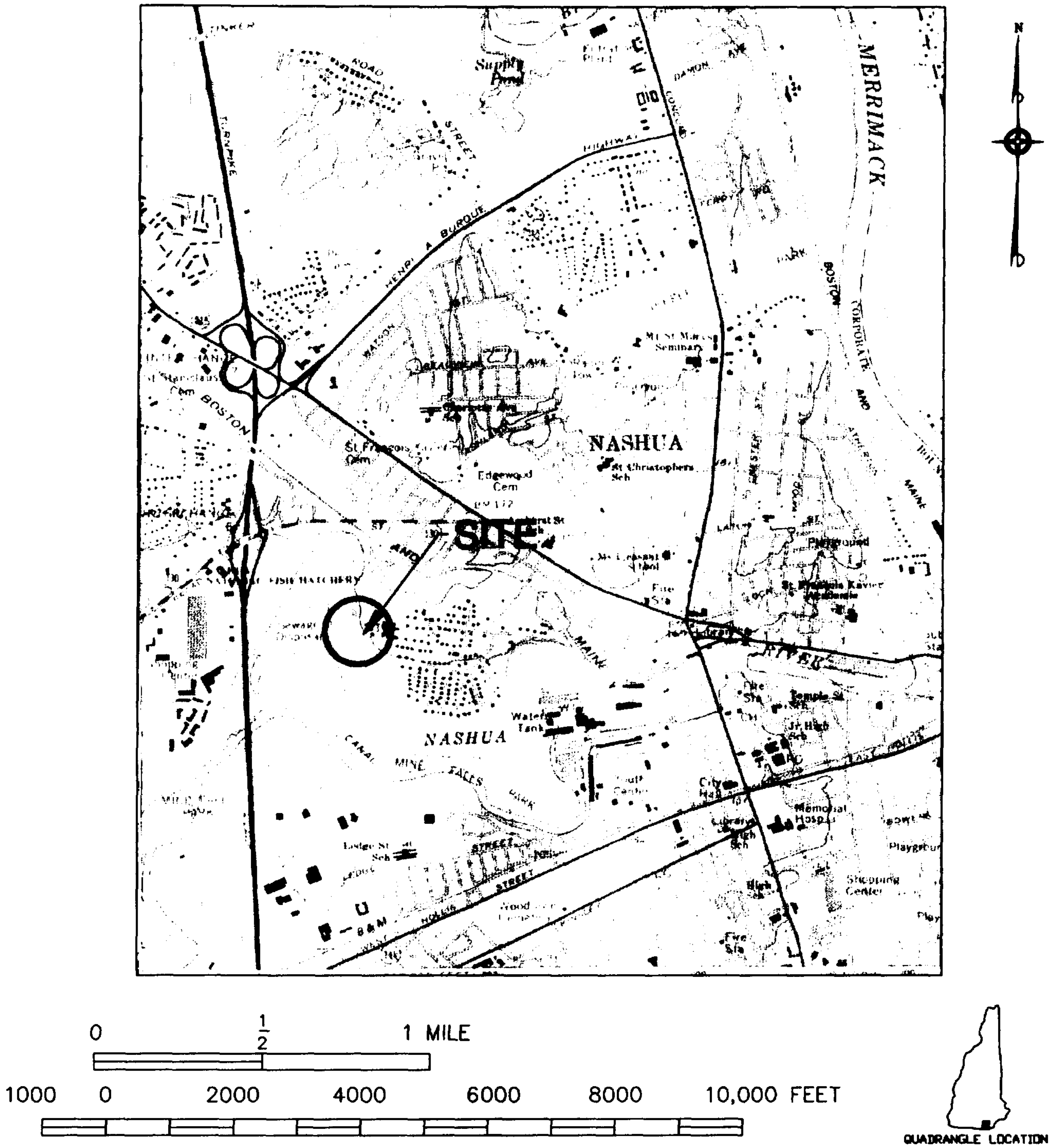
TABLE 5-10 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY			
Technical Feasibility	Excavation of sludge/waste below the water table could be technically difficult and adversely impact production rates, but would be technically feasible. Excavation of wastes in vicinity of sewer interceptor would require extra caution, but would be feasible. All other aspects of the Alternative would be readily implementable.	Excavation difficulties same as Alternative 1. May be difficult to design and construct on-site landfill that would contain large volume of waste, and be aesthetically acceptable to nearby residents.	Same as Alternative 1.
	Additional response actions could be implemented, if needed.	Similar to Alternative 1, but additional actions may be more difficult and costly if actions involve modifying the on-site landfill.	Same as Alternative 1.
	Would contribute to the site's long-term remedial action.	Comparable to Alternative 1. Contaminated sludge/waste would remain on site, but would be contained by the landfill liner and cover systems.	Same as Alternative 1.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Short-term Effectiveness	Limited impacts to community, on-site workers, and environment.	Same as Alternative 1.	Same as Alternative 1.
	Increase in heavy vehicle traffic in site vicinity anticipated. Would be addressed through traffic control and coordination with community and state agencies.	Comparable to Alternative 1. Alternative 2 would require less truck traffic to and from the site since excavated sludge/waste would not be transported off of the site. However, duration of site work would be longer.	Same as Alternative 1.
	Potential for sulfide odor and dust emissions (metals, SVOCs, dioxins) during excavation. Emissions monitoring and control measures would prevent or minimize potential problems.	Same as Alternative 1. Emissions issues could be slightly more problematic due to additional onsite handling of sludge/waste during landfill construction.	Same as Alternative 1.
	Increased noise due to site and construction activities. Would coordinate with community to lessen impacts.	Same as Alternative 1.	Same as Alternative 1.
	Estimated duration of on-site removal activities: 11 months.	Estimated duration of on-site removal activities: 16 months.	Estimated duration of on-site removal activities: 11 months.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Long-term Effectiveness and Permanence (cont.)	*Would be effective in the long term and* would be permanent.	*Would be effective in the long term and would be* permanent provided that the landfill system is properly operated and maintained. Long-term operation and maintenance of the landfill is required to ensure Alternative 2's continued effectiveness.	Same as Alternative 1.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No treatment involved under Alternative 1.	No treatment involved under Alternative 2.	Off-site treatment performed under Alternative 3 (incineration) would reduce the toxicity and volume of contamination in sludge/waste through treatment. Stabilization of treatment residuals (if necessary) would reduce the mobility of contaminants in sludge/waste residuals.
	Would not satisfy statutory preference for treatment.	Same as Alternative 1.	Would satisfy statutory preference for treatment.

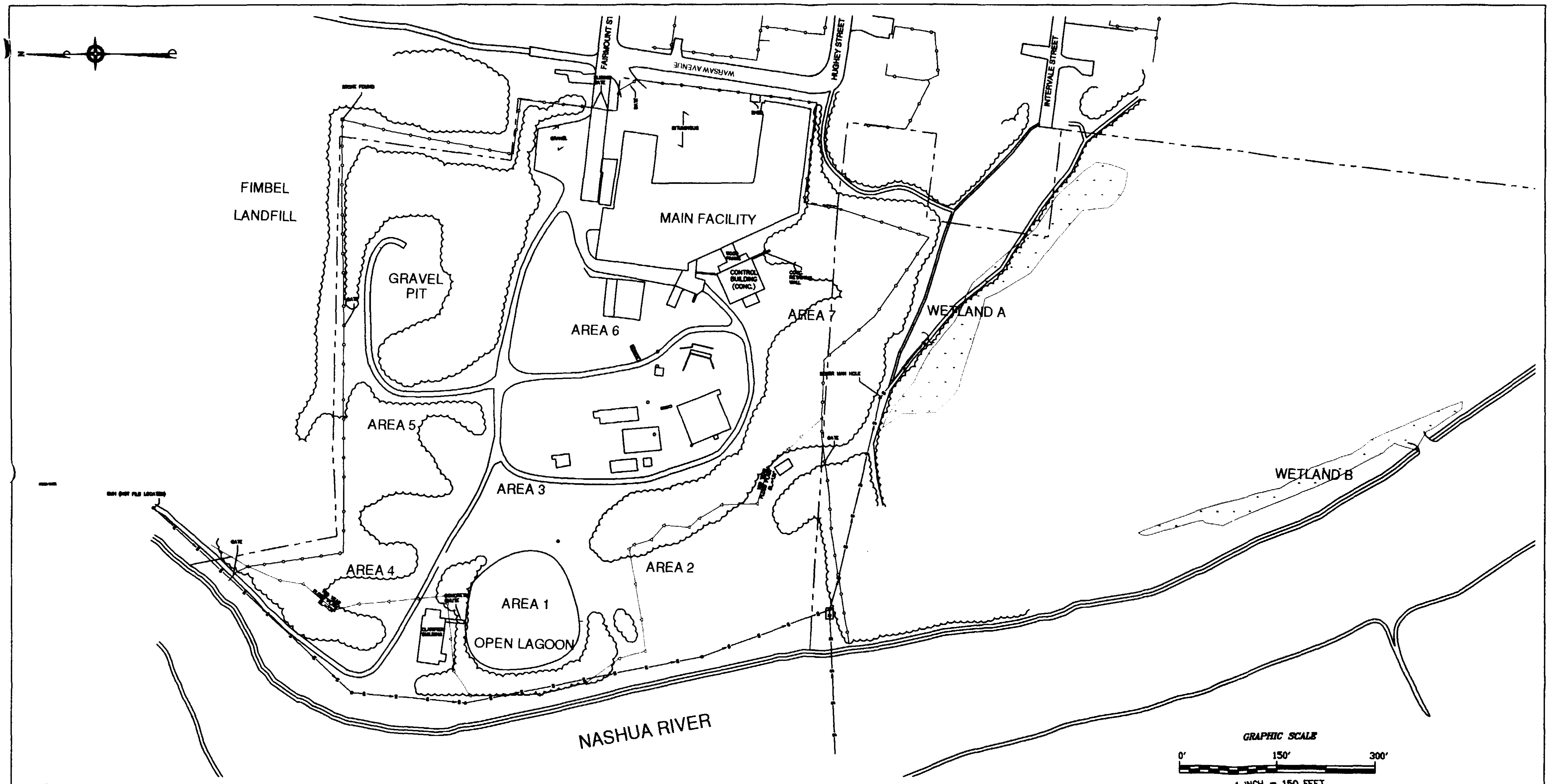
FIGURES



NOTE: Base Map from U.S.G.S. Nashua North Quadrangle, New Hampshire, 7.5 Minute Series, 1968, Photorevised 1985

SITE LOCATION				FIGURE 1-1
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASHUA, NEW HAMPSHIRE				
DRAWN BY:	R.G. DEWSNAP	REV.:	0	55 Jonspin Road Wilmington, MA 01887
CHECKED BY:	S. VETERE	DATE:	APRIL, 2002	(978)658-7899
SCALE:	AS SHOWN	ACAD NAME:	\DWG\4111\1010\FIGURE_1-1.DWG	

Originals in color.



NOTES:

1. BASE PLAN ELEVATION CONTOURS COMPILED FROM "TOPOGRAPHIC MAP OF CITY OF NASHUA, HILLSBOROUGH COUNTY NEW HAMPSHIRE", DIGITAL PHOTOGRAMMETRY BY CHAS. H. SELLS, INC., CHARLTON, MA, AERIAL PHOTOGRAPHY APRIL 13, 1998. SITE FEATURES AND SELECTED TEST PIT AND BORING LOCATIONS COMPILED FROM A PLAN BY OEST ASSOCIATES, INC., LABELED: "MOHAWK TANNERY, FAIRMONT STREET - NASHUA, NEW HAMPSHIRE, EXISTING CONDITIONS PLAN", NOVEMBER 20, 2001. SELECTED TEST PIT AND BORING LOCATIONS BASED ON GLOBAL POSITIONING SYSTEM (GPS) SURVEY BY TTNUS, SEPTEMBER, 2001.

2. COORDINATE / BEARINGS ARE BASED ON NEW HAMPSHIRE GRID COORDINATE SYSTEM (NAD 83). GRID NORTH. ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88), MEAN SEA LEVEL.

3. BASE FLOOD ELEVATION IS BASED ON FLOOD INSURANCE RATE MAP PANEL NUMBER 5 OF 10, COMMUNITY PANEL NUMBER 330097-0005B WITH AN EFFECTIVE DATE OF JUNE 15, 1979. BASE FLOOD ELEVATION DETERMINED TO BE 131.0 FEET (NAVD 88).

4. UTILITIES SHOWN ON PLAN ARE LOCATED APPROXIMATELY. LOCATIONS SHOWN ARE BASED ON PHYSICAL LOCATIONS AND / OR MAPS FROM THE CITY OF NASHUA.

5. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.

6. PLAN NOT TO BE USED FOR DESIGN.

Legend

- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- APPROXIMATE PROPERTY LINE
- WETLAND BOUNDARY

SITE PLAN				FIGURE 1-2
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASHUA, NEW HAMPSHIRE				55 Jonspin Road Wilmington, MA 01887 (978)658-7899
DRAWN BY:	D.W. MACDOUGALL	REV.:	0	
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002	
SCALE:	1" = 150'	FILE NO.:	\DWG\4111\1020\FIGURE_1-2.DWG	

EPA Region I New England
Superfund Document Management System

Doc ID # 32781
Page # 310

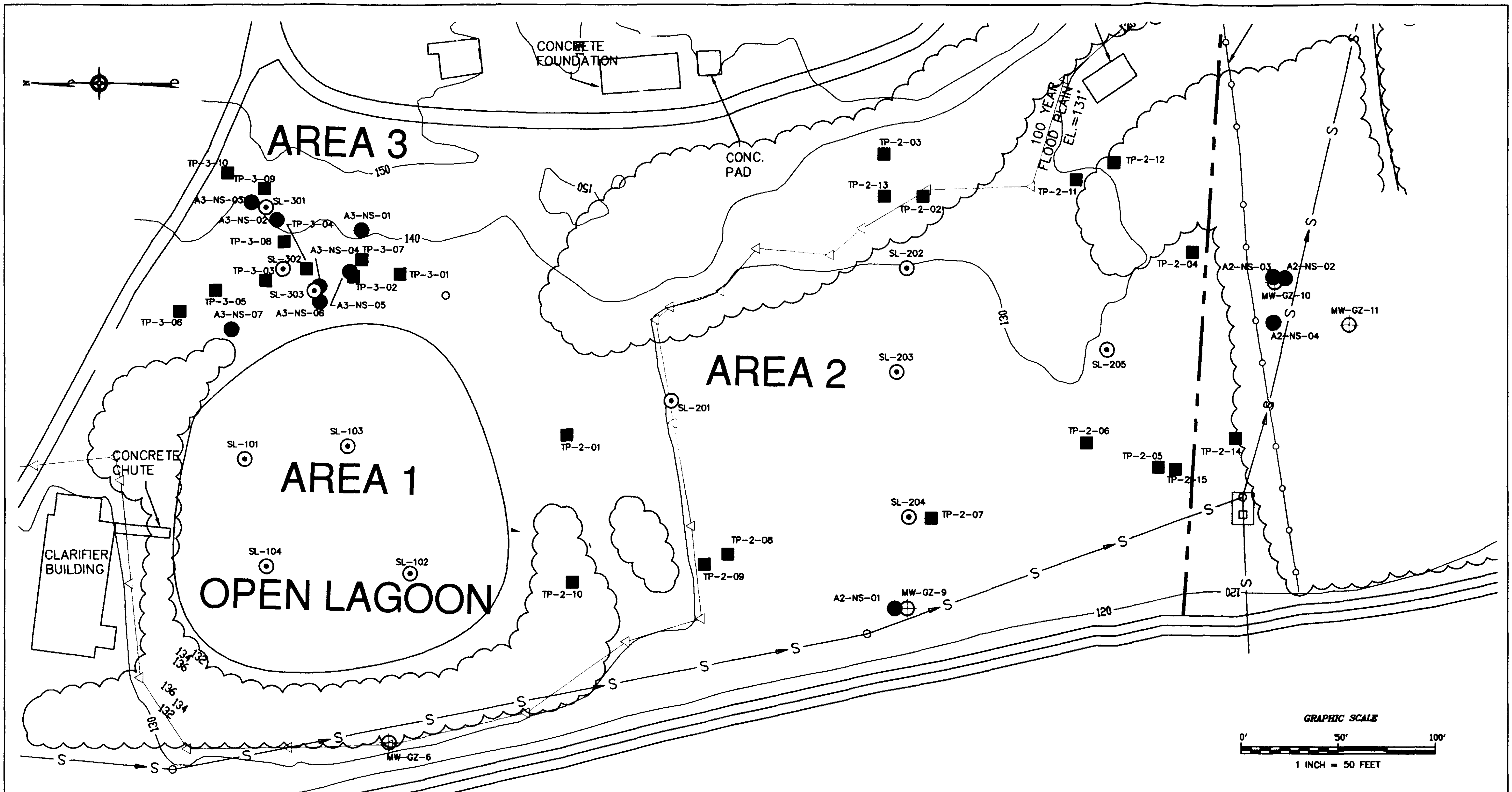
Imagery Cover Sheet
Unscannable Item

Contact the Superfund Records Center to View this Document

Site Name Mohawk Tannery
Operable Unit Entire Site
Break Number 2.2

Report or Document Title EE/CA

Date of Item 7/15/2002
Description of Item Site Plan + Sampling Locations
Number and Type of Item(s) 1 oversized Map



Legend

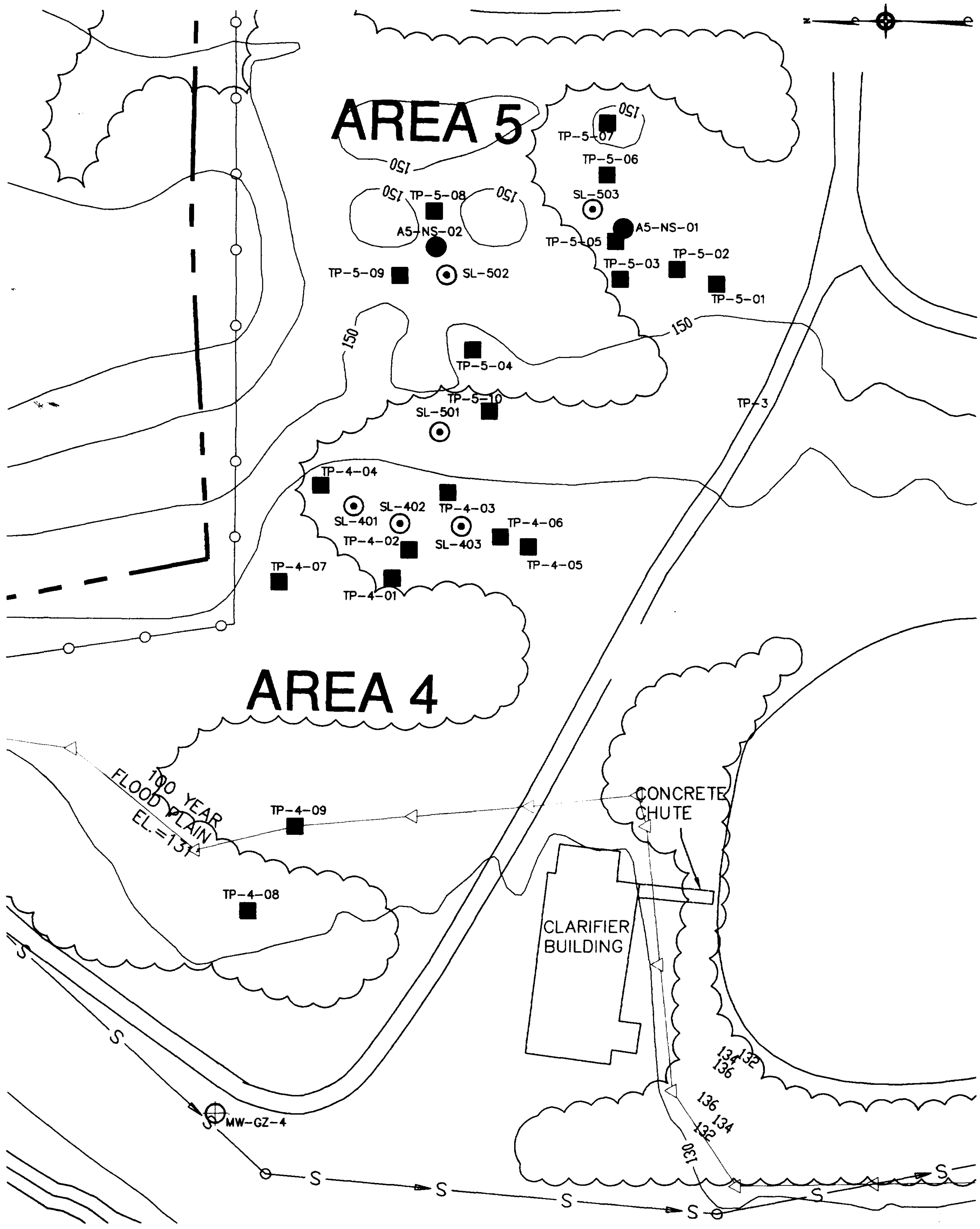
- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- WETLAND BOUNDARY
- APPROXIMATE PROPERTY LINE
- MONITORING WELL LOCATION WITH IDENTIFIER
- DPT OBSERVATION BORING LOCATION (NO SAMPLE COLLECTED) IDENTIFIER INDICATES AREA NUMBER, NO SAMPLE, BORING NUMBER
- SLUDGE / SOIL SAMPLING LOCATION (DPT BORING OR MANUAL BORING) IDENTIFIER INDICATES SAMPLE LOCATION – DISPOSAL AREA, BORING NUMBER
- TEST PIT LOCATION, IDENTIFIER INDICATES TEST PIT – AREA NUMBER – PIT NUMBER

SOIL BORINGS & TEST PIT LOCATIONS – AREAS 1, 2, & 3			
MOHAWK TANNERY SITE			
NASHUA, NEW HAMPSHIRE			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002
SCALE:	1" = 50'	FILE NO.:	\DWG\4111\1020\FIGURE_1-4.DWG

FIGURE 1–4

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887
(978)658-7899



Legend

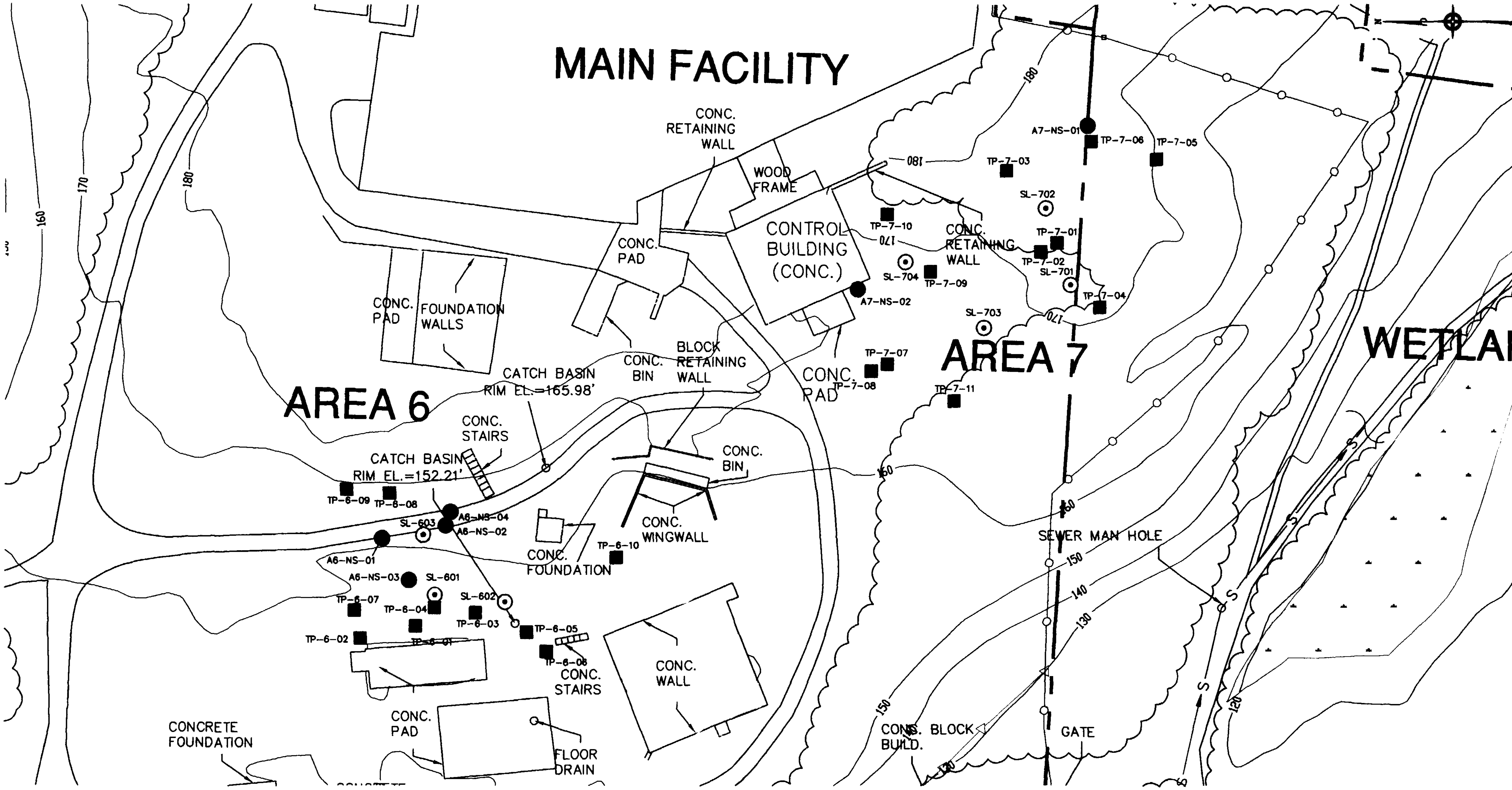
- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- WETLAND BOUNDARY
- APPROXIMATE PROPERTY LINE
- MW-GZ-1 MONITORING WELL LOCATION WITH IDENTIFIER
- A5-NS-07 DPT OBSERVATION BORING LOCATION (NO SAMPLE COLLECTED) IDENTIFIER INDICATES AREA NUMBER, NO SAMPLE, BORING NUMBER
- SL-201 SLUDGE / SOIL SAMPLING LOCATION (DPT BORING OR MANUAL BORING) IDENTIFIER INDICATES SAMPLE LOCATION – DISPOSAL AREA, BORING NUMBER
- TP-2-10 TEST PIT LOCATION, IDENTIFIER INDICATES TEST PIT – AREA NUMBER – PIT NUMBER

GRAPHIC SCALE

0' 40' 80'

1 INCH = 40 FEET

SOIL BORING & TEST PIT LOCATIONS – AREAS 4 & 5				FIGURE 1–5
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASUA, NEW HAMPSHIRE				55 Jonspin Road Wilmington, MA 01887 (978)658-7899
DRAWN BY:	D.W. MACDOUGALL	REV.:	0	
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002	
SCALE:	1" = 40'	FILE NO.:	\DWG\4111\1020\FIGURE_1-5.DWG	



Legend

SEWER LINE & MANHOLE
100 YEAR FLOODPLAIN BOUNDARY
FENCE
WETLAND BOUNDARY
APPROXIMATE PROPERTY LINE
MONITORING WELL LOCATION WITH IDENTIFIER
DPT OBSERVATION BORING LOCATION (NO SAMPLE COLLECTED) IDENTIFIER INDICATES AREA NUMBER, NO SAMPLE, BORING NUMBER
SLUDGE / SOIL SAMPLING LOCATION (DPT BORING OR MANUAL BORING) IDENTIFIER INDICATES SAMPLE LOCATION – DISPOSAL AREA, BORING NUMBER
TEST PIT LOCATION, IDENTIFIER INDICATES TEST PIT – AREA NUMBER – PIT NUMBER

GRAPHIC SCALE
0' 50' 100'
1 INCH = 50 FEET

SOIL BORINGS & TEST PIT LOCATIONS – AREAS 6 & 7

MOHAWK TANNERY SITE

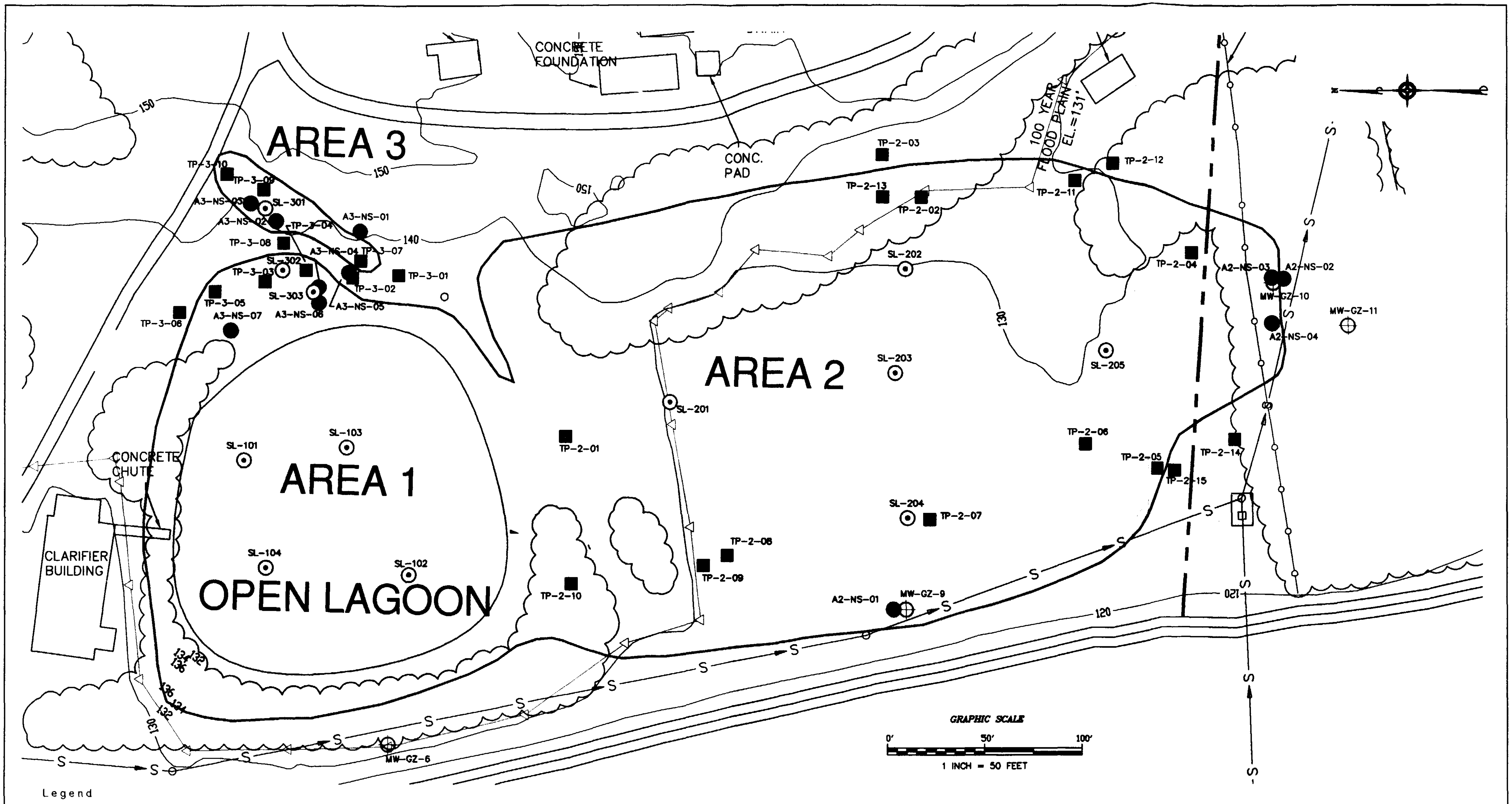
NASHUA, NEW HAMPSHIRE

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002
SCALE:	1" = 50'	FILE NO.:	\DWG\4111\1020\FIGURE_1-6.DWG

FIGURE 1-6

TETRA TECH NUS, INC.

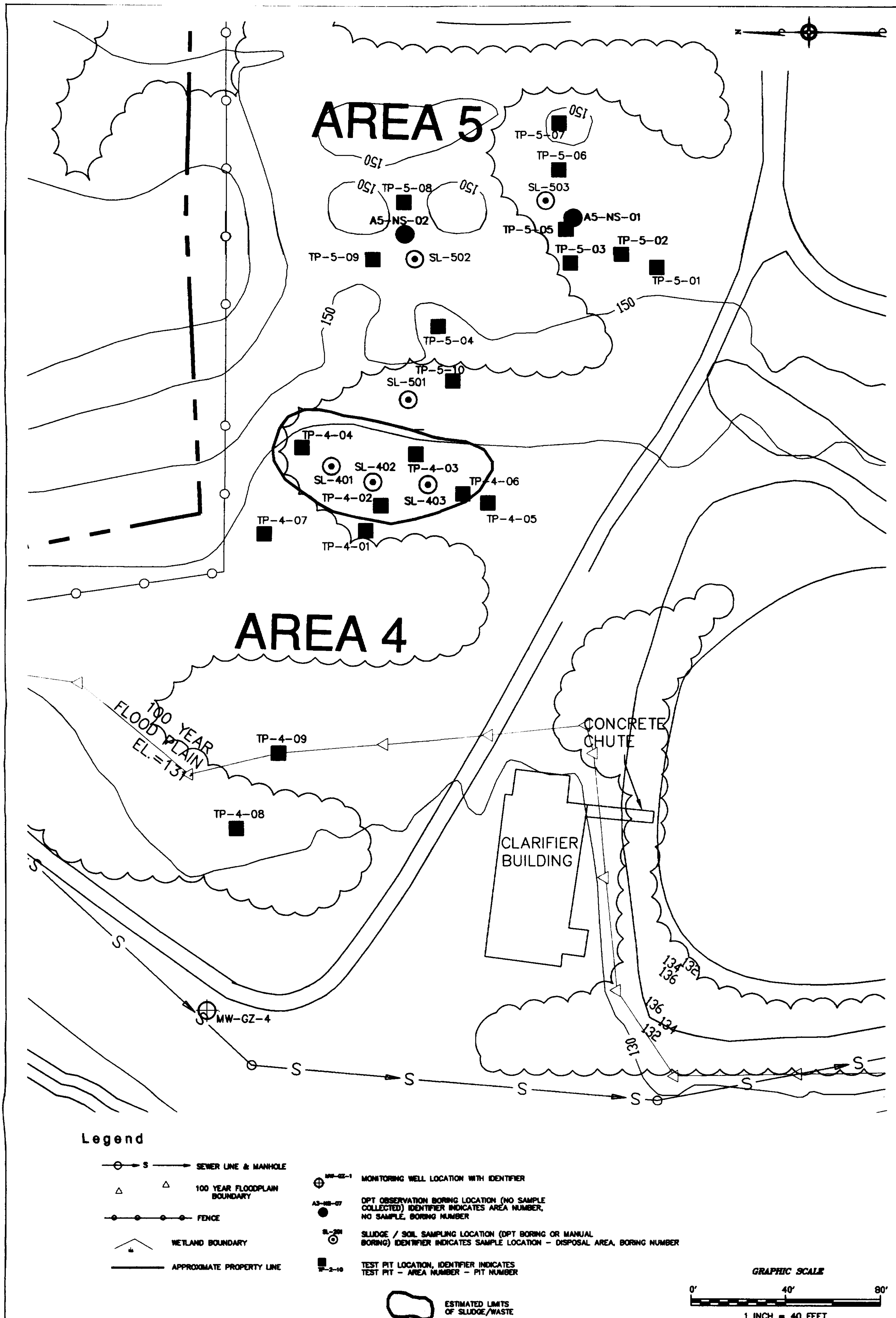
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



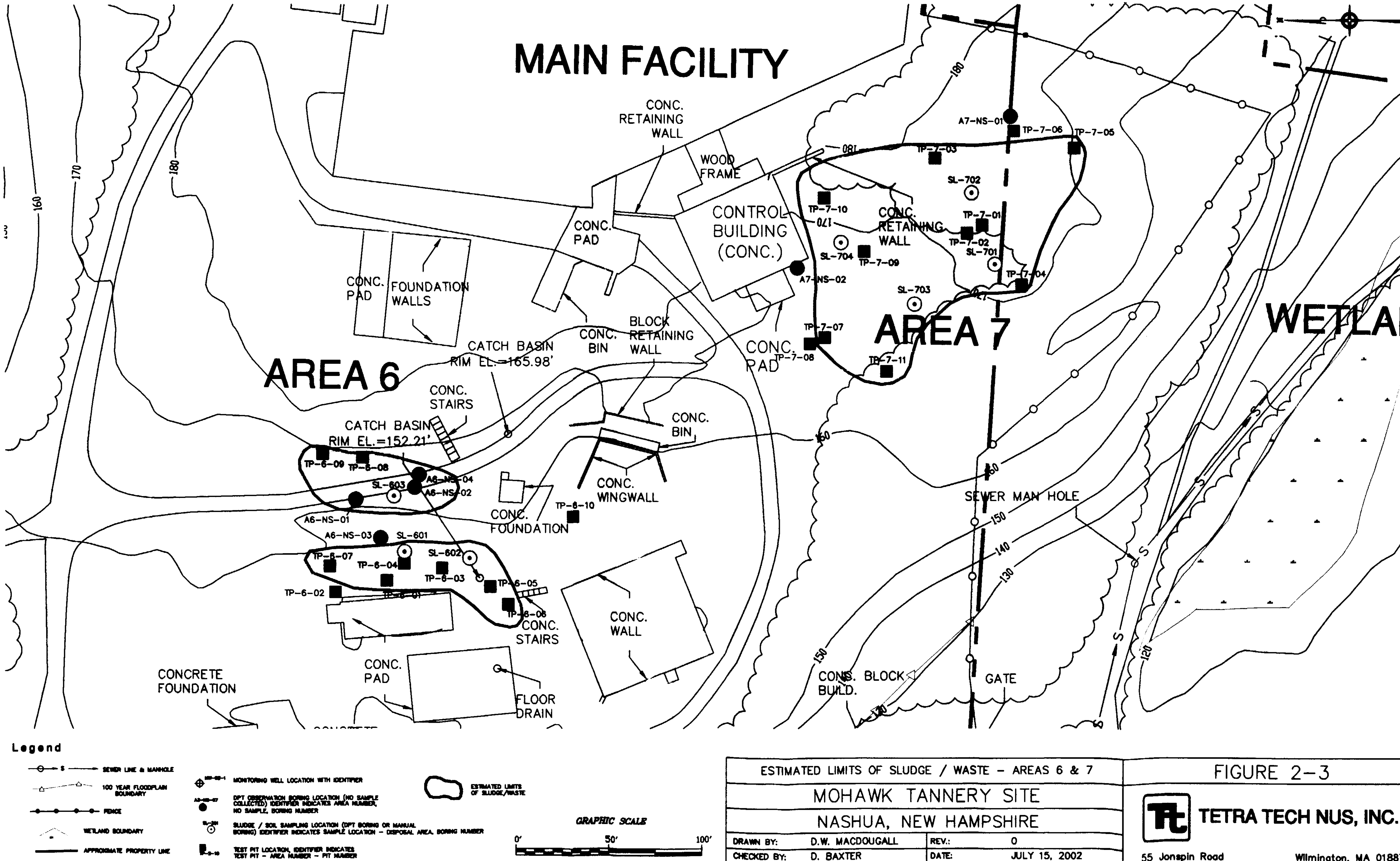
Legend

- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- WETLAND BOUNDARY
- APPROXIMATE PROPERTY LINE
- MONITORING WELL LOCATION WITH IDENTIFIER
- DPT OBSERVATION BORING LOCATION (NO SAMPLE COLLECTED) IDENTIFIER INDICATES AREA NUMBER, NO SAMPLE, BORING NUMBER
- SLUDGE / SOIL SAMPLING LOCATION (DPT BORING OR MANUAL BORING) IDENTIFIER INDICATES SAMPLE LOCATION - DISPOSAL AREA, BORING NUMBER
- TEST PIT LOCATION, IDENTIFIER INDICATES TEST PIT - AREA NUMBER - PIT NUMBER
- ESTIMATED LIMITS OF SLUDGE/WASTE

ESTIMATED LIMITS OF SLUDGE / WASTE - AREAS 1, 2, & 3				FIGURE 2-1
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASHUA, NEW HAMPSHIRE				
DRAWN BY:	D.W. MACDOUGALL	REV.:	0	55 Jonspin Road Wilmington, MA 01887
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002	(978)658-7899
SCALE:	1" = 50'	FILE NO.:	\DWG\4111\1020\FIGURE_2-1.DWG	



ESTIMATED LIMITS OF SLUDGE / WASTE - AREAS 4 & 5				FIGURE 2-2
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASHUA, NEW HAMPSHIRE				55 Jonspin Road Wilmington, MA 01887 (978)658-7899
DRAWN BY:	D.W. MACDOUGALL	REV.:	0	
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002	
SCALE:	1" = 40'	FILE NO.:	\DWG\4111\1020\FIGURE_2-2.DWG	



ESTIMATED LIMITS OF SLUDGE / WASTE – AREAS 6 & 7

MOHAWK TANNERY SITE

NASHUA, NEW HAMPSHIRE

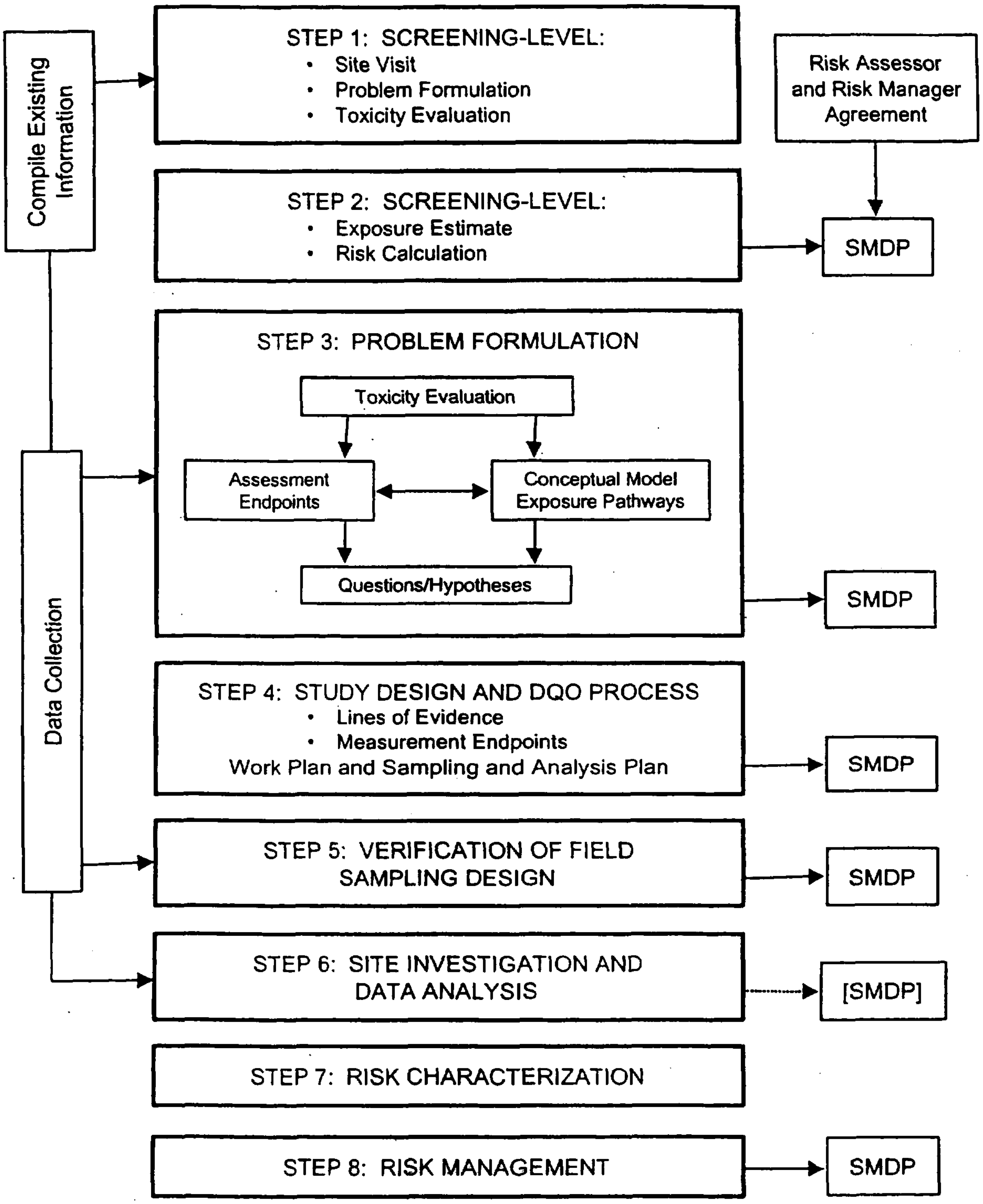
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002
SCALE:	1" = 50'	FILE NO.:	\DWG\4111\1020\FIGURE_2-3.DWG

FIGURE 2–3

TETRA TECH NUS, INC.

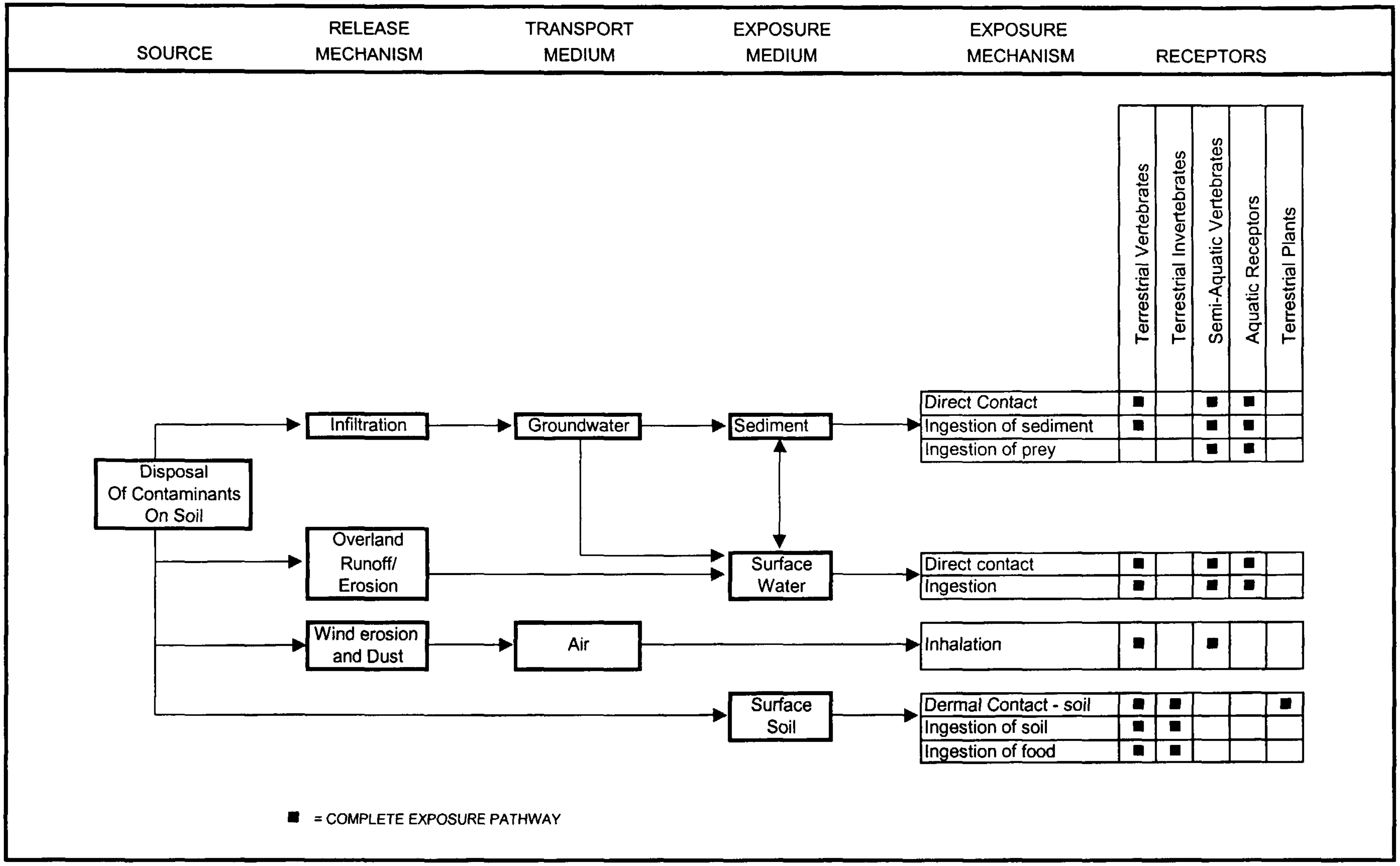
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

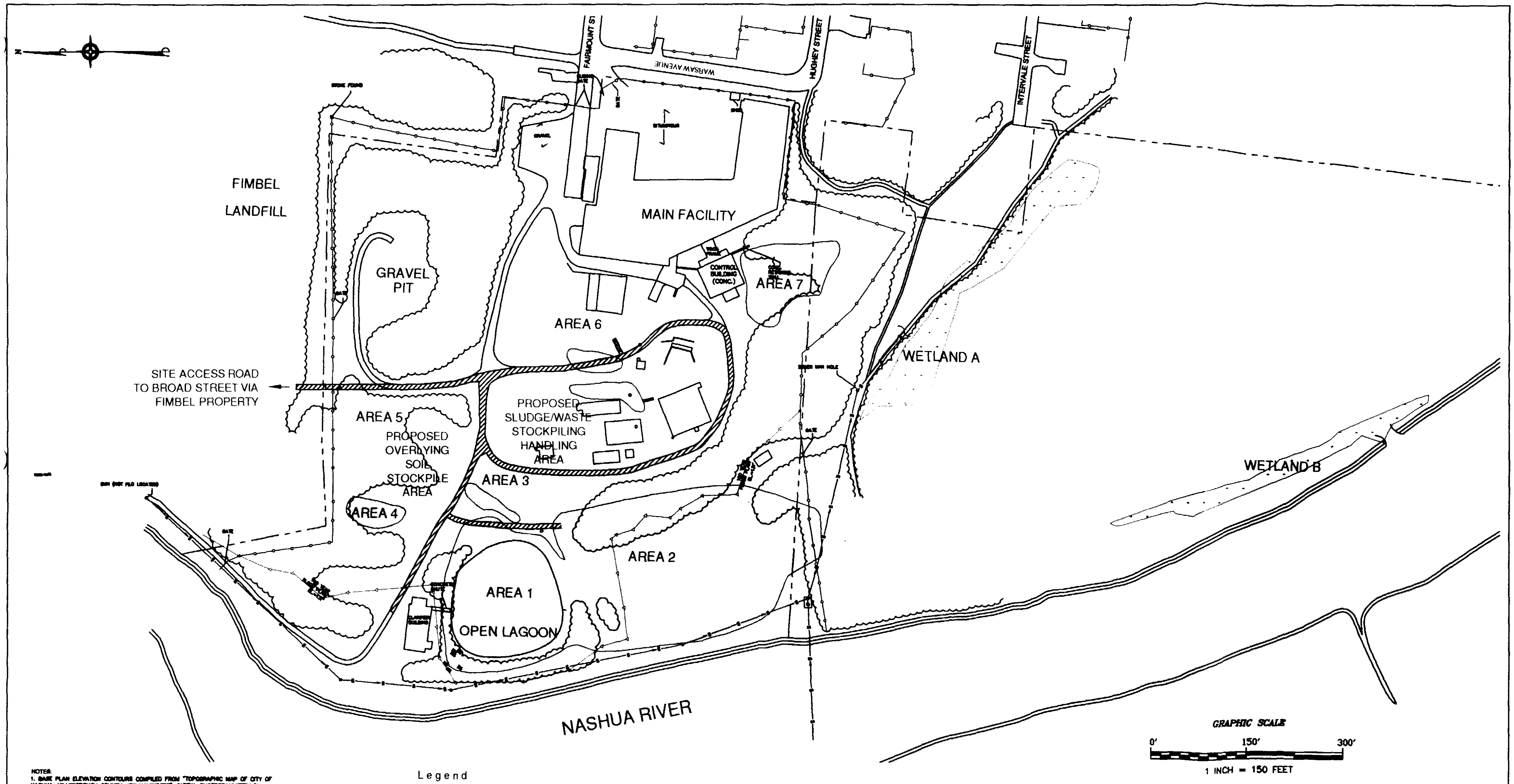
FIGURE 2-4
EIGHT STEP ECOLOGICAL RISK ASSESSMENT PROCESS FOR SUPERFUND ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE



Source: USEPA, 1997a

FIGURE 2-5
ECOLOGICAL CONCEPTUAL SITE MODEL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE





NOTES:

1. BASE PLAN ELEVATION CONTOURS COMPILED FROM "TOPOGRAPHIC MAP OF CITY OF NASHUA, HILLSBOROUGH COUNTY NEW HAMPSHIRE", DIGITAL PHOTOGRAMMETRY BY CHAS. H. SELLS, INC., CHARLTON, MA, AERIAL PHOTOGRAPHY APRIL 13, 1998. SITE FEATURES AND SELECTED TEST PIT AND BORING LOCATIONS COMPILED FROM A PLAN BY GEST ASSOCIATES, INC., LABELED: "MOHAWK TANNERY, FAIRMONT STREET – NASHUA, NEW HAMPSHIRE, EXISTING CONDITIONS PLAN", NOVEMBER 20, 2001. SELECTED TEST PIT AND BORING LOCATIONS BASED ON GLOBAL POSITIONING SYSTEM (GPS) SURVEY BY TTNUS, SEPTEMBER, 2001.

2. COORDINATE / BEARINGS ARE BASED ON NEW HAMPSHIRE GRID COORDINATE SYSTEM (NAD 83). GRID NORTH, ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88), MEAN SEA LEVEL.

3. BASE FLOOD ELEVATION IS BASED ON FLOOD INSURANCE RATE MAP PANEL NUMBER 5 OF 10, COMMUNITY PANEL NUMBER 330097-0005B WITH AN EFFECTIVE DATE OF JUNE 15, 1979. BASE FLOOD ELEVATION DETERMINED TO BE 131.0 FEET (NAVD 88).

4. UTILITIES SHOWN ON PLAN ARE LOCATED APPROXIMATELY. LOCATIONS SHOWN ARE BASED ON PHYSICAL LOCATIONS AND / OR MAPS FROM THE CITY OF NASHUA.

5. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.

6. PLAN NOT TO BE USED FOR DESIGN.

Legend

- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- APPROXIMATE PROPERTY LINE
- WETLAND BOUNDARY
- ESTIMATED LIMITS OF SLUDGE/WASTE
- HAUL ROADS TO BE IMPROVED

CONCEPTUAL SITE IMPLEMENTATION LAYOUT – ALTERNATIVES 1 & 3

MOHAWK TANNERY SITE

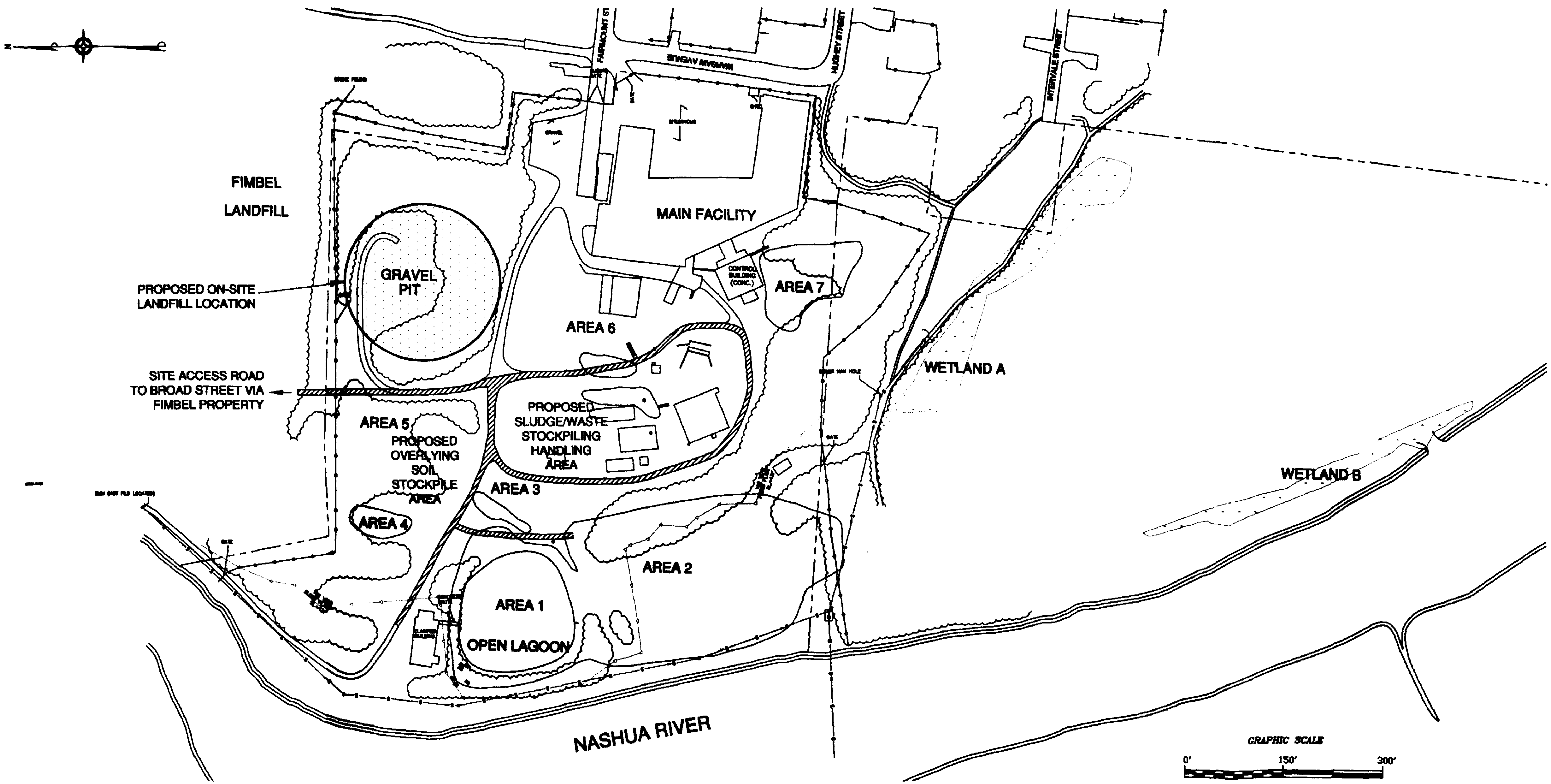
NASHUA, NEW HAMPSHIRE

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	S. VETERE	DATE:	APRIL, 2002
SCALE:	1" = 150'	FILE NO.:	\DWG\4111\1010\FIGURE_4-1.DWG

FIGURE 4–1

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887
(978)658-7899



NOTES:

1. BASE PLAN ELEVATION CONTOURS COMPILED FROM "TOPOGRAPHIC MAP OF CITY OF NASHUA, HILLSBOROUGH COUNTY NEW HAMPSHIRE", DIGITAL PHOTOGRAMMETRY BY CHAS. H. SELLS, INC., CHARLTON, MA, AERIAL PHOTOGRAPHY APRIL 13, 1998. SITE FEATURES AND SELECTED TEST PIT AND BORING LOCATIONS COMPILED FROM A PLAN BY CEST ASSOCIATES, INC., LABELED: "MOHAWK TANNERY, FAIRMONT STREET – NASHUA, NEW HAMPSHIRE, EXISTING CONDITIONS PLAN", NOVEMBER 30, 2001. SELECTED TEST PIT AND BORING LOCATIONS BASED ON GLOBAL POSITIONING SYSTEM (GPS) SURVEY BY TTNUS, SEPTEMBER, 2001.

2. COORDINATE / BEARINGS ARE BASED ON NEW HAMPSHIRE GRID COORDINATE SYSTEM (NAD 83). GRID NORTH, ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88), MEAN SEA LEVEL.

3. BASE FLOOD ELEVATION IS BASED ON FLOOD INSURANCE RATE MAP PANEL NUMBER 5 OF 10, COMMUNITY PANEL NUMBER 330097-0005B WITH AN EFFECTIVE DATE OF JUNE 15, 1979. BASE FLOOD ELEVATION DETERMINED TO BE 131.0 FEET (NAVD 88).

4. UTILITIES SHOWN ON PLAN ARE LOCATED APPROXIMATELY. LOCATIONS SHOWN ARE BASED ON PHYSICAL LOCATIONS AND / OR MAPS FROM THE CITY OF NASHUA.

5. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.

6. PLAN NOT TO BE USED FOR DESIGN.

Legend

- SEWER LINE & MANHOLE
- 100 YEAR FLOODPLAIN BOUNDARY
- FENCE
- APPROXIMATE PROPERTY LINE
- WETLAND BOUNDARY
- ESTIMATED LIMITS OF SLUDGE/WASTE
- HAUL ROADS TO BE IMPROVED

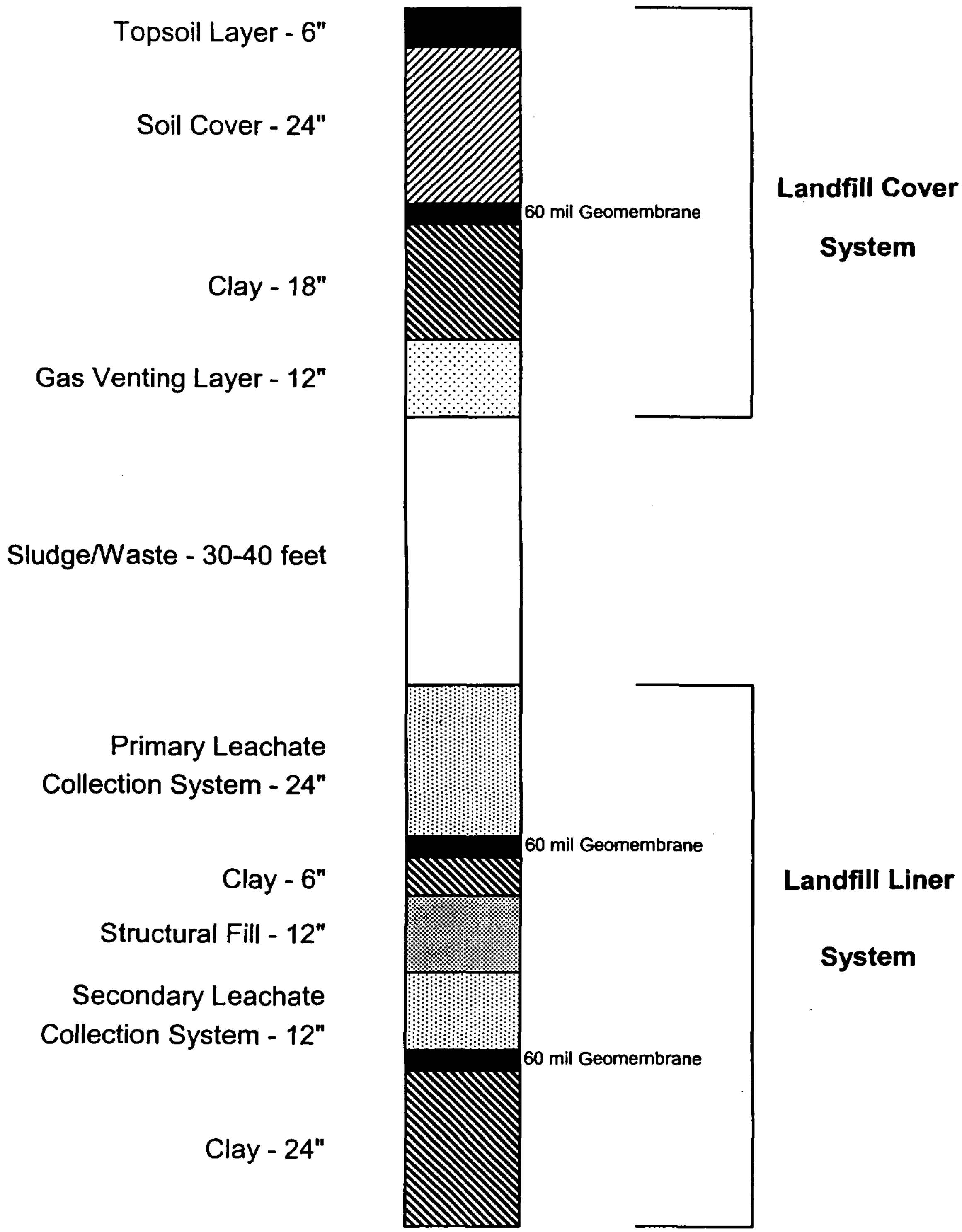
CONCEPTUAL SITE IMPLEMENTATION LAYOUT – ALTERNATIVE 2			
MOHAWK TANNERY SITE			
NASHUA, NEW HAMPSHIRE			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	D. BAXTER	DATE:	JULY 15, 2002
SCALE:	1" = 150'	FILE NO.:	\DWG\4111\1020\FIGURE_4-2.DWG

FIGURE 4–2

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887
(978)658-7899

FIGURE 4-3
ALTERNATIVE 2 - CONCEPTUAL DESIGN OF LANDFILL LINER AND COVER SYSTEMS
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE



* Landfill Conceptual Design based on regulations outlined in 40 CFR 258

FIGURE 5-1
ANTICIPATED PROJECT TIMELINES
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Alternative 1 - Excavation and Off-Site Disposal

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Task	Design and Specifications				Subcontract		Mob[1]	Excavation,Transportation,and Disposal										SR[2]
Notes							Estimated Duration of Site Work = 11 months											

Alternative 2 - Excavation and Consolidation into On-Site Landfill

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Task	Design and Specifications/Landfill Compliance								Subcontract		Mob	Site Prep/Lndfill Construct				Excavate/Consolidate into Landfill										Site Restore	
Notes											Estimated Duration of Site Work = 16 months																

Alternative 3 - Excavation, Off-Site Treatment and Disposal

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Task	Design and Specifications				Subcontract		Mob[1]	Excavation,Transportation,and Disposal										SR[2]
Notes							Estimated Duration of Site Work = 11 months											

[1]"Mob" includes mobilization and site preparation
[2]SR = Site Restoration

APPENDIX A

APPROVAL MEMORANDUM

MOHAWK TANNERY
2.2
Other: AR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
1 CONGRESS STREET, BOSTON, MA 02114

DATE: July 12, 2000

SUBJ: Mohawk Tannery Superfund Site - Approval Memorandum to perform an Engineering Evaluation/Cost Analysis for a Non-Time-Critical Removal Action

FROM: Neil Handler, Remedial Project Manager NH/RI Superfund Section

THRU: Larry Brill, Chief
Office of Site Remediation and Restoration I

Rich Cavagnero, Chief
Emergency Planning and Response Branch

TO: Patricia L. Meaney, Director
Office of Site Remediation and Restoration

I. Subject

Investigations by the United States Environmental Protection Agency (EPA) and the New Hampshire Department of Environmental Services (NHDES) have determined that there has been a release of hazardous substances to the environment at the Mohawk Tannery Superfund Site (the Site) in Nashua, New Hampshire. This Site was proposed for listing on the National Priorities List (NPL) on May 11, 2000, with the concurrence of the Governor of New Hampshire.

This memorandum documents the decision to proceed with an Engineering Evaluation/Cost Analyses (EE/CA) for a non-time-critical removal action (NTCRA) at the Site. The EE/CA will address contaminated tannery wastes which have been disposed of on-site in unlined lagoons and pits that are located within the 100-year flood plain of the Nashua River. There is evidence that the contaminants placed in these lagoons are migrating into the nearby Nashua River and groundwater. This approval memorandum authorizes the expenditure of federal funds for the EE/CA. EPA will be conducting a time-critical removal action during the summer of 2000, to address contaminants found in drums, laboratory containers, a storage tank, a primary clarifier, and asbestos on pipes at the Site. In addition, EPA hopes to initiate a remedial investigation and feasibility study later this year to evaluate the full nature and extent of groundwater contamination and impacts to the Nashua River.

The decision to proceed with the EE/CA is consistent with EPA guidance regarding Superfund Accelerated Cleanup Model (SACM) early actions and the long-term remedial strategy for this Site to minimize exposure to and migration of contaminants and to restore the Site and the Nashua River to productive uses. This memorandum is not a final Agency decision regarding the selection of a response action for the Site.

II. Background

A. Site Description and History

The Mohawk Tannery Superfund Site is located in the City of Nashua, Hillsborough County, New Hampshire. The Site is located approximately one mile west of the center of the city, at the intersection of Fairmount Street and Warsaw Avenue (See Figure 1). The Site consists of two contiguous properties: an approximately 15 acre developed parcel to the north, on which the inactive tannery facility is situated, and an undeveloped parcel to the south which is also approximately 15 acres in size. The parcels are bordered by the Nashua River to the west, a closed landfill to the north, and residential areas to the south and east. The nearest residence is located between 80 and 100 feet southeast of the property. There is a chain link fence along the northern, southern, and eastern borders of the site (the Nashua River is to the west). Several on-site structures have been demolished, but the debris has not been removed. Although the facility has been inactive for over 15 years, several commercial businesses (e.g., auto-repair, landscaping service) are reported to be currently operating at the site against local zoning ordinances. As a result the front gate is left open much of the time and access to the site is unrestricted.

The Mohawk Tannery, also known as Granite State Leathers, operated during the time period from 1924 to 1984. While in operation the facility used numerous hazardous substances during the preparation and tanning of hides. Such substances included volatile organic compounds (VOCs), inorganic metals, chlorinated phenols and alkaline and acidic solutions. The principal contaminant found in the waste streams produced at the Site was spent chromium. In addition to chromium, the wastes contained VOCs, chlorinated phenols, proteinaceous solids (e.g., hair, fleshings and hide scraps), alkaline and acidic residuals, mineral salts, and undissolved lime.

Due to incomplete records there is little known about the tannery's effluent treatment practices prior to the 1960's. In general, industry practice and regulatory requirements during that time frame did not require treatment of the wastes before their discharge into nearby waterways. In the 1960's, two unlined lagoons were constructed at the Site within approximately thirty feet of the Nashua River to provide some treatment of the wastewater before its discharge into the river. Both lagoons are located within the 100-year flood plain of the Nashua River. Treatment in the lagoons, which are identified as Area I and Area II on Figure 2, consisted of combining the alkaline and acid waste stream effluents to allow the solids to settle out. The liquid fraction was then discharged into the Nashua River.

A separate treatment process for the alkaline and acid waste streams was put in use from around 1971 to 1981. The alkaline effluent was pumped first into the Area II lagoon and then into the Area I lagoon before the liquid fraction was discharged into the Nashua River. The acid effluent was passed through a series of settling basins before being discharged to the Nashua River. The sludge from the lagoons and settling basins, consisting primarily of chromium salts, was periodically dredged and disposed of into four additional areas at the Site, noted as Areas III-VI on Figure 2 . The sludge in these disposal areas is estimated to range in thickness from approximately three feet to ten feet.

In anticipation of new state and local water quality discharge and solid waste disposal requirements, work began in 1971 to design a new treatment facility at the Site. The new treatment system, the construction of which was not completed until 1981, consisted of a control building, screen house, equalization tank, sulfide oxidation tank, primary clarifier, Indronova sludge dewatering unit with belt filter press, aerated lagoon (existing Area I lagoon), a secondary clarifier, and a PVC lined landfill (Fimbel Door Company Landfill as identified in Figure 2). During construction, it was reported that sludge located in the general vicinity of the new primary clarifier (Area VI as identified on Figure 2) was transferred to Areas III - V. The use of the Area II lagoon was discontinued prior to the completion of the new treatment system. The lagoon was covered with a layer of 4- to 12-inch diameter logs over which some fill was placed. Area II has since been allowed to naturally be re-vegetated and at this time is predominantly covered with aquatic vegetation such as cattails.

After the treatment system became operational in 1981, dried sludge was placed in the adjacent Fimbel Landfill (Area VIII as identified on Figure 2). The landfill, which is lined, comprises a three acre square-shaped parcel. Use of the new wastewater treatment system and adjacent landfill continued until July 1984, at which time the Mohawk Tannery ceased operations.

Since 1984, disposal areas III through VIII have been covered with up to a few feet of sand and gravel and allowed to naturally re-vegetate. Area I, the northern lagoon is still uncovered and is full of standing water for most of the year (See Figure 3). There is a pipe nearby Area I which appears to drain from the lagoon into the Nashua River, although it is unclear whether the pipe has collapsed or been plugged. The Fimbel Landfill has also been capped and closed under New Hampshire State Regulations.

In May of 1987, NHDES conducted an inspection of the property, and observed a release of aqueous material from the berm area of the Area I lagoon. The property owner, Warren Kean, was ordered to conduct additional sampling to determine the source of the release. Mr Kean was also required to conduct a study to characterize the contamination at the Site. To date there has been no remediation of the Site by the property owner.

Residents in the vicinity of the Site are supplied with municipal water by the Pennichuck Water Company. The majority of residents within 4 miles of the Site obtain their drinking water from municipal supplies located greater than 4 miles from the Site. Two drive point residential wells approximately 30 feet deep, were identified as the nearest receptors. These wells which are located approximately ½ mile southeast of the Site on Bitirnas Street, provide water for two households. These wells were last sampled and analyzed by NHDES for volatile organic compounds (VOCs) and inorganics in October1994. Laboratory analysis detected no evidence of contamination related to the Site.

C. Nature and Extent of Contamination

There have been a number of investigations completed at the Site to determine the nature and extent of soil, groundwater and surface water contamination caused by past disposal practices (e.g., burial of wastes in lagoons and disposal pits). The current Site conceptual model based on these investigations is that the sludge and wastes buried on-site have in the past and currently continue to impact the nearby surface water and the groundwater. It appears that contaminants found in the sludge and wastes are physically being transported (e.g., through direct pathways such as an existing outfall pipe or migrating via overland flow as soil is carried down to the river) into the Nashua River. In addition the lagoons are unlined and wastes have been buried below the water table in a number of the disposal areas, allowing for a direct impact to the groundwater. As a result the material buried on-site represents a long-term source of hazardous substances which will continue to contribute to surface water and groundwater contamination unless addressed. Additional information regarding the contaminants found at the Site and the basis for the Site conceptual model is provided below.

From 1972 to 1984, there were several investigations performed at the Mohawk Tannery by a number of different contractors including Goldberg-Zoino Associates, Incorporated (GZA) and Camp, Dresser, and McKee Incorporated (CDM). The investigations were performed primarily to evaluate areas of the Site for construction of the new treatment system, locate an area to be used as a landfill for sludge disposal, and as part of a hydrogeologic study performed by GZA. Although primarily geotechnical in nature, the early investigations showed the close proximity of wastes to the Nashua River and that the wastes were buried below the water table in the lagoons and many of the disposal pits. In addition, samples of the sludge taken during this time frame identified concentrations of total chromium ranging from 4,600 mg/l to 13,050 mg/l.

Starting in 1985, GZA worked on Phase II of a hydrogeologic study of the Site. As part of this work, eleven monitoring wells were installed and samples were taken of the groundwater, surface water, and sludge for analysis of contaminants. Elevated levels of volatile organic compounds, acid extractables, and toxic metals were detected in the sludge. Specifically, the compounds reported in the sludge and their highest concentrations included: methylene chloride (290 ppb), tetrachloroethylene (380 ppb), toluene (9,300 ppb), acetone (3,600 ppb), 2,4,6- trichlorophenol (140,000 ppb) , pentachlorphenol (510,000 ppb), chromium (1,000 ppb), and lead (400 ppb). It should be noted that the concentrations shown for metals represent the results of EP Toxicity Analyses rather than a total metals analyses.

In March of 1986, sludge samples were collected by EPA from Areas I through VII and analyzed for dioxin. The concentration of dioxin isomers detected in the sludge disposal areas ranged from 0.1 to 326 parts per billion (ppb), with Area II containing the highest concentration. In 1986, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), using equivalency calculations, determined that the concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the most toxic form of dioxin, was 2.27 ppb. The current recommended cleanup level for TCDD in soil for a residential exposure scenario is 1.0 ppb. It appears that the presence of dioxin at the Site may be linked to the use of pentachlorophenol as a biocide for hides undergoing the tanning process. Dioxin can be a by-product in the preparation of pentachlorophenol. Elevated levels of pentachlorophenol were detected in a number of sludge disposal areas as well as from a sample recently taken from the primary clarifier.

In response to the detection of dioxin isomers at the Site, the New Hampshire Department of Public Health Services (NHDPHS) in cooperation with the U.S. Fish and Wildlife Service (USFWS) completed a study in 1986 to address issues concerning potential human exposure to these contaminants through the consumption of fish in the Nashua River. The concern being that soil, which might contain these contaminants, if transported from the Site into the river could allow the contaminants to accumulate in the tissues of fish. The river is stocked and is fished by local residents nearby the Site.

The study completed by the NHDPHS and USFWS looked at the concentrations of polychlorinated dibenzo-p-dioxins (PCDD's) and polychlorinated dibenzofurans (PCDF's) in fish. The study focused primarily on bottom feeders because of their greater exposure to potentially contaminated sediments. The results showed the presence of 2,3,7,8-tetrachlorodibenzo furan (TCDF) in all samples. No other PCDD's or PCDF's were detected. At the time of the study there was no information available as to background levels of TCDF in New Hampshire's aquatic biota, making speculation difficult as to whether the concentrations detected were elevated or site-specific. However, the concentrations detected fall within the high end of the range of levels reported in literature for TCDF in fish from the Midwest and the Hudson River. Since the study was primarily screening in nature, the NHDPHS was unable to make specific fish consumption recommendations. The study indicated that additional sampling would be necessary to determine whether the levels found were of concern and were site-related .

In May of 1989, under EPA direction, Roy F. Weston conducted a magnetometer survey and subsurface sampling of a number of the disposal areas. The laboratory results confirmed that the predominant contaminants of concern in the sludge were metals but there were also elevated levels of semi-volatile compounds. Specifically, some of the compounds reported and their highest concentrations included: chromium (24,200 ppm), copper (257 ppm), lead (323 ppm), mercury (1.57 ppm), zinc (230 ppm). The New Hampshire remediation level established for direct human contact of chromium in soil is 1,000 ppm.

In October 1993 the NHDES completed additional sampling of sediment in the Nashua River adjacent to the Site to better quantify the impacts of the tannery on the river. Elevated levels of chromium, cadmium and lead were detected. The maximum concentration of chromium, cadmium and lead in the sediment was 144 ppm, 18.7 ppm, and 163 ppm. The concentration of chromium present in the sediment adjacent to the Site is significantly higher than the observed background concentration. In addition, the levels detected nearby the Site exceed both the lowest effect level and severe effect level, indicating a potential risk to sediment dwelling and other aquatic organisms. A preliminary ecological screening of available site-specific data by EPA in April 2000 strongly suggests that aquatic and terrestrial organisms associated with this area are being exposed to levels of contamination that could result in adverse biological effects.

One of the likely points of entry for contaminants from the Site into the surface water is a 12-inch to 14-inch diameter concrete pipe located on the east bank of the Nashua River adjacent to the Area I lagoon. A soil sample taken in October 1993 from soil around the pipe outfall detected elevated levels of chromium (3,290 ppm). In addition, the integrity of the berm itself separating the contaminated sludge from the Nashua River may be questionable as their have been a number of releases documented and reported by the NHDES during the operation of the tannery.

III. Threat to Public Health, Welfare, or the Environment

Section 300.415(b)(2) of the National Contingency Plan (NCP) lists a number of factors for EPA to consider in determining whether a removal action is appropriate, including:

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;

- (ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

- (iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;

- (iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;
- (v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;
- (vi) Threat of fire or explosion;
- (vii) The availability of other appropriate federal or state response mechanisms to respond to the release; and
- (viii) Other situations or factors that may pose threats to public health or welfare or the environment.

An evaluation of the conditions at the Mohawk Tannery Superfund Site conclude that factors (i), (ii), (iv), (v), and (vii) are applicable as described below.

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants -

At present, the contaminated sludge and sediments represents the most significant threat to human health and the environment. With regard to actual or potential exposure to nearby human populations, EPA has documented elevated levels of contaminants including chromium, cadmium, pentachlorophenol, and dioxins in numerous sludge disposal areas at the Site which could provide a threat to human health and the environment. These lagoons and disposal areas have never been provided with an engineered permanent cover and range from currently having no cover at all (i.e., nothing to prevent human or ecological receptor exposure) to being covered with fill from several inches to several feet thick. Although the Site is fenced, there are numerous areas where it appears that individuals still trespass on to the Site. In addition, the Site has be re-zoned residential by City of Nashua and there appears to be significant interest by private parties and the City to re-develop the property for that purpose. As a result, human populations could be further exposed to subsurface soils as a result of the development of the property. EPA's time-critical removal activities will eliminate the hazards presented by discarded drums, laboratory containers, and the contents of the primary clarifier but will not address the problems caused by hazardous substances improperly disposed of in the lagoons.

With regard to actual or potential exposure to animals or the food chain, the contaminants of concern as well as exposure scenarios are somewhat similar to that discussed above. The concern for direct exposure of wildlife to the contaminants at the Site has been documented by EPA and State personnel. During visits to the Site there have been ample evidence of wildlife activity including beaver and bird activity in the Area I lagoon where wastes have been left uncovered and there is a direct pathway for exposure. In addition, the results of earlier investigations and studies have confirmed that many of the contaminants of concern are migrating from the Site into sediments found in the adjacent Nashua River. A preliminary food chain study performed in 1986 identified the presence of furans in samples of fish tissue taken nearby the Site. However, the results of the study were inconclusive in identifying whether the furans came from the Site and whether an advisory related to food consumption should be issued.

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems -

The Nashua River and its associated wetlands and flood plain represent a sensitive ecosystem at the Site. Numerous media in this ecosystem have been affected by contamination: sediment, surface water, soil, and wetland areas. Although an ecological risk assessment has not yet been conducted at the Site, numerous birds, fish and animals have been observed at the Site by State and EPA personnel. A preliminary ecological screening indicates that birds, mammals, and fish may be at risk when they forage in the various habitats associated with the Site based on the elevated levels of hazardous substances found there.

(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate - High levels of hazardous substances have been found in soils largely at or near the surface of the lagoons and disposal areas at the Site. None of the lagoons or disposal areas have an engineered permanent cover. In addition, many have little to no fill over the hazardous substances disposed of in them. Nor do they have any means of run-on or run-off control. Accordingly, the wastes in these areas are subject to erosion as well as periodic flooding by the Nashua River. Erosion and flooding already appear to have caused the contaminated wastes to migrate, since elevated levels of hazardous substances associated with the Site have been found in Nashua River sediments located adjacent the Site.

(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released - A number of the lagoons and disposal areas at the Site are located in the 100-year flood plain of the Nashua River. The two largest of these areas (Area I and II lagoons) are located within 30 feet of the Nashua River. None of the areas were designed constructed, operated, and maintained in a way to prevent washout of hazardous substances in the event of a flood. In addition, there is evidence of repeated releases from at least the Area I lagoon into the Nashua River. These releases may be the result of unsound diking or a drainage pipe which discharges directly into the Nashua River. Weather conditions have caused and will continue to cause the migration of contaminated wastes at the Site into the Nashua River and the migration of contaminated sediments further downstream. In addition, if the integrity of the dikes surrounding Areas I and II were to fail than approximately 30,000 cubic yards of contaminated wastes could be released into the Nashua River.

(vii) The availability of other appropriate federal or state response mechanisms to respond to the release - There are no other known federal or state funds or response mechanisms available to finance this action. The current Site owner does not have sufficient assets available to perform this action.

Based upon the NCP factors previously listed, a current or potential threat exists to public health or welfare or the environment due to the release or threat of release of hazardous substances into the environment. A NTCRA is therefore appropriate to abate, prevent, minimize, stabilize, mitigate, or eliminate such threats.

The scope of the NTCRA will be to remove, control or contain the risk of actual or potential exposure to hazardous substances found in the lagoons and disposal areas located at the Site. This removal is designated as non-time-critical because more than six months planning time is available before on-site activities must be initiated. Prior to the actual performance of a non-time critical removal at this Site, Section 300.415(b)(4) of the NCP requires that an engineering evaluation/cost analysis (EE/CA) be performed in order to weigh different response options.

IV. Endangerment Determination

There may be an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance from the Site.

V. Scope of the EE/CA

The purpose of the EE/CA will be to evaluate alternatives for response measures to address the contaminated wastes in the lagoons and disposal areas at the Site and soils associated with these areas. The EE/CA will consider alternatives which meet the following general removal action objectives:

- Prevent, to the extent practicable, human exposure to contaminated wastes in the lagoons and disposal areas and associated soils found at the Site ; and

- Prevent, to the extent practicable, continued environmental impacts from the migration of contaminants from the lagoons and disposal areas into the Nashua River.

Pursuant to EPA guidance on EE/CAs, alternatives will be evaluated based upon effectiveness, implementability, cost and compliance with ARARs to the extent practicable. Further, alternatives which exceed $2 million dollars will be evaluated to determine their consistency with future remedial actions to be taken at the Site.

In developing the range of alternatives to be evaluated in the EE/CA, EPA will consider 300.415(d) of the NCP as well as relevant guidance. It is anticipated that the EE/CA will be completed within twelve to fifteen months of being fully funded. The EE/CA will form the basis of the Action Memoranda which will document the cleanup approach. Procurement of the response action contractor and construction of the NTCRA would begin immediately following the approval of the

Action Memoranda.

VI. Enforcement Strategy

On December 2,1999, EPA mailed Notice of Potential Liability and Request for Access to Chester Realty Trust, the current owner of the property. On April 4, 2000, a 104(e) Request for information letter was sent to Chester Realty Trust. On April 18, 2000, Notice of Potential Liability and 104(e) Request for information letters were sent to Warren W. Kean, a former owner/operator and beneficiary of Chester Realty Trust, W. Russell Kean Revokable Trust, a former owner/operator, and Granite State Tanning Company, a former operator. On June 1, 2000, a Notice of Potential Liability and 104(e) Request for information letter was sent to Mohawk Associates, Inc., a former operator.

EPA plans to issue a UAO to one or all, of the above parties to perform the time critical removal action, once the viability of the parties has been determined. It does not appear that any or all of the above parties has the financial resources to perform either the time-critical or non-time-critical removal actions.

VII. Estimated Costs

The EE/CA for the proposed NTCRA at the Mohawk Tannery Superfund Site will be performed by EPA. The EE/CA will likely be developed by an EPA contractor under the Response Action Contracts (RACs) program.

Extramural costs associated with sampling activities, the preparation of the EE/CA, community relations support activities, and the development of an Administrative Record is expected to cost approximately $500,000. Based upon a preliminary EPA estimate, costs associated with the removal action for the lagoons and disposal areas may range between $4 to $8 million. The costs will be significantly impacted by the volume of soil that may require disposal, whether the material is considered a hazardous waste, and whether on-site or off-site disposal is required.

VIII. Other Considerations

In addition to considering the Section 300.415(b)(2) factors which were discussed in Section III of this Memorandum, EPA guidance also recommends that the following additional factors be considered in determining whether to employ a non-time-critical removal action or remedial action :(1) time-sensitivity of the response; (2) the complexity of both the problems to be addressed and the action to be taken; (3) the comprehensiveness of the proposed action and (4) the likely cost of the action. The February 14, 2000, EPA Guidance for the Use of Non-Time-Critical Removal Authority in Superfund Response Actions, states that a NTCRA is generally appropriate where a site presents a relatively time-sensitive, non-complex problem that can and should be addressed relatively inexpensively.

To summarize the information provided in other Sections of this Memorandum, hazardous substances from the lagoons and disposal areas at the Site which are located within the 100-year flood plain, are migrating into the Nashua River. The levels of site-related contaminants found in soil and sediment at and/or nearby the Site already present a risk to human health and the environment. As these impacts are likely increase over time and have the potential to increase exponentially if the dikes separating the two largest disposal areas (Area I and II) from the river were to fail, the time-sensitivity of this action is well documented.

The scope of the work to be completed and focus of this response action is fairly well defined (i.e., to remove, control or contain the risk of actual or potential exposure to contaminants found in the lagoons and disposal areas located at the Site) and therefore its complexity falls within the anticipated range for a NTCRA. Certainly additional sampling work and data evaluation needs to occur as part of the EE/CA to better quantify and qualify the sludge and define disposal options but these are manageable and discrete tasks.

It is intended that whatever solution the EE/CA identifies (i.e., ranging from capping in place to excavation and disposal of off-site) it will provide a comprehensive solution. Mitigating the main "sources" of contamination at the Site provides such a comprehensive solution since it is certainly and integral portion of the overall cleanup at the Site whether its pursued as a removal action or response action. The groundwater and surface water components of the overall site-wide cleanup will still remain to be addressed but because of the complexity of these problems they do not lend themselves to being pursued through the removal process.

The last factor to be discussed relates to the anticipated cost of the NTCRA. Based on preliminary data it is anticipated that this response action will cost between $4 to $8 million. EPA has attempted to be conservative in some of its initial assumptions and therefore the actual costs to implement may be towards the lower end of the above estimate. However, the cost estimate will likely exceed the $2 million ceiling thereby requiring a waiver for implementation. Certainly with the current budget constraints funding is an important issue but as indicated in the February 14, 2000, guidance the $2 million ceiling is meant as a fiscal check and not part of the statutory definition of a "removal".

The problem to be addressed at the Site (i.e., to remove, control or contain the risk of actual or potential exposure to contaminants found in the lagoons and disposal areas located at the Site) meets the criteria discussed above and therefore the proposed response action is appropriate as a NTCRA. The proposed NTCRA is congruent with the anticipated remedial actions to minimize exposure to and migration of contaminants and to restore the Site and the Nashua River to their respective productive uses. The proposed NTCRA is one part of a three phased approach to address concerns at the Mohawk Tannery Superfund Site. The other two components are (1) the EPA time-critical removal action which is schedule to take place during the summer of 2000 to address contaminants found in drums, laboratory containers, a storage tank, a primary clarifier, and asbestos on pipes at the Site, and (2) an RI/FS which will characterize the groundwater and surface water contamination at the Site, followed by implementation of the selected remedy. EPA hopes to begin work on the

RI/FS later this year.

The State of New Hampshire, the City of Nashua, and residents living nearby the tannery all support an early action at this Site.

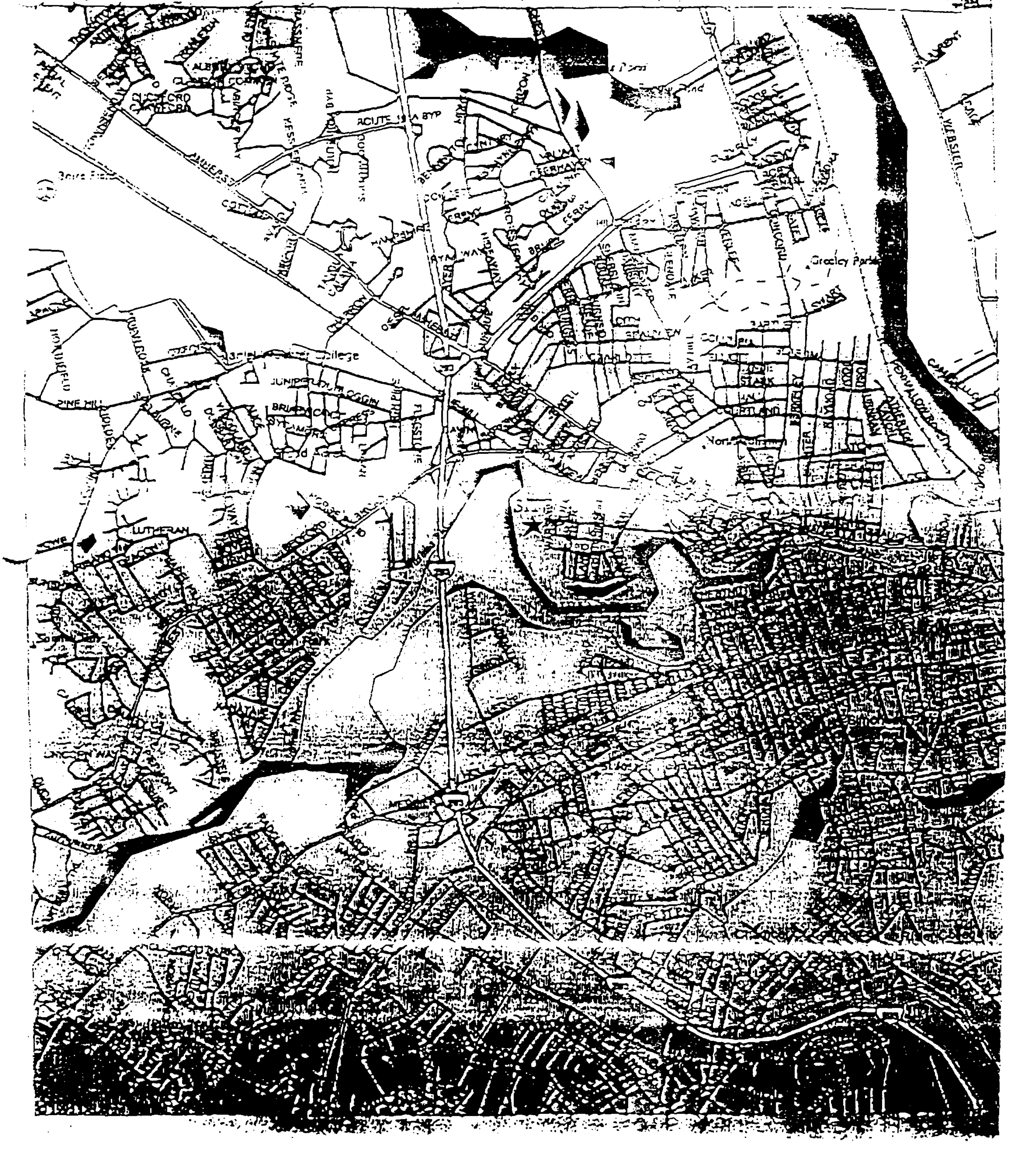
IX. Recommendation

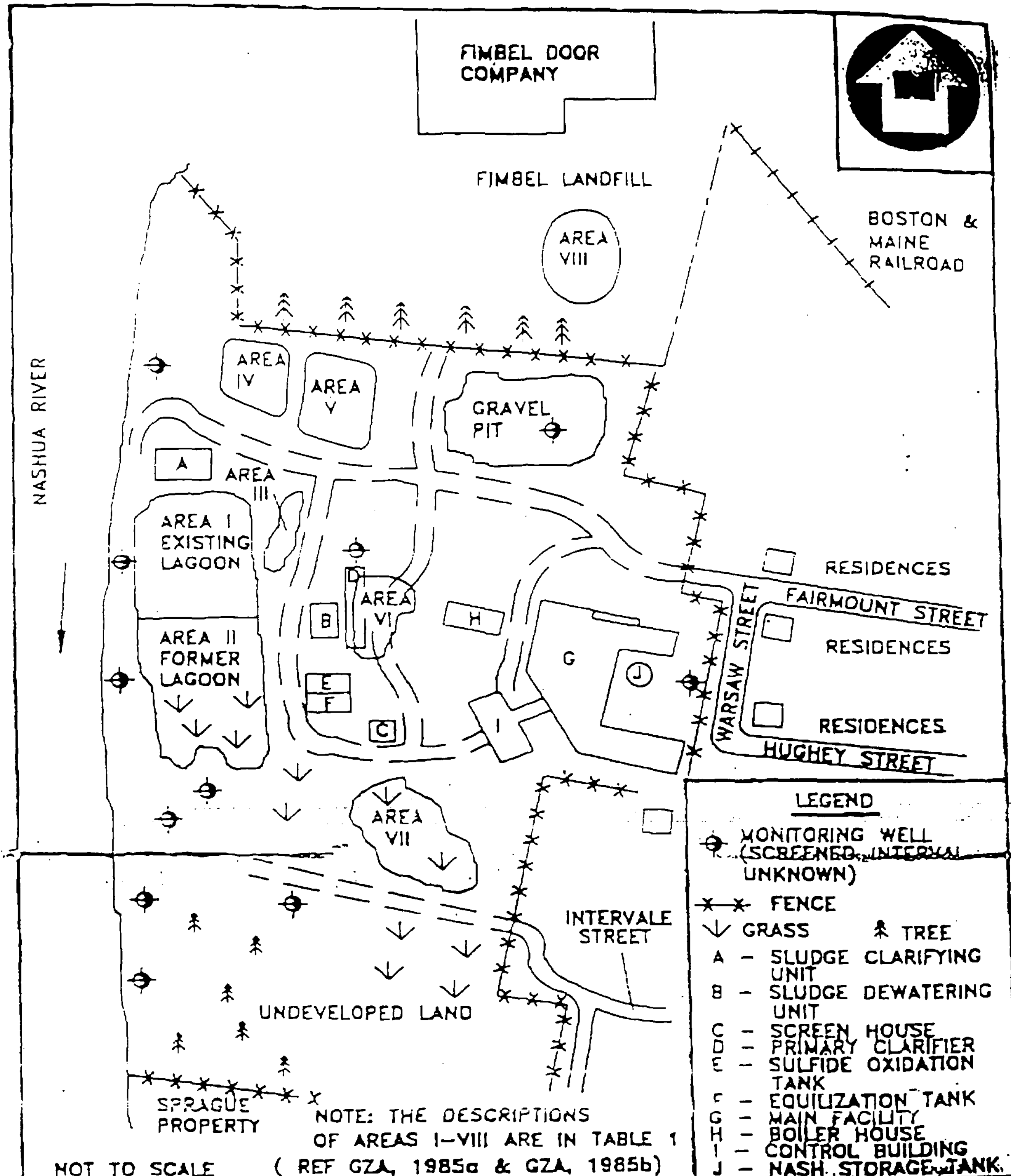
Ongoing investigations have determined that there has been a release of hazardous substances to the environment. Additionally, the conditions at the Site meet the NCP Section 300.415(b) criteria for a removal. Consistent with Section 104(b) of CERCLA and NCP Section 300.415(b)(4), further investigation is necessary to plan and direct the future removal actions. We recommend your approval of this request to perform an EE/CA at the Mohawk Tannery Superfund Site. The total estimated extramural cost of performing the EE/CA is $500,000.

July 13, 2000
Date

for Patricia L. Meaney, Director
Office of Site Remediation and Restoration

FIGURE 1 SITE LOCUS MAP





SITE SKETCH

MOHAWK TANNERY

NASHUA, NEW HAMPSHIRE

FIGURE 3

AREA I LAGOON AS OF 5/10/2000

MOHAWK TANNERY
ADMINISTRATIVE RECORD FILE
EE/CA JULY 2000

1. SITE ASSESSMENT

1. REPORT: PHASE 2 HYDROGEOLOGIC STUDY & CONCEPTUAL CLOSEOUT PLAN.
   TO: FAIRMOUNT HEIGHTS ASSOCIATES
   AUTHOR: GOLDBERG-ZONIO & ASSOCIATES INC
   DOC ID: 6738 10/01/1985 261 PAGES

2. SAMPLING & ANALYSIS DATA: DIOXIN SAMPLING RESULTS.
   TO: NH DEPT OF ENVIRONMENTAL SERVICES
   AUTHOR: US EPA REGION 1
   DOC ID: 6743 06/10/1986 17 PAGES

3. LETTER: REVIEW OF DIOXIN SAMPLING DATA.
   TO: MARILYN DISIRIO, US EPA REGION 1
   AUTHOR: JEFFREY A LYBARGER, US DHHS/AGENCY FOR TOXIC SUBSTANCES & DISEASE REGISTRY
   DOC ID: 6744 07/07/1986 4 PAGES

4. LETTER: RESULTS OF STATE INSPECTION OF LAGOON 1.
   TO: WARREN M KEAN, GRANITE STATE LEATHER INC
   AUTHOR: JOHN A MINICHIELLO, NH DEPT OF ENVIRONMENTAL SERVICES
   DOC ID: 6742 06/22/1987 3 PAGES

5. REPORT: PRELIMINARY ASSESSMENT.
   TO: US EPA REGION 1
   AUTHOR: NUS/TETRA TECH INC
   DOC ID: 6739 07/31/1987 11 PAGES

6. REPORT: SITE INVESTIGATION.
   TO: US EPA REGION 1
   AUTHOR: ROY F WESTON INC
   DOC ID: 6740 07/01/1989 55 PAGES

7. REPORT: SCREENING SITE INSPECTION REPORT, FINAL.
   TO: NH DEPT OF ENVIRONMENTAL SERVICES
   AUTHOR: NUS/TETRA TECH INC
   DOC ID: 6737 07/05/1989 36 PAGES

8. REPORT: SITE INSPECTION PRIORITIZATION REPORT, FINAL.
   TO: US EPA REGION 1
   AUTHOR: NH DEPT OF ENVIRONMENTAL SERVICES
   DOC ID: 6736 11/01/1996 187 PAGES

9. LETTER: EXPRESSION OF THE STATE OF NEW HAMPSHIRE'S SUPPORT FOR INCLUSION OF GRANITE STATE LEATHER (MOHAWK TANNERY) SITE ON SUPERFUND NATIONAL PRIORITIES LIST.
   TO: CAROL BROWNER, US EPA HEADQUARTERS
   AUTHOR: JEANNE SHAHEEN, NH GOVENOR
   DOC ID: 6735 03/08/2000 2 PAGES

MOHAWK TANNERY
ADMINISTRATIVE RECORD FILE
EE/CA JULY 2000

2. REMOVAL RESPONSE

1. REPORT: REMOVAL PROGRAM PRELIMINARY ASSESSMENT/SITE INVESTIGATION REPORT FOR 08/11/1999.
   TO: US EPA REGION 1
   AUTHOR: ROY F WESTON INC
   DOC ID: 6741 10/01/1999 49 PAGES

2. REPORT: REVIEW & TECHNICAL COMMENTS ON ECOLOGICAL SCREENING OF PRELIMINARY DATA & RECOMMENDATIONS FOR ADDITIONAL SAMPLING.
   TO: NEIL E HANDLER, US EPA REGION 1
   AUTHOR: PATTI LYNNE TYLER, US EPA REGION 1
   DOC ID: 6745 04/17/2000 16 PAGES

3. MEMO : CONSULTATION ON DRAFT ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) APPROVAL MEMO.
   TO: LARRY REED, US EPA HQ/OFFICE OF EMERGENCY & REMEDIAL RESPONSE
   AUTHOR: ART JOHNSON, US EPA REGION 1
   DOC ID: 6803 06/22/2000 2 PAGES

4. MEMO : APPROVAL MEMORANDUM TO PERFORM AN ENGINEERING EVALUATION/COST ANALYSIS FOR A NON-TIME-CRITICAL REMOVAL ACTION.
   TO: PATRICIA L MEANEY, US EPA REGION 1
   AUTHOR: NEIL E HANDLER, US EPA REGION 1
   DOC ID: 6801 07/12/2000 15 PAGES

). RECORDS MANAGEMENT

1. INDEX : GUIDANCE DOCUMENTS.
   DOC ID: 6805 1 PAGE

APPENDIX B

TEST PIT LOG SHEETS

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/4111-0322
Location: Nashua, NH

Test Pit No.: TP-2-01
Date: 8/17/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1.5	white/beige, fine sand	SP	dry
1.5	3	dark brown fine-medium sand	SP	moist
3	5	yellow brown medium sand	SP	
5	7	black clay-like sludge		damp, 20 % hair/hide
7	13	black clay-like sludge		water table at approx. 7' bgs

Test Pit Cross Section and/or Plan View

REMARKS: see reverse for cross-section

PHOTO LOG: photo #6—pit lithology, photos #7, #8—extracted material

TEST PIT: TP-2-01

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-01 ~~II~~ SAV 11/17/02

about 10' long, 4' wide, 13' deep

0 bgs ———————— GS

white fine sand

1.5 — — — — — — —

dark brown fine-medium sand

3.0 — — — — — — —

yellow/ beige fine sand / med. sand

5.0 — — — — — —

black, clayey sludge mat'l

7.0 — ∇ — moist, damp — —

black sludge

13.0 — — — — — — — —

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/4111-0322
Location: Nashua, NH

Test Pit No.: TP-2-02
Date: 8/17/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	dark, poorly-graded sand with roots	SP	sand all the way to sludge
1	3.5	dark brown fine-medium sand	SP	
3.5	6	sludge, black, clayey		80-90% hair/hide
6	8	green sludge		80-90% hair/hide
8	12	black sludge		80-90% hair/hide
12		gravel layer		gravel layer below sludge

Test Pit Cross Section and/or Plan View

SEE REVERSE FOR CROSS-SECTION

REMARKS: sludge is 80%-90% hair/hide, silty clay consistency (10-20%)
sludge is wet, but water not seeping through
depths are approximate—too unstable to measure

PHOTO LOG: camera #1, photo 9

TEST PIT: TP-2-02

Tt NUS FORM 0011

TP-2-02
~~TP II-2~~ SAV

approx. 8' long, 4' wide, 12' deep

0 bgs

roots, dark sand

1

dark brown fine-medium sand

3.5

black/gray sludge, hair/hide

6

green sludge, clayey w/ hair/hide

8

black sludge

12

gravel (stop dig)

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-2-03
Project Number:	N4024/4111-0322	Date:	8/17/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	8	Medium sand, tan, clean	SP	Dig stopped 8' bgs

Test Pit Cross Section and/or Plan View

REMARKS: Eastern tree line, all clean sand. No contamination at 8'.

PHOTO LOG: Dave's Camera

TEST PIT: TP-2-03

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-03

~~# 3~~ SAV

6' long, 3' ~~deep~~ wide, 10' deep

bgs — gs

6' dk. brown sand, PS

6' — 1' black Sludge material

7' — 1' silty sand, beige/tan, moist

8'

↓

to bottom of hole (10')

Michele Croot 8/17

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Project Number: N4024/4111-0322

Location: Nashua, NH

Test Pit No.: TP-2-04

Date: 8/17/01

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	6	Medium sand, dark brown	SP	
6	7	Black sludge, some hair	50% hair	Silty sludge
7	8	Tan silty sand, moist	SM	
8	10	Brown sand	SP	
Bottom	Total depth ~ 10'			

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Very thin lense of sludge

PHOTO LOG:

TEST PIT: TP-2-04

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-2-05
Project Number: N4024/4111-0322
Date: 8/17/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	5.5	Yellow/tan, medium sand	SP	
5.5	6	Dark brown, medium sand possibly contaminated soil	SP	A globule of tar 6-8"
6	8	Dark brown soil, 1 glob tar, little green material w/hair	SP	Some hair material (5%)
8	11	Yellow/beige silty sand, more moisture	SM	Moist, bottom material

Test Pit Cross Section and/or Plan View

Total Depth ~11'.

See Reverse

REMARKS: Slight odor, contamination is not obvious.

PHOTO LOG:

TEST PIT: TP-2-05

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-05

~~II-5~~ SAV

3-4 wide, 8' long, 11' deep.

bgs

0 ——— gs

↓ 6' beige medium sand

6'

contained very little hairy material, smelly ↓ 2-3' dark brown sand

8'

↓ 2' beige silty sand, moist

11'

Micu Cof

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-2-06
Project Number:	N4024/N4011-0322	Date:	8/17/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	5.5	Yellow/beige fine-medium sand	SP	
5.5	7	Dark brown, 5-10% hair	SP	
7	11	Sludge material, hair, moist		70% hair/hide
11	13	Grey silty, clayey, sand moist	SM	Moist, bottom material

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Total Depth ~ 13'.

PHOTO LOG: D.S. Camera

TEST PIT: TP-2-06

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-06

~~#-4~~ SAV

10' long, 4' wide, 13' deep

' bgs — gs

yellow/beige sand

5.5 — 5.5

1.5-2' dk. brown/black material, bits of hairy material

7' —

~4' black Sludge, 70% hair/hide

11' —

grey silty sand 2'

13' — 13' bottom

Micael Crot

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-2-07

Project Number: N4024/N4111-0322

Date: 8/17/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Dark brown, root matter (60%)	SW	
1	4	Light brown, medium sand	SW	
4	7	Sludge material, grey; 50% hair/hide		Silver clayey sludge (60%) hairy, black dryer sludge (40%)
7	13	Black sludge		

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______

TEST PIT: TP-2-07

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-07 ~~II~~ 7 SAV

10' LONG, 4' WIDE, 13' DEEP

bgs (ft)

roots — 1'

LGT BROWN MEDIUM SAND — 3'

4' - - - - - - -

GREY SLUDGE, HIGH PLASTICITY — 3'

7' - - - - - - -

BLACK
NO PLASTICITY — 6'

13' - - - - - - -

bottom of TP

LOGGED BY M. CROOT

TRANSCRIBED BY S. VETERE

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-2-08
Project Number: N4024/N4111-0322
Date: 8/20/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1.5	Roots from phragmytes, tan sand	SP	
.5	4	Tan sand, little root material	SP	Logs
4	4.5	Grey sand	SP	
4.5	12	Sludge material, green/grey to black		50% silty clay, 50% sandy with hair/hide

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Water table ~4.5; hole collapsing at total depth 12'

PHOTO LOG: 2 of cross-section, 1 of material
Dave's camera, roll #2

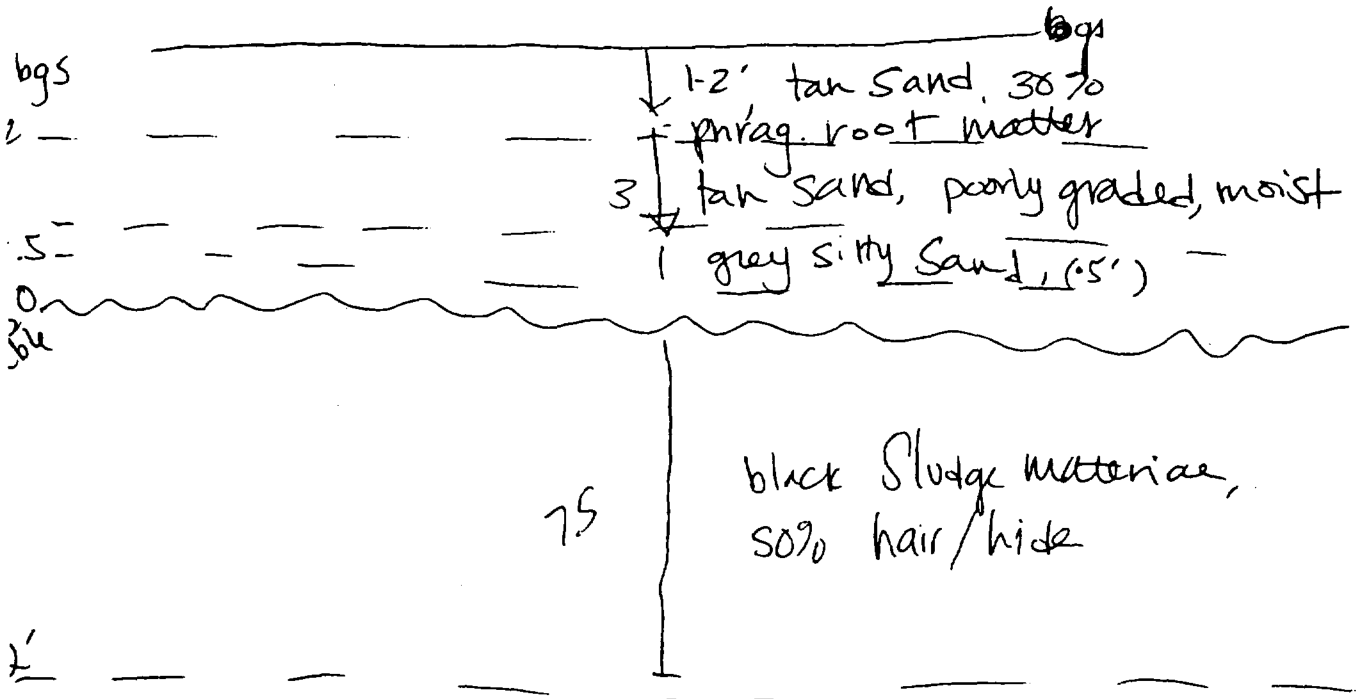
TEST PIT: TP-2-08

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-08 ~~II 8~~ SAV

6' wide, 8' long, 12' deep



hole collapsing, sludge still prevalant at 12'.

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-2-09
Project Number:	N4024/N4111-0322	Date:	8/20/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Yellow/beige sand, 20% roots	SP	
4	4.5	Sludge material, black		Strips of leather 50% hair/hide

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: hole closed upon sludge detection – vertical extent not found

PHOTO LOG: Roll #2 TEST PIT: TP-2-09

Tt NUS FORM 0011

TP-2-09

~~#-9~~ SAV

3' Wide, 6' Long, 4-5' deep

GS

1'bgs 1' roots

↓ 3' yellow/beige sand

4' ↓ Sludge material, leather scraps.

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-2-10
Project Number: N4024/N4111-0322
Date: 8/20/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Tan sand, mixed e/small gravel	SW	Some root matter
2	3	Dark brown grey sand	SP	
3	13	Sludge material		50% hair/hide

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Water Table at ~ 6.5' bgs

PHOTO LOG: Roll #2

TEST PIT: TP-2-10

PAGE 1 OF 1

Tt NUS FORM 0011

AP-2-10

~~IT-10~~ SAV

7' Long, 3' wide, ~12' deep

bgs ———————————————— gs

2-3' tan sand, little gravel (small)

3' — 1' darker sand, grey siltish layer

black Sludge material, wet, 50% hair/hide

~7' water table

8-9'

12' ——— bottom

Michael C[illegible]

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-2-11
Project Number:	N4024/N4111-0322	Date:	8/20/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Dark brown soil	SP	20% hair/hide scraps
4	13	Sludge material		Black sludge, 50% hair/hide
13	14	Grey silty moist material	MS	Clayey bottom material

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______________________

PHOTO LOG: ______________________ TEST PIT: TP-2-11

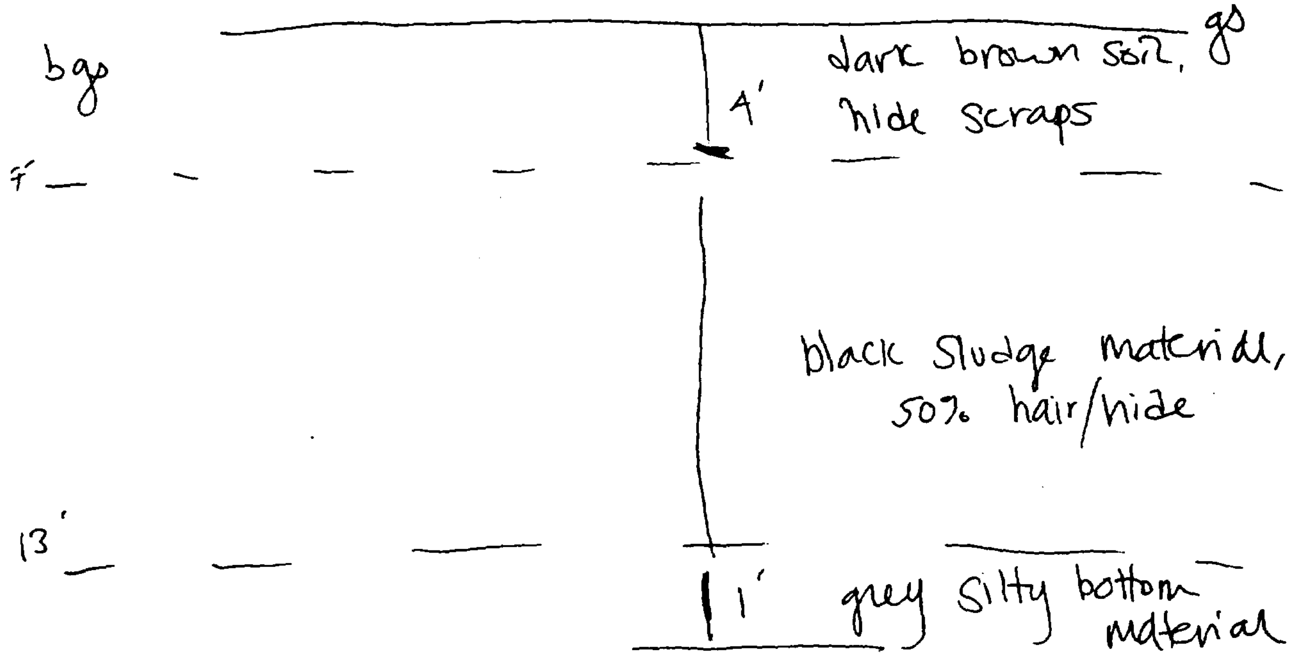
PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-11

~~II II~~ SAV

8 long, 3 wide, ~13 deep



M.C.

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-2-12
Project Number: N4024/N4111-0322
Date: 8/21/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Brown sand, medium, moist	SP	
3	6	Dark brown sand, root material	SP	
6	9	Yellow moist, silty material	MS	Water table 6.5' bgs

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:
TEST PIT: TP-2-12

PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-12

~~#-12~~ SAV

8' Long, 3' wide, 9' deep

bgs — gs

3ft. light brown medium sand

3

3ft. dark brown medium sand, roots

6

3ft. yellow silty sand, moist

9'

hole closed at 9' after finding no sludge or hair/hide material

~~~ watertable

N.C.
8/21
~~~

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-2-13
Project Number:	N4024/N4111-0322	Date:	8/21/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Tan medium/fine sand	SP	
3	5	Brown sand, 50% hair/hide		Not sludge
5	9	Yellow fine sand	SP	
0	3	Tan medium/fine sand	SP	
3	5	50% hair/hide		
5	9	Sludge		

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-2-13

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-2-14
Project Number:	N4024/N4111-0322	Date:	8/21/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Yellow fine sand	SP	Thin pockets of dark brown with roots
2	8	Darker medium sand, little gravel	SP	
8	11	Yellow silty sand, damp	MS	Water table ~ 7.5–8.0 ft.

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-2-14

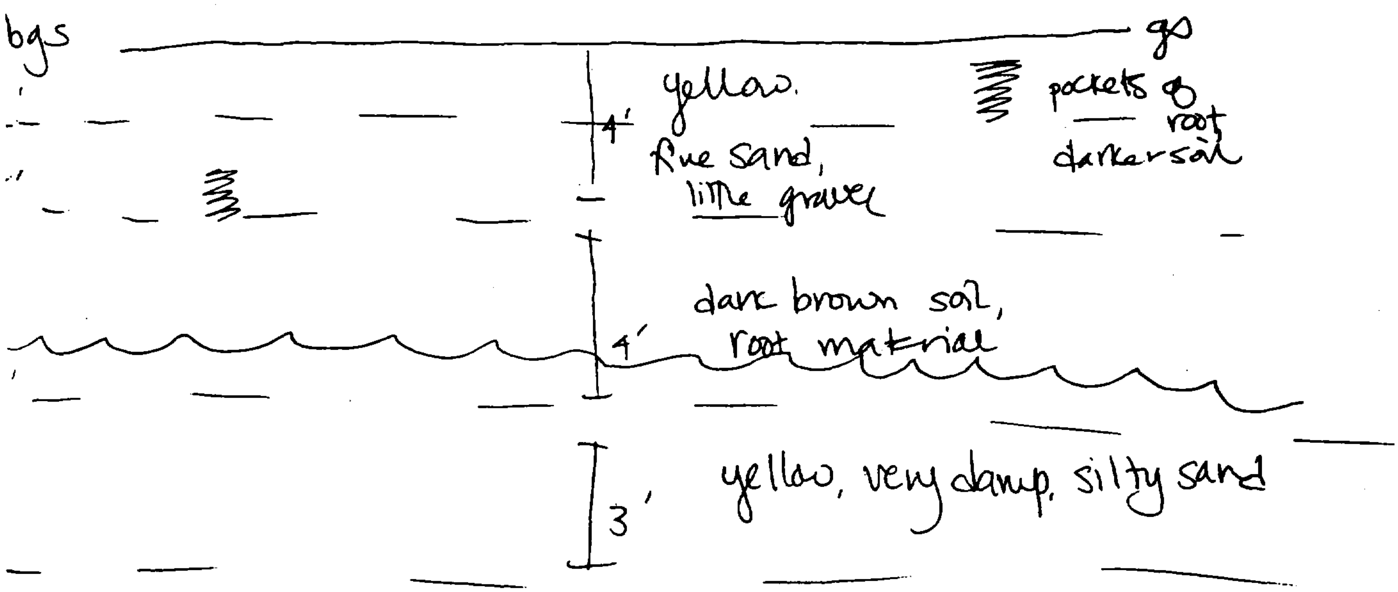
PAGE 1 OF 1

Tt NUS FORM 0011

TP-2-14

~~II = 14~~ SAV

8' Long, 3' wide, 11' deep.



water table

MC
8/21/07

Tt TETRA TECH NUS, INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-2-15
Date: 8/21/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	7	Fine yellow sand, some root material	SP	
7	9	Dark brown organic soil, roots	SP	
9	11	Yellow/tan, moist, silty sand	MS	Very moist

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Clean

PHOTO LOG: TEST PIT: TP-2-15

PAGE 1 OF 1

Tt NUS FORM 0011

~~II-15~~ SAN 8' Long, 3' wide, 11' deep

TP-2-15

All Clean

bgs ' — gs

some root material

7'

fine, yellow sand

7'

2' darker brown sand, moist, with root material (small roots)

2' damp, silty sand, yellow

MC.

8/21

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-3-01
Project Number: N4024/N4111-0322
Date: 8/20/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Roots and organics in medium sand	SP	
1	12	Yellow/beige sand, fine-medium	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Clean all the way to 12-13' bgs

PHOTO LOG:
TEST PIT: TP-3-01

Tt NUS FORM 0011

TP-3-01 ~~III~~ I SAV

3' wide, 8' Long, 12' deep

gs

1' root matter, sand

11' fine-medium yellow/beige (light) sand, clean.

12' bgs

Michele Grot

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-3-02

Project Number: N4024/N4111-0322

Date: 8/20/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Tan sand, root matter	SP	
3	13	Lighter sand, fine-medium	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Clean to bottom

PHOTO LOG:

TEST PIT: TP-3-02

PAGE 1 OF 1

Tt NUS FORM 0011

TP-3-02

~~#-2~~

3' wide, 7' long, 13' deep

gs

1' — roots, medium sand

sand, tan

2.3 —

white/beige fine-medium sand

clean

13' — extent of boom capacity

Michele Croft

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-3-03
Project Number:	N4024/N4111-0322	Date:	8/20/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	6	Fine tan sand, some roots	SP	
6	6.5	Hair/hide matter		Thin lens of contaminant
6.5	6.8	Grey silty sand, moist	MS	Clay-like layer usually precedes sludge
6.8	7	Hair/hide matter		Thin lens of hair/hide
7	12	Tan, fine/medium sand	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-3-03

PAGE 1 OF 1

Tt NUS FORM 0011

TP-3-03 ~~III 3~~

4' wide, 8' Long. 12-13' deep

bgs — gs

5.5-6'
nice tan sand, SP

6'

Thin (1-2") lens of hair/hide

4" grey silty sand, moist

2" lens hair/hide

1'

5'

tan, med. grain sand, looks clean

-13'

bottom of excavation

Michelle Gst

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-3-04
Project Number:	N4024/N4111-0322	Date:	8/20/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Tan, fine/medium sand	SP	
2	4	Dark brown sand	SP	Some roots
4	8	Hair/hide matter, thin		Thin lens
8	13	Tan medium sand	SP	Very little gravel

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Only a thin lens of hair/hide, the rest clean

PHOTO LOG: ____ TEST PIT: TP-3-04

PAGE 1 OF 1

Tt NUS FORM 0011

TP-3-04 ~~III-4~~ SAV 7' Long, 3' wide, 3' deep

gs

bgs (')

2' tan sand

1'

2' dark brown sand, moist

small (3-4") hair/hide

Clean, fine/medium sand

3'

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-3-05
Project Number: N4024/N4111-0322
Date: 8/20/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Tan fine sand	SP	
3	6	Grey silty material, moist	MS	
6	8	Dark tan fine sand with small, patchy lens sludge	SP	
8	13	Light, fine, clean sand	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

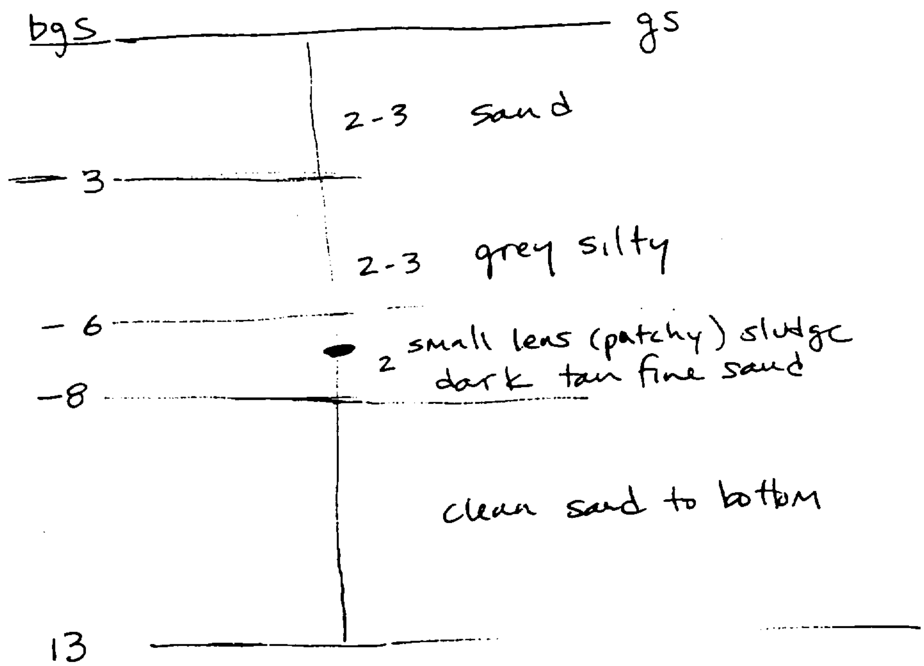
PHOTO LOG:

TEST PIT: TP-3-05

PAGE 1 OF 1

Tt NUS FORM 0011

TP-3-05


bgs
gs
2-3 sand
3
2-3 grey silty
6
small lens (patchy) sludge
2 dark tan fine sand
8
clean sand to bottom
13

Tt TETRA TECH NUS, INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-3-06
Project Number: N4024/N4111-0322
Date: 8/20/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Tan fine/medium sand, roots	SP	
1	2	Dark brown organic sand	SP	
2	6	Light yellow, moist sand	SP	
6	12	Grey silty sand, moist	MS	Some gravel (15%)
	12' bottom			

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-3-06

Tt NUS FORM 0011

TP-3-06

~~III-4~~ SAV 10' Long, 3' wide ~~deep~~ MC, 12' deep

gs

pgs'

1' roots, dk. sand

.5' dark brown sand

3-4', yellow/tan medium sand

grey, silty, moist material.
Some rock

12'

M.C.

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-3-07
Project Number:	N4024/N4111-0322	Date:	8/24/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Fine tan/white sand, some roots, traces hide	SP	
3	4	Dark, packed sand, trace hide scraps semi-cohesive	SP	
4	5	1' lens of dark soil, trailing into berm	SP	
5	11	Brown sand, moist, trace silt	SP	
11	13	Light tan/yellow, semi-cohesive, silty sand	SM	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ____________________

PHOTO LOG: ____________________ TEST PIT: TP-3-07

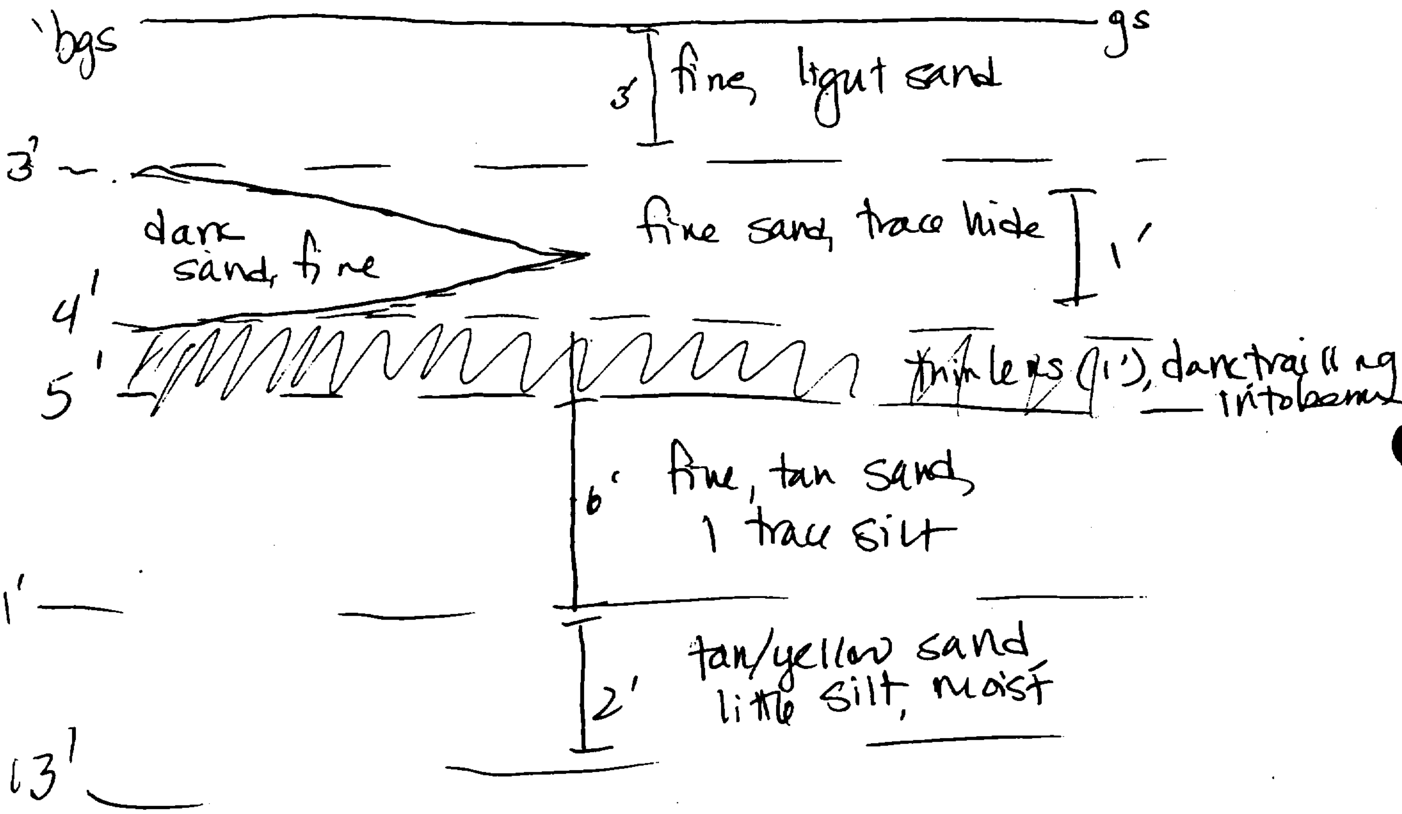
PAGE 1 OF 1

Tt NUS FORM 0011

TP-3-07

~~III-7~~ SAN

3' wide, 8-10' long, 13' deep



MC.
8/24

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-3-08

Project Number: N4024/N4111-0322

Date: 8/24/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	5	Fine, light brown sand, roots	SP	
5	12	Very fine sand, light tan, trace silt	SP	moist

Test Pit Cross Section and/or Plan View

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-3-08

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-3-09
Project Number:	N4024/N4111-0322	Date:	9/5/01
Location:	Nashua, NH	Field Geologist:	T. Dorgan

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	~1	Organic rich (leaf litter, roots) fine-course sand. Trace fine-coarse gravel	SW	Dry & loose
1	~5	Sand mostly fine-med. Poorly graded sand. Trace silt, trace fine-course rounded gravel.	SP	Dry & loose x-bedding.
5	10	Similar to above, inc. in coarse granule and inc. cobbles to 6" diam.	SW	Dry & loose FID = 0.0
		Note: Mixed waste/fill (hair, plastic) w/dark staining noted in sands up to 4' east of west side of excavation (low end.)		EOP @ ~10.5' – 11' bgs

Test Pit Cross Section and/or Plan View

No Analytical samples collected

REMARKS: * depths based on measurements from west side of excavation

PHOTO LOG: None taken

TEST PIT: TP-3-09

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-3-10
Date: 9/5/01
Field Geologist: T. Dorgan

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Sand. Mostly fine-coarse well graded sand, trace silt.	SW	Dry
1	4	Abundant leaf litter and roots in upper 6" sand. Mostly fine-medium sand Trace silt. Trace fine-coarse gravel including re-worked or old soil horizon w/roots @ ~2' and 3' bgs	SP	
4	6	Sand, similar to above, but includes irregular shaped fill deposits. Abundant hair and sections of hide. Med-dark brown stained.	SP/fill	
6	9	Sand, mostly fine-medium slight bedding layers noted. Trace silt.	SP	
9		End of pit		

Test Pit Cross Section and/or Plan View

No samples taken.

REMARKS:

PHOTO LOG: None taken

TEST PIT: TP-3-10

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-4-01
Project Number: N4024/N4111-0322
Date: 8/21/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	6	Yellow, fine sand, roots	SP	Roots in side of hole

Test Pit Cross Section and/or Plan View

REMARKS: Refusal at approx. 6 ft.

PHOTO LOG: None taken

TEST PIT: TP-4-01

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-4-02
Project Number:	N4024/N4111-0322	Date:	8/21/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Brown soil, medium grain, roots	SP	
1	3	Hide scraps, hair		
3	7	Sludge, black, damp		50% hair/hide, in tan sand, gravel
7		Clean, white sand, moist, fine	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-4-02

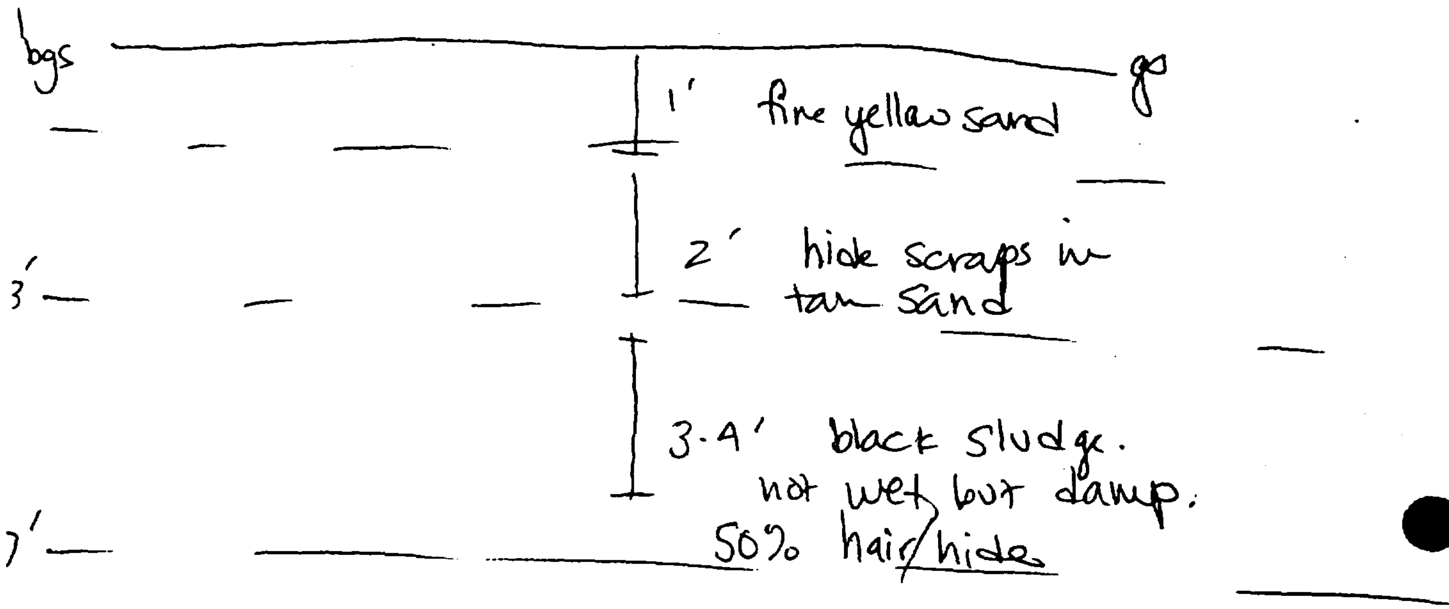
PAGE 1 OF 1

Tt NUS FORM 0011

TP-4-02

IV Z SAV

7' long, 3' wide, 7' deep.



- contaminated on one wall of hole, not on the other, marking a very clear delineation of contamination extent.

MC.

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-4-03
Project Number:	N4024/N4111-0322	Date:	8/21/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3.5	Tan sand, fine, some gravel	GS	
3.5	4	Tan sand w/hide scraps		30-40% hide scraps
4	8	Black sludge hair/hide about 50-60%, damp		~ 30% gravel (medium) mixed w/sludge stones
8	9	Rocky white sand layer	GS	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG: TEST PIT: TP-4-03

PAGE 1 OF 1

Tt NUS FORM 0011

TP-4-03

~~IV-3~~ SAV

8' long, 3' wide, 9' deep

bgs — 0'

4' — tan sand mixed w/ about 20% small/medium gravel

4' — 6" white rocky sand

4' — black sludge, 30-40% gravel (medium stones), damp, hair/hide, in sand.

8' — white rocky layer

9' bottom

MC
8/21

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-4-04
Project Number:	N4024/N4111-0322	Date:	8/21/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Yellow/tan, fine-medium sand, little roots	SP	
4	10	Black sludge material, trace gravel, hair/hide 50%		Damp and cohesive
10	11	Lighter sand, fine/medium	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Almost clean on wall nearest berm

PHOTO LOG: TEST PIT: TP-4-04

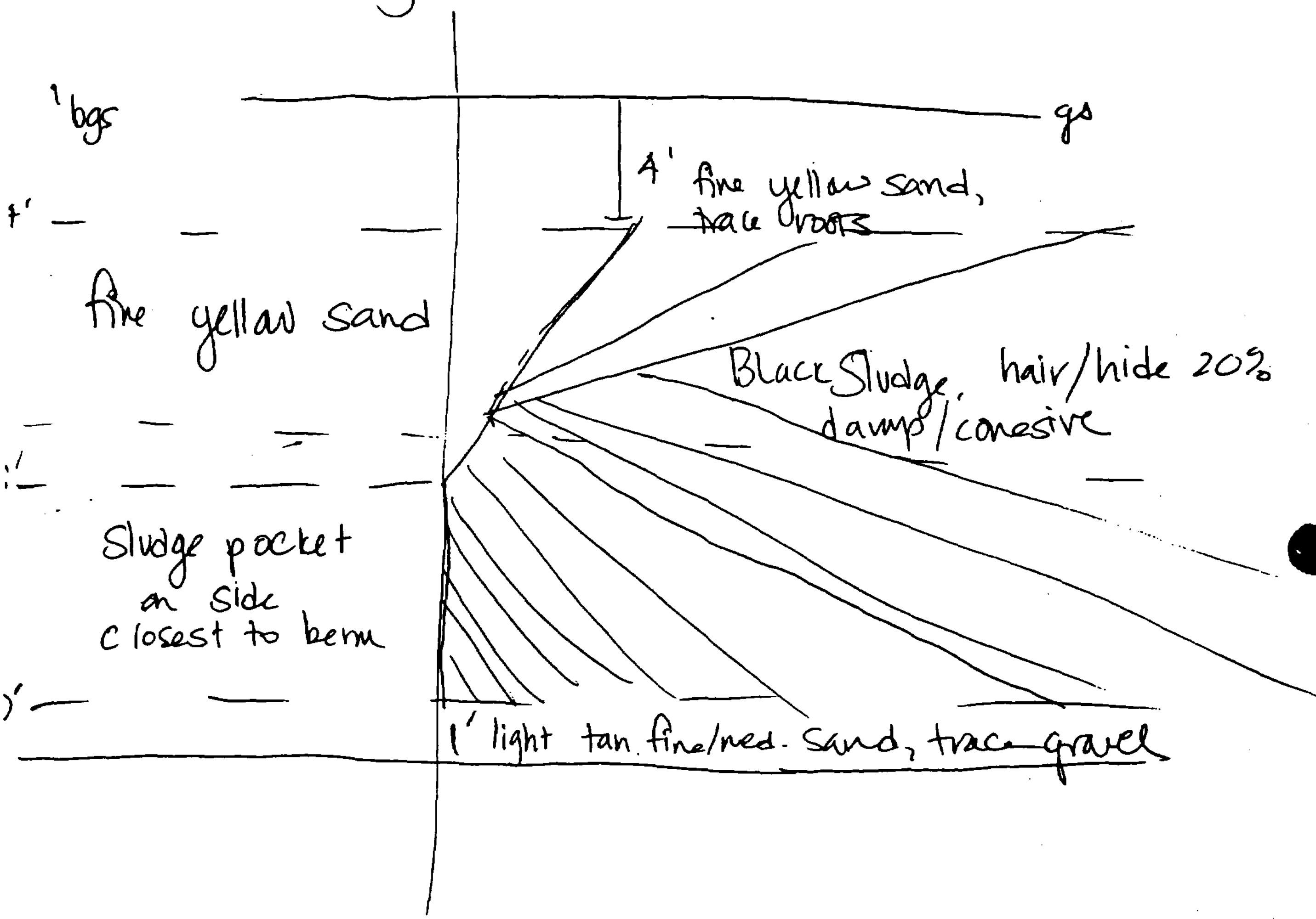
PAGE 1 OF 1

Tt NUS FORM 0011

TP-4-04

~~#~~ 4

8' Long, 3' wide, 11' deep



TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-4-05
Project Number: N4024/N4111-0322
Date: 8/21/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Tan fine/medium sand, some roots	SP	
1	3	Dark brown fine sand	SP	
3	5	Tan/grey sand, little gravel, fine to coarse	SW	
5	7	Dar sand, fine grain	SP	
7	12	Very light fine grain sand, bottom material	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: All clean

PHOTO LOG:

TEST PIT: TP-4-05

TP-4-05

~~IV~~ 5

SAV

8' Long, 3' wide, 12-13' deep

gs

2'

dark sand, fine/med, roots

2'

tan, fine/medium sand

2'

tan/grey sand, gravel

4'

dark soil, fine/med.

2" light bottom material, white/tan fine sand

All Clean

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-4-06
Project Number: N4024/N4111-0322
Date: 8/21/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Brown sand, root matter	SP	
1	3	Dark tan, hide scraps/hair		
3	10	Black sludge, 50% hair/hide, damp, cohesive		
10	11	Fine to coarse white sand, moist, trace gravel	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Very clean line between clean and dirty (4-06 to 4-05)

PHOTO LOG:

TEST PIT: TP-4-06

PAGE 1 OF 1

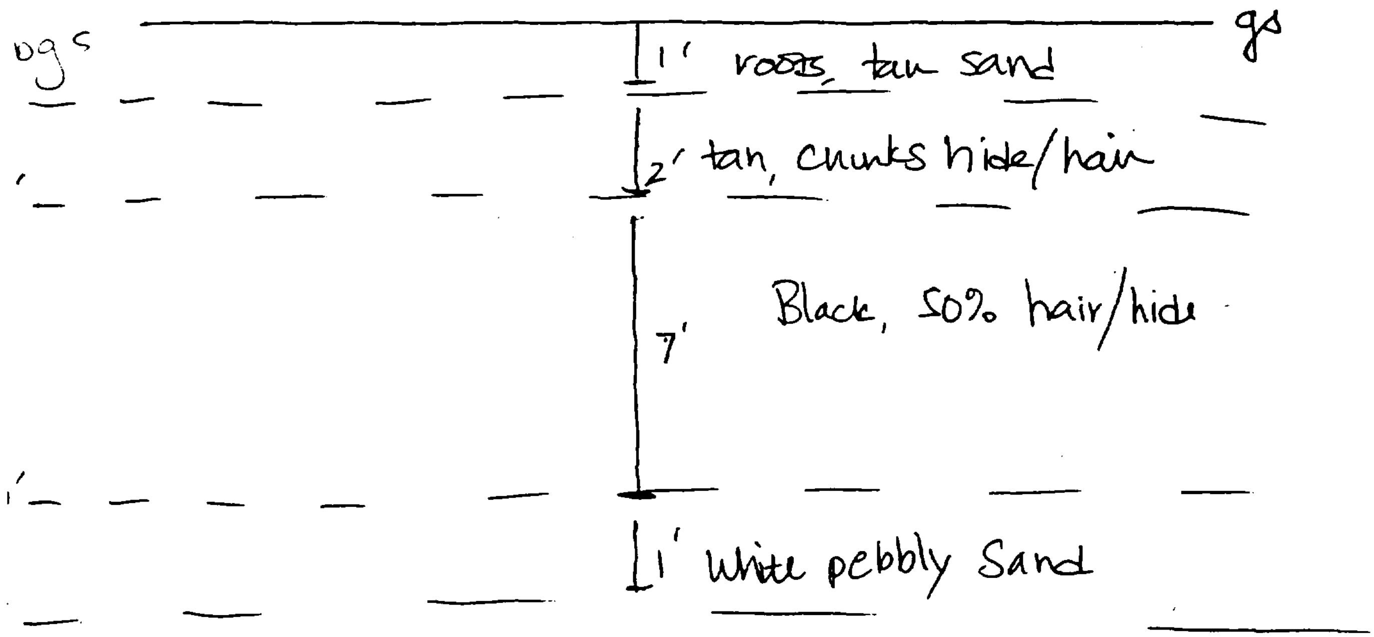
Tt NUS FORM 0011

TP-4-06

~~IV~~ -6 SAM

8' Long, 3' Wide, 11' deep

| crosssection of dirty wall | (Northern wall)



TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-4-07

Project Number: N4024/N4111-0322

Date: 8/22/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3.5	Light tan, fine grain sand	SP	
3.5		Bedrock	GP	refusal

Test Pit Cross Section and/or Plan View

REMARKS: Refusal at 3.5' bgs

PHOTO LOG:

TEST PIT: TP-4-07

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-4-08

Project Number: N4024/N4111-0322

Date: 8/22/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Very fine, tan (light) sand	SP	
4		Bedrock	GP	Refusal

Test Pit Cross Section and/or Plan View

REMARKS: Clean to refusal at 4' bgs

PHOTO LOG:

TEST PIT: TP-4-08

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-4-09
Project Number:	N4024/N4111-0322	Date:	8/22/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Roots and fine sand	SW	
1	5	Light sand, fine; trace gravel (small, rounded)	SP	
5		Bedrock	GP	

Test Pit Cross Section and/or Plan View

REMARKS: Bedrock refusal, clean fill

PHOTO LOG: TEST PIT: TP-4-09

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-5-01
Project Number: N4024/N4111-0322
Date: 8/16/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	6	Medium sand, clean	SW	No evidence of sludge
6		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: South boundary of Area 5

PID= 0.0; H_2S= 0.6

PHOTO LOG: No photo

TEST PIT: TP-5-01

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-5-02
Date: 8/16/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	6	Fine-medium sand	SP	Roots, scraps of leather at 3.5'
6		End of test pit		
		* Excavate TP-5-03 & TP-5-04, then return to TP-5-02*		
6	12	Medium sand	SP	Trace gravel, traces of leather
12		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: No evidence of sludge
Return to TP-5-02 & excavate to 12' bgs
PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo
TEST PIT: TP-5-02

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-5-03

Project Number: N4024/N4111-0322

Date: 8/16/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	8	Fine-grained sand	SM	Trace gravel, moist, roots observed throughout
8		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: No evidence of sludge

PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo

TEST PIT: TP-5-03

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-5-04
Project Number: N4024/N4111-0322
Date: 8/16/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	12	Fine sand, little gravel, with roots	SM	
12		End of test pit * Rock encountered		

Test Pit Cross Section and/or Plan View

REMARKS: Appears to be in depression of an old test pit

No evidence of sludge

No instrument reading observed

PHOTO LOG: No photo

TEST PIT: TP-5-04

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH

Test Pit No.: TP-5-05
Date: 8/16/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	12	Medium sand	SP	
12		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: Excavated along western berm
No evidence of sludge
PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo

TEST PIT: TP-5-05

PAGE 1 OF 1

Tt NUS FORM 0011

Tt TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-5-06
Project Number: N4024/N4111-0322
Date: 8/16/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Fill material	Fill	
4	10	Medium sand	SP	Appears native
10		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: Old tree limbs & rusty can pulled from test pit
No evidence of sludge
PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo
TEST PIT: TP-5-06

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-5-07

Project Number: N4024/N4111-0322

Date: 8/16/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	10	Fine-medium sand, light brown	SP	Rust colored sand @ 10'
10		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: No evidence of sludge

PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo

TEST PIT: TP-5-07

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-5-08
Project Number:	N4024/N4111-0322	Date:	8/16/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	11	Medium sand, white (20%), light brown (80%)	SP	Natural river deposits
11		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: No evidence of sludge

PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo

TEST PIT: TP-5-08

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-5-09
Project Number: N4024/N4111-0322
Date: 8/16/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	11	Medium sand	SP	Natural
11		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: No evidence of sludge

PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo

TEST PIT: TP-5-09

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS, INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-5-10
Date: 8/16/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	11	Medium sand	SP	Natural
11		End of test pit		

Test Pit Cross Section and/or Plan View

REMARKS: No evidence of sludge

PID= 0.0; H_2S= 0.0

PHOTO LOG: No photo

TEST PIT: TP-5-10

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-6-01
Project Number: N4024/N4111-0322
Date: 8/22/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Dark brown soil, moist, little roots	SP	
2	5	Grey, moist clayey material	SC	
5	7	Grey clay with rusty deposits, semi-cohesive	SC	Traces of hair/hide, in small globs
7	10	Gray silty sand, semi-cohesive	SP	
10	13	Natural fill, with pebbles, (20%)	SG	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: Clean except apple-sized globs of 50-60% hair and clay

PHOTO LOG:

TEST PIT: TP-6-01

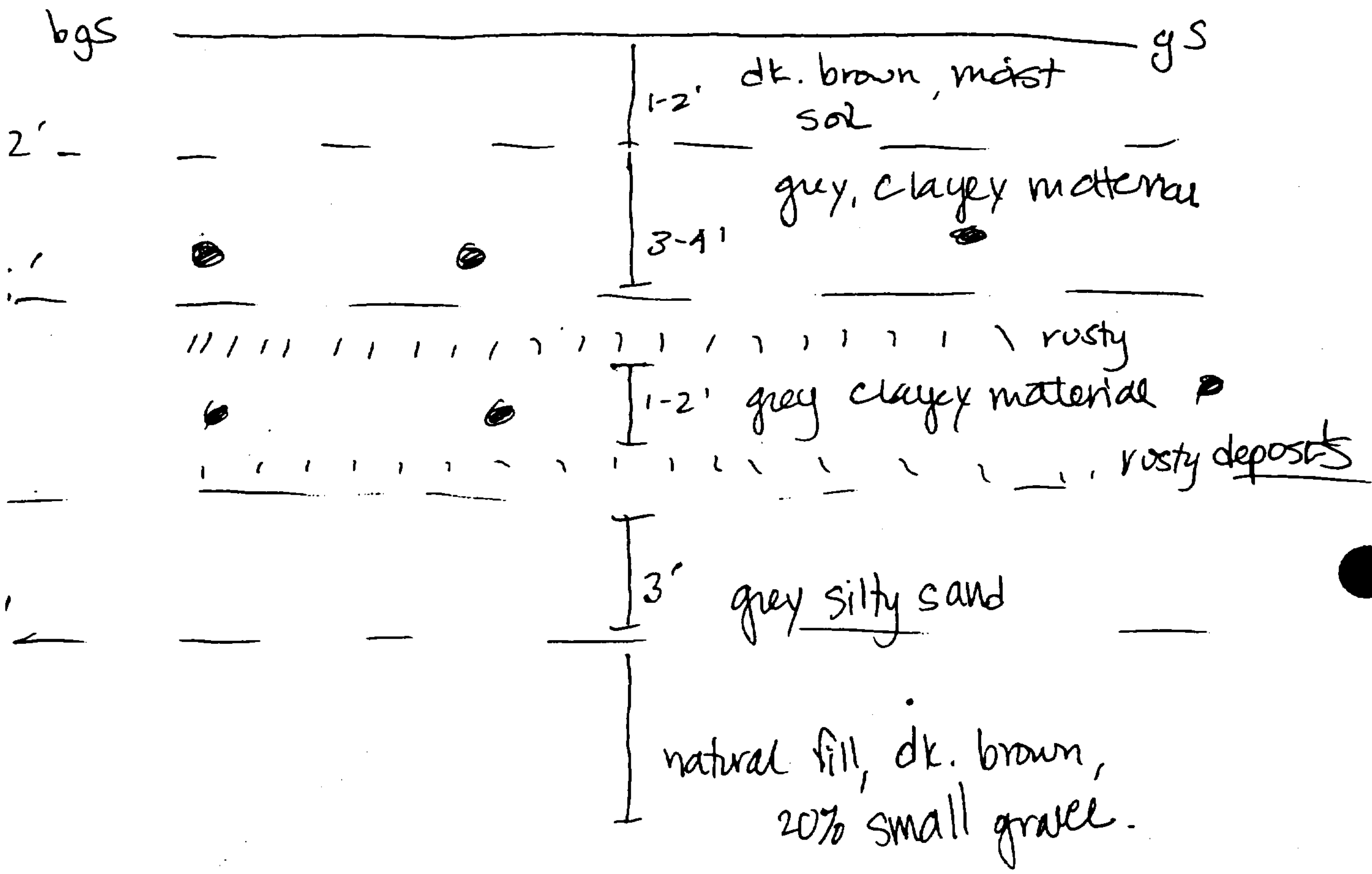
PAGE 1 OF 1

Tt NUS FORM 0011

TP-6-01

~~VI~~ - T SAV

10' long, 3' wide, 13' deep



● - pockets of hairy material, 60% hair

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-6-02
Date: 8/22/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Dark soil, moist, root matter and fill	SW	
3	11	White sand, moist, trace silt, some gravel (rounded river rock)	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG: TEST PIT: TP-6-02

PAGE 1 OF 1

Tt NUS FORM 0011

TP-6-02

~~VI~~ 2 SW

10' Long, 3' wide, 11-12' deep

'bgs — gs

roots, dark fill

3

white and tan sands, fine, trace silt, trace gravel (small)

11'

Clean

Mc

8/22

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-6-03
Project Number: N4024/N4111-0322
Date: 8/22/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Dark brown soil, roots	SP	
2	6	Black sludge material, 70 – 80% hair/hide		Some indigo coloring
6	7	Rusty colored sand/gravel, rounded (30%)	SW	

Test Pit Cross Section and/or Plan View

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-6-03

PAGE 1 OF 1

Tt NUS FORM 0011

TP-6-03
~~VI-3~~
SAM

3' WIDE, 7' LONG

on the berm,
waste is under berm

'bgs — GS

roots and soil

2' - - - - - - - - -

black and indigo/gray
sludge, 60-70% hair/hide

6' - - - - - - - - -

rusty, rock & sand

7' - - - - - - - - -

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-6-04
Project Number: N4024/N4111-0322
Date: 8/22/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	1	Soil and roots	SP	
1	5	Roots and 70% hide/hair, 20% sludge		
5	6	Rocky natural bottom material	GP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-6-04

Tt NUS FORM 0011

TP-6-04

~~IV~~-4

8' Long, 4' wide, 6-8' deep

bgs' 1' — roots — gs

70% hair/hide scraps,

4'

~~wet~~ damp sludge

'

1' gravely bottom material

'

(15' from top of berm)

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-6-05
Date: 8/22/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Brown sand, little gravel	SP	
3	7	Dark brown hide/hair (70%) material in berm		In berm wall
7	8	Brown sand bottom material, some gravel	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-6-05

PAGE 1 OF 1

Tt NUS FORM 0011

TP-6-05

~~VI-5~~ SAV

~ 8' long, 3' wide, ~ 8' deep

berm top

gs

bgs

brown sand little gravel

-3'

brown hide/hair (70%) on berm wall

6-7'

rocky bottom material

Ml

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Project Number: N4024/N4111-0322

Location: Nashua, NH

Test Pit No.: TP-6-06

Date: 8/22/01

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Brown soil, medium grain, roots	SP	
3	4	Wet black sludge seeping from pipe		Seeping from within a broken pipe
4	5	Brown medium/fine sand	SP	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-6-06

PAGE 1 OF 1

Tt NUS FORM 0011

TP-6-06

bgs — gs

3' brown sand, trace roots

3'

1' sludge, seeping from broken pipe

4'

brown sand

*storm drain broke

5'

MC
8/22/11

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-6-07
Project Number: N4024/N4111-0322
Date: 8/22/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Brown sand, fine/medium, little roots	SP	
2	3	Small pocket of dark brown hair/hide	SP	Indicates the edge of contamination in the berm

Test Pit Cross Section and/or Plan View

REMARKS: Good indicator of extent of contamination

PHOTO LOG:

TEST PIT: TP-6-07

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-6-08
Date: 9/5/01
Field Geologist: T. Dorgan

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	0.4	Soil horizon. Dark brown silty, fine-medium sand	SM	Dry & loose
0.4	2	Sand. Mostly fine-medium poorly graded sand. Trace silt, trace gravel	SP	Dry & loose
2	2.3	Fill/waste layer including hair. Dark brown staining	Fill	Dry & loose
2.3	4	Sand. Poorly graded fine-medium sand. Trace silt, trace fine-coarse gravel	SP	Dry & loose
4	4.3	Fill/waste layer, similar to 2'-2.3'	Fill	Dry & loose
		EOP @ 6' (west) 8' (east)		

Test Pit Cross Section and/or Plan View

REMARKS: No samples taken. Log describes west end.

PHOTO LOG: 2 photos of east face

TEST PIT: TP-6-08

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-6-09
Date: 9/5/01
Field Geologist: T. Dorgan

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	3	Fill including slag, glass, metal, trash, plastic. Trace hair fibers noted	Fill	Including used oil filter
3	6	Mostly fine-medium poorly graded sand. Trace silt including trace gravel at 5'-6'.	SP	Appears natural @ ~3-6'.
6		EOP @ 6' (west side)		

Test Pit Cross Section and/or Plan View

REMARKS: No samples taken.

PHOTO LOG: No photos taken

TEST PIT: TP-6-09

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-6-10
Date: 9/5/01
Field Geologist: T. Dorgan

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Mostly fine-medium poorly graded sand. Trace silt.	SP	
2	6	Mostly fine-coarse well graded sand. Trace fine-coarse rounded gravel.	SW	
6		EOP @ 6' bgs		No sign of waste or sludge

Test Pit Cross Section and/or Plan View

REMARKS: No samples taken.

~4" diam. Asbestos ? pipe located along north edge of T.P. @ ~2.5' bgs.

PHOTO LOG: Photo taken of pipe on north side

TEST PIT: TP-6-10

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-7-01
Project Number: N4024/N4111-0322
Date: 8/22/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	2	Tan fine/medium sand, little roots.	SP	
2	4	Tan fine sand, traces of refuse, hair/hide	SP	
4	11	Black material, damp		Only on northern wall
11	12	Purplish material. Wood soaked in oily substance		Wood scraps
12	13	Burnt refuse. Wood, plastics.		Some burn odor

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-01

Tt NUS FORM 0011

TP-7-01

~~IIII~~ SAV

8' long, 3' wide, 5-6' deep

N wall | S wall

gs

bgs

N wall	S wall
1-2' tan, roots	1-2' tan, roots
tan sand, 15% refuse, 20% hair/hide — 2'	1-2' tan sand, traces refuse
black sludge, 40% hide/hair — 1'	1' dk. brown sand, trace gravel

black, burned soil, ash-like — 5-6'

burned wood, refuse, ash, plastic — 2-3'

M.C.
8/22/01

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-7-02
Project Number:	N4024/N4111-0322	Date:	8/22/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	7	Dark brown fine-medium sand. 5% refuse.	SP	Bottles, plastic, garbage
7	13	Dark sand mixed w/ possibly burned refuse, wood scraps, metals.	SW	Appears to be burned material

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: No sludge, but seems to be contaminated refuse

PHOTO LOG: ______ TEST PIT: TP-7-02

PAGE 1 OF 1

Tt NUS FORM 0011

TP-7-02

~~VII-2~~ SAV

10' long, 3' wide, 13' deep.

' bgs — gs

7' — dark brown sand fine-med; trace refuse.

6' — sand containing 30% - 40% refuse, burned (?) wood scraps, ash-like substance, to bottom. Not sludge.

3'

MC
8/22/01

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH

Test Pit No.: TP-7-03
Date: 8/22/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	13	Fine-medium sand, tan, trace scraps hide/hair	SP	

Test Pit Cross Section and/or Plan View

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-03

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Project Number: N4024/N4111-0322
Location: Nashua, NH
Test Pit No.: TP-7-04
Date: 8/23/01
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	5	Fine white/tan sand, trace roots, trace hide scraps	SP	
5	7	Darker sand, trace silt, 20% hide scraps	SP	
7	11	Blackened burned material, 60% debris		Wood, bottles, plastic, all black
11	13	Tan, fine sand, 20% gravel, hair/hide, debris	SW	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-04

Tt NUS FORM 0011

TP-7-04

~~VII - 4~~ SAV

10- 12' Long, 3' wide, 13' deep

' bgs — gs

5' — light sand. trace hide scraps

5'

2' — darker sand. trace silt, more hide

7'

9' — ~~blackened~~ debris, gravel, wood, plastic, bottles.

11

2' — tan sand, gravel, some hide

13'

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Project Number: N4024/N4111-0322

Location: Nashua, NH

Test Pit No.: TP-7-05

Date: 8/23/01

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	5	Fine tan sand mixed w/ hide scraps, trace gravel	SP	
5	6	Thin black layer w/ hide scraps, trace gravel	SP	
6	11	Tan sand, fine/medium, 40-50% hide scraps	SW	Medium graded w/ leather
11	13	Fine-medium sand, 20% gravel, small rounded	SW	Medium graded w/ gravel

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-05

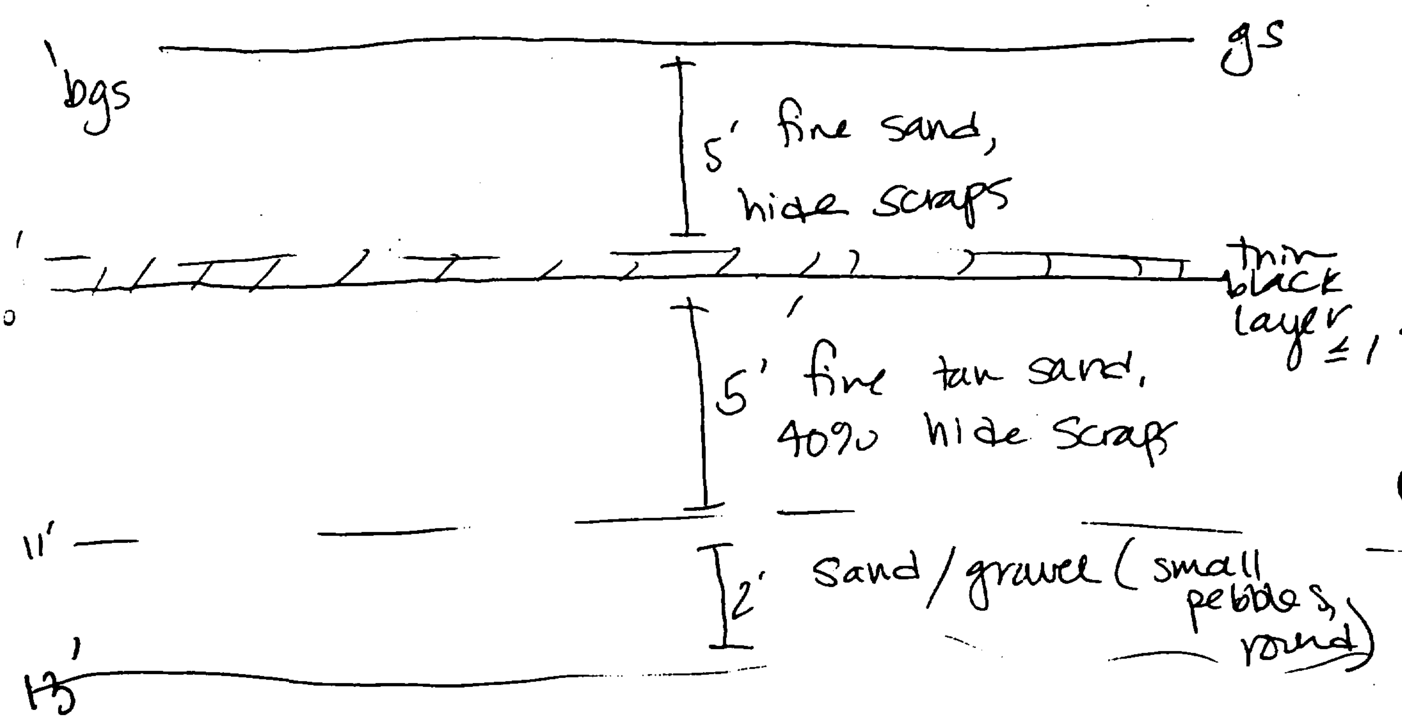
PAGE 1 OF 1

Tt NUS FORM 0011

TP-7-05

~~VII-5~~, SAV

9-10' Long, 3' wide, 13' deep



MC 8/23/10

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-7-06
Project Number: N4024/N4111-0322
Date: 8/23/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	11	Tan, fine-grained sand, poorly graded, no hide/hair	SP	
11	13	Fine-grained sand, small pebbles (15%), very light tan/white	SP	

Test Pit Cross Section and/or Plan View

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-06

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery
Test Pit No.: TP-7-07
Project Number: N4024/N4111-0322
Date: 8/23/01
Location: Nashua, NH
Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Tan sand, trace gravel, trace hide scraps	SP w/hide	
4	8	Blackened debris, fine sand, (ash-like), gravel	SW	
8	10	Fine white sand, 30-50% gravel natural bottom material	SW	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-07

PAGE 1 OF 1

Tt NUS FORM 0011

TP-7-07

~~VII~~ - 7

SAV 8' Long. 3' wide, 10' deep

' bgs ——————————————— gs

fine Sand,
trace gravel,
trace hide — 4'

4' ——

black material,
contaminated debris,
ash-like substrate — 4'

8' ——

very fine Sand
w/ gravel. Small,
Some rounded, Some odd
shaped, pebbles — 2'

11' ——

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-7-08
Project Number:	N4024/N4111-0322	Date:	8/23/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Brown sand, trace roots, fine-medium	SP	
4	10	Darker brown sand, fine-medium	SP	
10	12-13	Very fine sand, white w/odd shaped pebbles	SW	

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS: ______

PHOTO LOG: ______ TEST PIT: TP-7-08

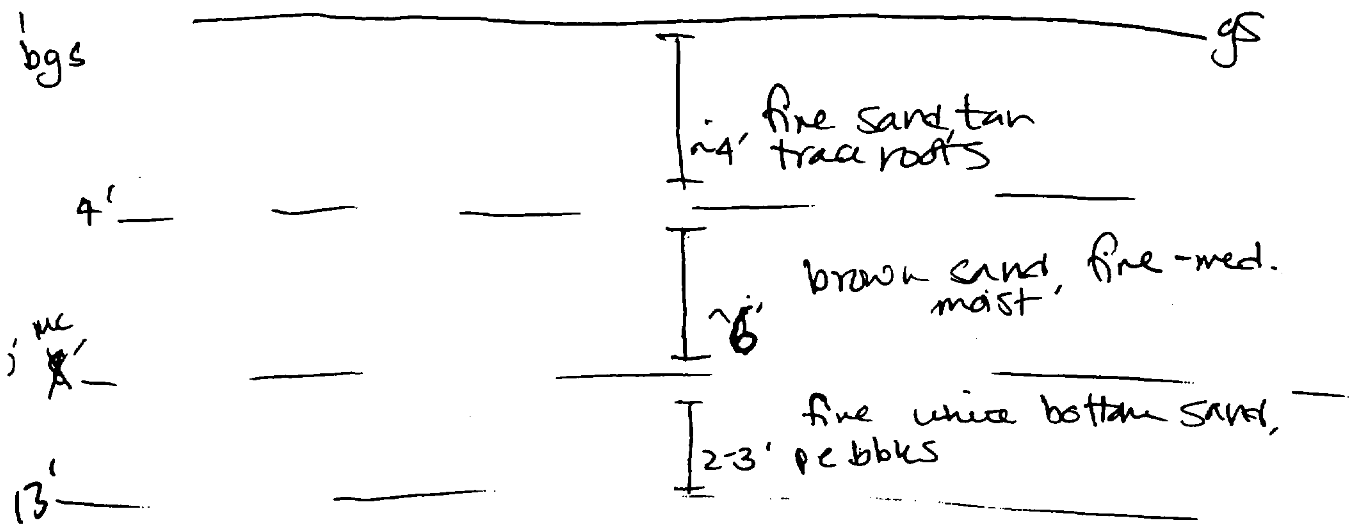
PAGE 1 OF 1

Tt NUS FORM 0011

TP-7-08

~~VII~~ 8 SAV

8' long, 13' deep, 3' wide



Me.

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name:	Mohawk Tannery	Test Pit No.:	TP-7-10
Project Number:	N4024/N4111-0322	Date:	8/23/01
Location:	Nashua, NH	Field Geologist:	M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	5	Fine/medium sand, roots	SP	
5	11	Damp sludge mixed with purple substance		Strong odor see log #001 for readings

Test Pit Cross Section and/or Plan View

REMARKS: Hole closed after encountering unknown contamination.

PHOTO LOG: ____ TEST PIT: TP-7-10

PAGE 1 OF 1

Tt NUS FORM 0011

TETRA TECH NUS. INC.

TEST PIT LOG

Site Name: Mohawk Tannery

Test Pit No.: TP-7-11

Project Number: N4024/N4111-0322

Date: 8/23/01

Location: Nashua, NH

Field Geologist: M. Croot

DEPTH (feet)	LITHOLOGY CHANGE (Depth, feet)	MATERIAL DESCRIPTION (Soil Density/Consistency, Color)	USCS	REMARKS
0	4	Medium sand, very fine, trace hides	SP	
4	11	Brown sand, fine hide scraps, plastic, refuse	SP	30% hide scraps
11	13	Black burned material, wood, ash, trace sludge		Sludge globs, very cohesive, hairy

Test Pit Cross Section and/or Plan View

See Reverse

REMARKS:

PHOTO LOG:

TEST PIT: TP-7-11

Tt NUS FORM 0011

TP-7-11

~~VII-7~~ SAV, 8' long, 3' wide, 13' deep

' bgs ——— gs

4' — very fine brown sand, trace of hide scrap

4' - - - - - -

7' — fine brown sand, ~30% hide (leathery) scraps, little plastic, refuse

11' - - - - - -

2' — black ash-like substrate small (grapefruit size) globs of sludge material, 50% hair in globs only.

13' - - - - - -

APPENDIX C

OBSERVATION (NON-SAMPLE) BORING LOG SHEETS

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A2-NS-01
PROJECT NO.:	N4024/4111-0322	START DATE:	9/4/01
LOGGED BY:	M. Croot	COMPLETION DATE:	9/4/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID/H2S]
0	NA	3.5	No Sample	00	Loose	Lgt Brn	fine-medium sand	SP	Dry	0.0/0.0
	NA									
4	NA	4.0		02	Very Dense	Brown	Semi-cohesive, fine-medium sand	SP	Possibly contaminated	
	NA									
4	NA	4.0	No Sample	04	Loose	Brown	Fine-medium sand	SP		0.0/0.0
	NA			05	Dense	Black	Sludge		Moist	
8	NA	4.0								
	NA									
8	NA	4.0								
	NA		No Sample							
12	NA	4.0		10	Dense	Black	Cohesive, clayey sludge		Moist	0.0/0.0
	NA			11	Loose	Black	Medium grain, sandy sludge			
12	NA	4.0								
	NA		No Sample	13	Very Loose	Black	Sandy sludge, coarse-grained	SP	Saturated	0.0/0.0
16	NA	4.0								
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	12-14 ft. bgs
OTHER OBSERVATIONS:	Southwest corner of Area 2, near well on river bank

Tetra Tech NUS, Inc.

BORING NO.: A2-NS-01

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A2-NS-02
START DATE: 9/4/01
COMPLETION DATE: 9/4/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA	3.0	No Sample	00	Loose	Brown	Fine sand, trace roots	SP	Damp, small black specks	0.0/0.0
	NA									
4	NA	4.0								
	NA									
4	NA	1.6	No Sample							
	NA									
8	NA	4.0		06	Loose	Brown	Medium sand, some gravel	SW	Moist	0.0/0.0
	NA									
8	NA	2.0	No Sample							
	NA									
12	NA	4.0		10	Very Loose	Brown	Gravel, well-graded	GW	Saturated	0.0/0.0
	NA			11	Dense	Tan	Very fine sand	SP	Saturated	

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: 8-10 ft. bgs
OTHER OBSERVATIONS: Southeast corner of Area 2, south of the fence

BORING NO.: A2-NS-02

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A2-NS-03
START DATE: 9/4/01
COMPLETION DATE: 9/4/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA	2.0	No Sample	00	Loose	Brown	Fine sand, trace roots	SP		0.0/0.0
	NA									
4	NA	4.0		03	Very Dense	Brown	Fine sand	SP		
	NA			3.5	Loose	Lgt Brn	Bits of log, with hairy sand	SW		
4	NA	4.0	No Sample	04	Dense	Brown	60 percent hair		Damp	0.0/0.0
	NA									
8	NA	4.0		06	Dense	Black	Sludge, semi-cohesive		Moist	
	NA									
8	NA	2.0	No Sample							
	NA									
12	NA	4.0		10	Dense	Gry/Tan	Very fine sand, clean	SP	Saturated	0.0/0.0
	NA			11	Loose	Tan	Fine-medium sand, 40-50% gravel	GW	Saturated	

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: 8-10 ft. bgs
OTHER OBSERVATIONS: 3' from well, behind fence

BORING NO.: A2-NS-03

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery		BORING NO.: A2-NS-04
PROJECT NO.:	N4024/4111-0322		START DATE: 9/4/01
LOGGED BY:	M. Croot	TRANSCRIBED BY: SAV	COMPLETION DATE: 9/4/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham		MONITORING WELL NO.: NA
GRD. SURFACE ELEVATION:		ELEVATION FROM: NA	CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID, H2S]
0	NA	2.0		00	Loose	Brn/Tan	Fine sand, poorly graded	SP	dry	0.0/0.0
	NA		No Sample							
4	NA	4.0								
	NA									
4	NA	4.0		04	Dense	Brown	Very hairy, cohesive sand		Damp	0.0/0.0
	NA		No Sample							
8	NA	4.0								
	NA			07	Dense	Black	Sludge		Moist	
8	NA	2.0								
	NA		No Sample							
12	NA	4.0		10	Loose	Lgt Brn	Fine-medium sand, some gravel	SW	Saturated	0.0/0.0
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	8-10 ft. bgs
OTHER OBSERVATIONS:	

Tetra Tech NUS, Inc.

BORING NO.: A2-NS-04 PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A3-NS-01
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID,H2S]
0	NA		No Sample	00		Brown	Fine-medium sand, trace roots	SP		0.0/0.0
	NA									
4	NA	4.0		02		Lgt Tan	Fine sand	SP		
	NA			03		Lgt Brn	Fine-medium sand, trace gravel	SP		
4	NA		No Sample	04		Tan/Grey	Fine-medium sand, trace silt	SP	Throughout interval	0.0/0.0
	NA									
8	NA	4.0								
	NA									
8	NA		No Sample							
	NA									
12	NA	4.0		10.5		Lgt Brn	Fine-medium sand, trace gravel	SP	Moist	0.0/0.0
	NA									
12	NA		No Sample							
	NA			13.8		Lgt Brn	Medium-coarse sand, trace gravel	SP	Potential staining, darker brown streaks	0.0/0.0
16	NA	4.0								
	NA			14		Lgt Brn	Medium-coarse sand, trace gravel	SP	Moist	
16	NA		No Sample							
	NA									
20	NA	4.0		19.3		Rust/Brn	Coarse sand, trace gravel, brown staining	SP	Water table ≈ 19 ft.	0.0/0.0
	NA			19.5		Brn/Gry	Coarse sand, 20-30% gravel	SP		

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: Approx. 19 ft. bgs
OTHER OBSERVATIONS:

BORING NO.: A3-NS-01

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A3-NS-02
PROJECT NO.:	N4024/4111-0322	START DATE:	8/28/01
LOGGED BY:	M. Croot	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA			00		Lgt Brn	Fine sand, some gravel	SP		0.0/0.0
	NA		No Sample							
4	NA	4.0								
	NA									
4	NA			04		Lgt Brn	Fine-medium sand, traces of dark brown staiining	SP		0.0/0.0
	NA		No Sample						Dark, moist, but not quite sludge, tannery waste	
8	NA	4.0		06		Drk Brn	Semi-cohesive with 40% green, hairy clumps			
	NA			07		Lgt Brn	Fine sand, trace silt	SP		
8	NA			08		Lgt Brn	Fine-medium sand	SP		0.0/0.0
	NA		No Sample							
12	NA	4.0								
	NA									
12	NA			12		Lgt Brn	Medium sand, trace gravel	SP		0.0/0.0
	NA		No Sample							
16	NA	4.0								
	NA									
16	NA									
	NA		No Sample							
20	NA	4.0								
	NA			19		Brown	Cohesive sandy silt, little gravel	SM	Water table ≈ 19 ft.	0.0/0.0

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	Approx. 19 ft. bgs
OTHER OBSERVATIONS:	

Tetra Tech NUS, Inc.

BORING NO.: A3-NS-02

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A3-NS-03
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID,H2S]
0	NA			00		Brown	Fine-medium sand, trace gravel	SP		0.0/0.0
	NA		No Sample							
4	NA	4.0								
	NA									
4	NA									
	NA		No Sample							
8	NA	4.0		06		Black	Semi-cohesive sludge-like layer, trace hair		Similar to A3-NS02	0.0/0.0
	NA			7.5		Lgt Brn	Fine-medium sand, trace gravel	SP		
8	NA			08		Lgt Brn	Fine sand	SP		0.0/0.0
	NA		No Sample							
12	NA	4.0								
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

BORING NO.: A3-NS-03

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A3-NS-04
PROJECT NO.:	N4024/4111-0322	START DATE:	8/28/01
LOGGED BY:	M. Croot	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA			00		Tan	Medium sand, trace gravel	SP		0.0/0.0
	NA		No Sample							
4	NA	4.0								
	NA									
4	NA									
	NA		No Sample							
8	NA	4.0		07		Brn/Gry	Medium sand, trace silt	SP	Very moist	0.0/0.0
	NA			7.7		Drk Brn	Medium sand, trace silt, potentially contaminated	SP	Very moist, no hair/odor	
8	NA									
	NA		No Sample	09		Black	Sludge-like material, no hair; mixed with coarse sand		Saturated, strong odor, no positive readings	0.0/0.0
12	NA	4.0								
	NA									
12	NA									
	NA		No Sample							
16	NA	4.0		14.9		Black	Sludge in coarse sand, with trace gravel		Water table	0.0/0.0
	NA			15.5		Tan/Grey	Coarse sand, trace gravel	SP		

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	Approx. 15 ft. bgs
OTHER OBSERVATIONS:	

BORING NO.: A3-NS-04

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A3-NS-05
PROJECT NO.:	N4024/4111-0322	START DATE:	8/28/01
LOGGED BY:	M. Croot	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID,H2S]
0	NA		No Sample	00		Lgt Brn	Fine sand	SP		0.0/0.0
	NA									
4	NA	4.0								
	NA									
4	NA		No Sample	04		Lgt Brn	Very fine sand, trace silt	SP		0.0/0.0
	NA									
8	NA	4.0								
	NA									
8	NA		No Sample	08		Lgt Brn	Coarse sand	SP		0.0/0.0
	NA									
12	NA	4.0								
	NA									
12	NA		No Sample							
	NA									
16	NA	4.0		14.5		Tan/Grey	Coarse sand	SP	Moist	0.0/0.0
	NA			15.5		Rust	Coarse sand	SP	Moist	

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe		*Tetra Tech NUS, Inc.*
METHOD OF ADVANCING BORING:	DPT		
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve		
METHOD OF ROCK CORING:	NA		
GROUNDWATER LEVELS:	13-15 ft. bgs		
OTHER OBSERVATIONS:	Advanced within 5' northeast of TP-3-02	BORING NO.: A3-NS-05	PAGE: 1 OF 1

BORING LOG FOR:	Mohawk Tannery			BORING NO.:	A3-NS-06
PROJECT NO.:	N4024/4111-0322			START DATE:	8/28/01
LOGGED BY:	M. Croot	TRANSCRIBED BY:	SAV	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham			MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		ELEVATION FROM:	NA	CHECKED BY:	

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID, H2S]
0	NA			00		Lgt Brn	Fine sand	SP	Damp, not wet	0.0/0.0
	NA		No Sample							
4	NA	4.0								
	NA									
4	NA									
	NA		No Sample							
8	NA	4.0		06		Lgt Brn	Fine sand, trace gravel (round, medium sized)	SP	Some streaks of rusty sand observed	0.0/0.0
	NA									
8	NA									
	NA		No Sample							
12	NA	4.0								
	NA			11		Brown	Coarse sand, some gravel	GS	Water table encountered	0.0/0.0
12	NA			12		Black	Sludge to end of boring (16 ' bgs)		Moist	0.0/0.0
	NA		No Sample							
16	NA	4.0								
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	9-11 ft. bgs
OTHER OBSERVATIONS:	

BORING NO.: A3-NS-06

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A3-NS-07
PROJECT NO.:	N4024/4111-0322	START DATE:	8/28/01
LOGGED BY:	M. Croot	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA		No Sample	00		Brown	Medium sand, trace gravel	SP	Streaks of black staining	0.0/0.0
	NA									
4	NA	4.0								
	NA									
4	NA		No Sample							
	NA									
8	NA	4.0		06		Rust	Well-graded gravelly sand	SW		0.0/0.0
	NA									
8	NA		No Sample							
	NA									
12	NA	4.0							No positive instrument readings	0.0/0.0
	NA			11		Black	Gravelly sand with sludge color and smell			
12	NA		No Sample	12		Black	Contaminated, sludge-like material to end of boring (16')		No positive readings	0.0/0.0
	NA									
16	NA	4.0								
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	NA
OTHER OBSERVATIONS:	

BORING NO.: A3-NS-07

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:
TRANSCRIBED BY: SAV
ELEVATION FROM: NA
BORING NO.: A5-NS-01
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA		No Sample	00		Lgt Brn	Fine-grained sand	SP		0.0/0.0
	NA									
4	NA	4.0		1.5		Drk Brn	Fine sand	SP	Moist	
	NA									
4	NA		No Sample	04		Drk Brn	Fine-medium sand	SP	Moist	0.0/0.0
	NA									
8	NA	4.0		06		Drk Brn	2 thin lenses of dark medium sand (approx. 3" thick)	SP	≈ 40% hair, no hide	
	NA			07		Lgt Brn	Very fine, natural sand	SP		
8	NA		No Sample	08		Lgt Brn	Very fine sand, natural deposits	SP	Rust noted, no trace of hair	0.0/0.0
	NA									
12	NA	4.0								
	NA									
12	NA		No Sample	12		Brown	Fine, natural sand with deposits	SP	Moist, no trace of hair	0.0/0.0
	NA									
16	NA	4.0								
	NA									
16	NA		No Sample	16		Brown	Fine, natural sand, trace gravel, rust deposits throughout	SP	Moist, no trace of hair	0.0/0.0
	NA									
20	NA	4.0								
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

BORING NO.: A5-NS-01

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A5-NS-02
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID, H2S]
0	NA			00		Brown	Medium sand, trace gravel, trace root material	SP		0.0/0.1
	NA		No Sample							
4	NA	4.0		02		Lgt Brn	Fine sand with traces of rust coloring	SP		
	NA			03		Drk Brn	Medium sand, little gravel, traces of hair	SP	Hair in small globs	
4	NA			04		Lgt Brn	Very fine sand, trace pebbles	SP	Moist	0.0/0.0
	NA		No Sample							
8	NA	4.0								
	NA									
8	NA									
	NA		No Sample							
12	NA	4.0		10		Drk Brn	Thin, 2" lens of dark brown sand, trace gravel	SP	Moist, no hair	0.0/0.0
	NA			11		Orange	Rusty, fine sand	SP	Moist, no hair	
12	NA			12		Lgt Brn	Fine sand, rusty deposit, natural	SP	No trace of hair	0.0/0.0
	NA		No Sample							
16	NA	4.0		14		Lgt Brn	Fine sand, trace silt	SP	No trace of hair	
	NA									
16	NA			16		Lgt Brn	Very fine sand, trace silt	SP		0.0/0.0
	NA		No Sample							
20	NA	4.0								
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: A5-NS-02

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A6-NS-01
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA			00		Brown	Topsoil		Layer of staining at ≈ 2.5'	0.0/0.0
	NA		No Sample	0.5		Brown	Stained medium to coarse sand, little gravel	SW		
4	NA	4.0								
	NA									
4	NA									
	NA		No Sample							
8	NA	4.0		06		Brown	Fine-medium grained stained sand (small streaks)	SP		0.0/0.0
	NA			07		Yell/Tan	Fine-medium sand	SP		
8	NA									
	NA		No Sample							
12	NA	4.0		10		Grey	Fine-medium sand with rusty stains/streaks and thin lenses	SP		0.0/0.0
	NA									
12	NA									
	NA		No Sample	13		Drk Brn	Medium sand with possible staining	SP		0.0/0.0
16	NA	4.0								
	NA			15		Grey	Sand with small rusty streaks, trace gravel, brown stains	SP		
16	NA									
	NA		No Sample							
20	NA	4.0		18		Lgt Brn	Coarse sand, some gravel	SW		0.0/0.0
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: A6-NS-01

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A6-NS-02
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA			00		Drk Brn	Medium-grained sand	SP		0.0/0.0
	NA		No Sample							
4	NA	4.0		2.3		Brown	Sand with 2" wide black stain at 2.3' bgs	SP		
	NA			3.8		Drk Brn	Some black sand, possibly conaminated	SP		
4	NA									0.0/0.0
	NA		No Sample	05		Black	Coarse-grained, stained sand	SW	Potential waste	
8	NA	4.0		06		Tan/Yell	Fine-medium sand, trace gravel	SP		
	NA									
8	NA			08		Brown	Clean sand	SP		0.0/0.0
	NA		No Sample							
12	NA	4.0								
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

BORING NO.: A6-NS-02

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A6-NS-03
START DATE: 8/28/01
COMPLETION DATE: 8/28/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA		No Sample	00		Brown	Medium-grained sand	SP		0.0/0.0
	NA									
4	NA	4.0								
	NA			03		Drk Brn	Fine-medium stained sand, almost black	SP		
4	NA		No Sample	04		Lgt Brn	Medium sand	SP		0.0/0.0
	NA									
8	NA	4.0								
	NA									
8	NA		No Sample	08		Grey	Semi-cohesive silty sand	SM	moist	0.0/0.0
	NA									
12	NA	4.0								
	NA									
12	NA		No Sample	12		Brown	Coarse sand, trace gravel	SP	Some rusty staining throughout	0.0/0.0
	NA									
16	NA	4.0								
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

BORING NO.: A6-NS-03

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: SAV
ELEVATION FROM: NA

BORING NO.: A6-NS-04
START DATE: 9/5/01
COMPLETION DATE: 9/5/01
MONITORING WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID, H2S]
0	NA	3.0	No Sample	00	Loose	Lgt Brn	Very fine sand, trace gravel	SP		0.0/0.0
	NA									
4	NA	4.0								
	NA									
4	NA	4.0	No Sample							
	NA									
8	NA	4.0		06	Dense	Brown	Semi-cohesive sludge, medium sand	SP	Damp; contaminated, but not hairy	0.0/0.0
	NA									
8	NA	2.0	No Sample							
	NA									
12	NA	4.0		10	Very Loose	Brn/Rust	Coarse sand, some gravel	SW	Damp	0.0/0.0
	NA									
12	NA	2.0	No Sample							
	NA			13	Loose	Lgt Brn	Medium-coarse sand, trace gravel	SP	Moist	0.0/0.0
16	NA	4.0								
	NA									
16	NA	1.5	No Sample							
	NA									
20	NA	4.0		18	Very Loose	Beige	Medium-coarse sand	SP	Moist	0.0/0.0
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: 8-10 ft. bgs
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: A6-NS-04

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A7-NS-01
PROJECT NO.:	N4024/4111-0322	START DATE:	8/28/01
LOGGED BY:	M. Croot	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID, H2S]
0	NA			00		Brown	Fine-medium sand	SP		0.0/0.0
	NA		No Sample	2.5		Yellow	3" of fine sand	SP		
4	NA	4.0		2.8		Brown	Medium sand	SP		
	NA			03		Lgt Brn	Fine-medium sand	SP		
4	NA			04	Loose	Grey	Medium sand	SP	Likely fill material	0.0/0.0
	NA		No Sample							
8	NA	4.0								
	NA									
8	NA			08	Loose	Grey	Coarse, gravelly sand	GW	fill	0.0/0.0
	NA		No Sample							
12	NA	4.0								
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	NA
OTHER OBSERVATIONS:	

BORING NO.: A7-NS-01

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery	BORING NO.:	A7-NS-02
PROJECT NO.:	N4024/4111-0322	START DATE:	8/28/01
LOGGED BY:	M. Croot	COMPLETION DATE:	8/28/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MONITORING WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: SAV

ELEVATION FROM: NA

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID, H2S]
0	NA			00	Loose	Grey/Tan	Medium sand	SP		0.0/0.0
	NA		No Sample							
4	NA	4.0								
	NA									
4	NA									0.0/0.0
	NA		No Sample	05		Black	Small black spot, possible contamination	SP		
8	NA	4.0		5.3		Grey/Tan	Medium sand	SP		
	NA									
8	NA			08	Loose	Grey/Brn	Gravelly, coarse sand	SW		0.0/0.0
	NA		No Sample							
12	NA	4.0								
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe		Tetra Tech NUS, Inc.
METHOD OF ADVANCING BORING:	DPT		
METHOD OF SOIL SAMPLING:	Disposable 2.0-inch ID Plastic Sampling Sleeve		
METHOD OF ROCK CORING:	NA		
GROUNDWATER LEVELS:	NA		
OTHER OBSERVATIONS:	Advanced approximately 23' north of TP-7-09, near southwest corner of building	BORING NO.: A7-NS-02	PAGE: 1 OF 1

Ttnus Form 0018

APPENDIX D

SAMPLE BORING LOG SHEETS

BORING LOG FOR: Mohawk Tannery – Manual Coring
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): TtNUS/K. O'Neill, S. Vetere
GRD. SURFACE ELEVATION:
TRANSCRIBED BY: LJD
ELEVATION FROM:
BORING NO.: SL-101
START DATE: 9/11/01
COMPLETION: DATE: 9/11/01
MON. WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID,H2S]
0		9.8	1030	00	Loose	Black	Water		Surface H_2O	325 during sampling
5		10	MT-SL-101-0010	0.5			Sludge, very wet		VOC grab sample collected at 1.0' bgs	PID=3.4 in BZ H2S=3.9 in BZ
5			1035							
10			MT-SL-101-0010	08	Dense	Gray	Sludge bit drier, semi-cohesive		VOA grab sample collected at 8.0' bgs	
			1115 Sludge homogenized And Sampled							
							Hammer to 10.2' (refusal) With manual slide hammer			

TYPE OF DRILLING RIG: Boat – Manual Coring
METHOD OF ADVANCING BORING: Manual Direct Push/Slide Hammer
METHOD OF SOIL SAMPLING: 2" ID Sch. 80 PVC
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: Surface Water (0.6' Deep)
OTHER OBSERVATIONS:

6.4 feet of sample extruded

Tetra Tech NUS, Inc.

BORING NO.: SL-101

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery – Manual Coring	BORING NO.:	SL-102
PROJECT NO.:	N4024/4111-0322	START DATE:	9/11/01
LOGGED BY:	M. Croot	COMPLETION: DATE:	9/11/01
DRILLED BY (Company/Driller):	TtNUS/K. O'Neill, S. Vetere	MON. WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: LJD

ELEVATION FROM:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [H2S/PID]
0				00		Blk/grn	Water			0.0/0.0 in BZ
		11	1245	0.5	Loose	Black	Sludge, very wet		VOC grab sample collected at 2' bgs.	
5			MT-SL-102-0011							
		11.8								
5										
			1245							
10			MT-SL-102-0011	8.5	Dense	Black	Clayey sludge		VOC grab sample collected at 9' bgs	
							Hammered to 11.8' refusal with manual slide hammer			

TYPE OF DRILLING RIG:	Boat – Manual Coring	
METHOD OF ADVANCING BORING:	Manual Direct Push/Slide Hammer	
METHOD OF SOIL SAMPLING:	2" ID Sch. 80 PVC	~6 of sample extruded
METHOD OF ROCK CORING:	NA	
GROUNDWATER LEVELS:	Surface Water (0.5' Deep)	
OTHER OBSERVATIONS:		BORING NO.: SL-102

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery – Manual Coring
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): TtNUS/K. O'Neill, S. Vetere
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-103
START DATE: 9/17/01
COMPLETION: DATE: 9/17/01
MON. WELL NO.: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID/H2S]
0				00			Water			307/999
		8.4	1130	0.6	Loose	Black	Sludge, very wet			0.0/0.0 in BZ
5			MT-SL-103-0010							
		10.6								
5										477/999
			1136							0.0/0.0 in BZ
10			MT-SL-DUP-06	08	Dense	Blk/Gry	Clayey sludge, hair 30%			
							End of Boring Refusal at 10.6 '			

TYPE OF DRILLING RIG: Boat - Manual Coring
METHOD OF ADVANCING BORING: Manual Direct Push/Slide Hammer
METHOD OF SOIL SAMPLING: 2" ID Sch. 80 PVC
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: Surface Water (0.6' Deep)
OTHER OBSERVATIONS:

8.9 feet of sample extruded

Tetra Tech NUS, Inc.

BORING NO.: SL-103

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery – Manual Coring	BORING NO.:	SL-104
PROJECT NO.:	N4024/4111-0322	START DATE:	9/17/01
LOGGED BY:	M. Croot	COMPLETION: DATE:	9/17/01
DRILLED BY (Company/Driller):	TtNUS/K. O'Neill, S. Vetere	MON. WELL NO.:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: LJD

ELEVATION FROM:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID,H2S]
0				00			Water			78/417
		6.8	1430	0.2		Black	Sludge, wet			0.0/0.0 in BZ
5			MT-SL-104-0010							
		9.8								
5										>300/>600
										0.0/0.0 in BZ
10										
				10						
							End of Boring			
							Refusal at 9.8'			

TYPE OF DRILLING RIG:	Boat – Manual Coring	
METHOD OF ADVANCING BORING:	Manual Direct Push/Slide Hammer	
METHOD OF SOIL SAMPLING:	2" ID Sch. 80 PVC	6.8 feet of sample extruded
METHOD OF ROCK CORING:	NA	
GROUNDWATER LEVELS:	Surface Water (0.2' Deep)	
OTHER OBSERVATIONS:		BORING NO.: SL-104

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-201
START DATE: 8/29/01
COMPLETION: DATE: 8/29/01
TOTAL DEPTH: 18'
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID/H2S]
0	NA	2.4	1000	00	Loose	Lgt. Brn	Fine sand	SP		0.0/0.0
	NA		MT-SO-A2-OVCOMP						VOC grab sample collected at 1.5' bgs	
4	NA	4.0	portion for composite	2.3	Loose	Lgt. Brn	Sand, fine-medium	SP		
	NA									
4	NA	3.0		05	Very	Brown	Medium sand, trace sludge, trace gravel	SP	Trace Gravel	0.0/0.0
	NA		1015		Loose				VOC grab sample collected at 7.0' bgs	
8	NA	4.0	MT-SL-201-0616	5.5	Loose	Black	Sludge, medium-coarse			
	NA									
8	NA	3.0		8.8	Dense	Black	Sludge, fine, semi-cohesive, trace hair			0.0/0.0
	NA		1015							
12	NA	4.0	MT-SL-201-0616	11	Loose	Black	Sludge, medium coarse			
	NA			12						
12	NA	2.5			Loose	Black	Sludge, coarse-medium, saturated			0.0/0.0
	NA		1015							
16	NA	4.0	MT-SL-201-0616							
	NA									
16	NA	2.0		16'	Loose	Black	Bedrock and gravel material	GW	Wet	
	NA									
18	NA	2.0		18						
	NA									
							Refusal at 18' bgs (bedrock)			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: SL-201

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery - DPT
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-202
START DATE: 8/29/01
COMPLETION: DATE: 8/29/01
TOTAL DEPTH: 20'
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = PID
0	NA	2.5	1130	00	V. Loose		Topsoil, roots (pnrag)	SW		0.0
	NA		MT-SO-A2-OVCOMP						VOC grab sample collected at 2.7' bgs	
4	NA	4.0	portion for composite	02	Loose	Lgt. Brn	Sand , fine-medium	SP		
	NA			03	Loose	Dk. Brn	Sand, damp			
4	NA	2.0						SP	*Smells awful, damp*	0.0
	NA		1200							
8	NA	4.0	MT-SL-202-0717						VOC grab sample collected at 6' bgs	
	NA			07	Loose	Black	Sludge material, medium-coarse			
8	NA	4.0		08	Dense	Green	Clayey sludge, very fine, cohesive		Moist	0.0
	NA		1200							
12	NA	4.0	MT-SL-202-0717	10	Dense	Black	Sludge, moist, shiny		VOC grab sample collected at 11.2' bgs	
	NA									
12	NA	4.0								0.0
	NA		1200							
16	NA	4.0	MT-SL-202-0717							
	NA			15	Dense	Gray	*Clayey material, moist*			
16	NA	3.5	1200							0.0
	NA		MT-SO-A2-UNCOMP	17.5	Dense	Gray	Silty sand, cohesive, moist	SM	VOC grab sample collected at 18.3' bgs	
20	NA	4.0	portion for composite							
	NA									

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS:

BORING NO.: SL-202

Tetra Tech NUS, Inc.

BORING LOG FOR:	Mohawk Tannery - DPT	BORING NO.:	SL-203
PROJECT NO.:	N4024/4111-0322	START DATE:	8/29/01
LOGGED BY:	M. Croot	COMPLETION: DATE:	8/29/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MON. WELL NO:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: LJD

ELEVATION FROM:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = PID
0	NA	2.0	1215	00	Loose	Brown	Sand, medium, trace gravel (small), trace roots	SP		0.0
	NA		MT-SO-A2-OVCOMP							
4	NA	4.0	portion for composite							
	NA			03	Dense	Drk Brn	Sand, coarse, little gravel	SW		
4	NA	3.5		4.6	Very Loose	Lgt Brn	Sand, medium	SP		0.0
	NA		1230							
8	NA	4.0	MT-SL-203-0619	06	Loose	Black	Sludge, coarse grain, moist			
	NA			07	Dense	Blk/Gry	Fine grain, cohesive, clayey sludge,			
8	NA	2.5								0.0
	NA		1230							
12	NA	4.0	MT-SL-203-0619							
	NA			11	Dense	Black	Fine grain, not clayey, sludge			
12	NA	2.0								0.0
	NA		1230							
16	NA	4.0	MT-SL-203-0619	14	Dense	Black	Sludge, wet-saturated			
	NA									
16	NA	3.0		16	Dense	Black	Sludge, saturated			0.0
	NA		1230							
19	NA	3.0	MT-SL-203-0619							
	NA								REFUSAL AT 19'	
19	NA	1.0		19	V. Dense	Blk/Gry	Weathered rock			0.0
	NA		No underlying soil							
22	NA	3.0	sample collected						2nd TRY-- REFUSAL AT 22'	
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	2" ID disposable plastic sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	
OTHER OBSERVATIONS:	

Tetra Tech NUS, Inc.

BORING NO.: SL-203

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery - DPT	BORING NO.:	SL-204
PROJECT NO.:	N4024/4111-0322	START DATE:	8/29/01
LOGGED BY:	M. Croot	COMPLETION: DATE:	8/29/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MON. WELL NO:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: LJD

ELEVATION FROM:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = PID
0	NA	3.0	1355	00	Loose	Lgt. Brn	Sand, medium grain	SP		0.0
	NA		MT-SO-A2-OVCOMP							
4	NA	4.0	portion for composite	2.5	Dense	Drk. Brn	Sand, fine-medium	SP	VOC grab sample collected at 3' bgs	
	NA									
4	NA	3.2								0.0
	NA		1415		Loose				VOC grab sample collected at 5.5' bgs	
8	NA	4.0	MT-SL-204-0618	06	V. Loose	Lgt. Brn	Sand, trace gravel	SP		
	NA			6.8	Dense	Black	Sludge, moist, coarse grain			
8	NA	4.0	1415							0.0
	NA		MT-SL-204-0618	09	Dense	Gray	Silty-clayey, cohesive sludge			
12	NA	4.0		10	V. Dense	Black	Sludge, coarse grain			
	NA									
12	NA	4.0		12	Dense	Black	Sludge, saturated			0.0
	NA		1415							
16	NA	4.0	MT-SL-204-0618							
	NA									
16	NA	3.0	1530	18	Dense	Grn/Gry	Fine sand, trace silt	SP		
	NA		MT-SO-A2-UNCOMP	18.5	Dense	Black	2" band of contamination, sludge			
20	NA	4.0	portion for composite	18.8	Dense	Grn/Gry	Fine sand, trace silt	SP		
	NA			19.5	Dense	Black	2" band of contamination, sludge			
20	NA	1.0		19.8	Dense	Grn/Gry	Fine sand, trace silt	SP		
	NA									
21	NA	1.0		20	Dense	Grn/Gry	Bottom material, covered w/black leachate			
	NA									

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	2" ID disposable plastic sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	
OTHER OBSERVATIONS:	

Tetra Tech NUS, Inc.

BORING NO.: SL-204

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery - DPT
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-205
START DATE: 8/29/01
COMPLETION: DATE: 8/29/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = PID
0		3.7	1510	00	Dense	Brown	Sand, fine grained	SP		
			MT-SO-A2-OVCOMP						VOC grab sample	
4		4.0	portion for composite						collected at 3' bgs	
4		4.0								
			1515							
8		4.0	MT-SL-205-0616	06	Dense	Brown	Sand, fine, stained w/black	SP		
				6.6	Dense	Black	Sludge, some sand			
8		3.3								
			1515							
12		4.0	MT-SL-205-0616	10	Dense	Black	Sludge, moist, no sand		VOC grab sample collected at 11' bgs	
12		3.3		12	Dense	Black	Sludge, saturated			
			1515							
16		4.0	MT-SL-205-0616							
16		3.1	1530	16	Dense	Gray	Silty sand, wet	SP	VOC grab sample collected at 17' bgs	
			MT-SO-A2-UNCOMP							
20		4.0	portion for composite							

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS:

BORING NO.: SL-205

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery - DPT
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-301
START DATE: 8/30/01
COMPLETION: DATE: 8/30/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID/H2S]
0	NA	3.0	1230	00	Loose	Tan	Fine sand	SP	Dry	0.0/0.0
	NA		MT-SO-A3-OVCOMP							
4	NA	4.0	portion for composite	02	Loose	Brown	Sludge, hair material		VOC grab sample collected at 2 bgs	
	NA									
4	NA	3.0	1230						VOC grab sample collected at 4' bgs	0.0/0.0
	NA		MT-SL-301-0208							
8	NA	4.0		06	Loose	Tan	Sand, light, medium	SP		
	NA									
8	NA	3.0	1235						VOC grab sample collected at 7' bgs	0.0/0.0
	NA		MT-SO-A3-UNCOMP							
12	NA	4.0	Portion for composite							
	NA			12						
							End of Boring at 12' bgs No Refusal			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: SL-301

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery - DPT	BORING NO.:	SL-302
PROJECT NO.:	N4024/4111-0322	START DATE:	8/30/01
LOGGED BY:	M. Croot	COMPLETION: DATE:	8/30/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MON. WELL NO:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: LJD

ELEVATION FROM:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [FID/H2S]
0		3.0	1300 MT-SO-A3-OVCOMP	00	Dense	Lgt Brn	Sand, fine	SP	VOC grab sample collected at 2' bgs	0.0/0.0
4		4.0	portion for composite							
				03	Dense	Brown	Contamination, hair		Not sludge, but mixed	
4		4.0							VOC grab sample collected at 4' bgs	0.0/0.0
			1305							
8		4.0	MT-SL-302-0309						VOC grab sample collected at 7' bgs	
8		3.0								0.0/0.0
			1315	09	Dense	Brown	Sand, some rusty stains	SP	VOC grab sample collected at 9'bgs	
12		4.0	MT-SO-A3-UNCOMP portion for composite							
							End of Boring at 12' bgs No Refusal			

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	2" ID disposable plastic sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	
OTHER OBSERVATIONS:	

Tetra Tech NUS, Inc.

BORING NO.: SL-302

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-303
START DATE: 8/30/01
COMPLETION: DATE: 8/30/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID/H2S]
0	NA	3.0	1340	00	Loose	Lgt Brn	Fine-medium sand	SP	VOC grab sample collected at 1' bgs	0.0/0.0
	NA		MT-SO-A3-OVCOMP							
4	NA	4.0	portion for composite							
	NA									
4	NA	3.6								
	NA									
8	NA	4.0	1350	06	Dense	Brown	Silty, sludgey material	SM	Mixed Sludge, VOC grab sample collected at 7' bgs	0.0/0.0
	NA		MT-SL-303-0618							
8	NA	4.0								
	NA		1350							88.0/0.0
12	NA	4.0	MT-SL-303-0618	10	Dense	Black	Sludge, Moist		VOC grab sample collected at 11' bgs	(8-12'bgs)
	NA									
12	NA	3.0								
	NA		1350							
16	NA	4.0	MT-SL-303-0618	14	Loose	Blk/Gry	Coarse, sandy material	SP	VOC grab sample collected at 14' bgs	0.0/0.0
	NA									
16	NA	3.0								
	NA		1410	18	Dense	Black	Thin lens (2-3") sludge		VOC grab sample collected at 18' bgs	0.0/0.0
20	NA	4.0	MT-SO-A3-UNCOMP	19	Dense	Gray	Wet, clayey material	SC		
	NA		portion for composite							

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	2" ID disposable plastic sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	
OTHER OBSERVATIONS:	

BORING NO.: SL-303

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-401
START DATE: 8/30/01
COMPLETION: DATE: 8/30/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [FID/H2S]
0		2.3	0900 MT-SO-A4-OVCOMP portion for composite	00	Loose	Brown	Fine sand	SP		0.0/0.3
4		4.0		3.4	Dense	Drk. Brn	Fine sand	SP	VOC grab sample collected at 2.8' bgs Possibly transitional	
4		3.5	0910	05	Dense	Black	Sludge, moist, trace gravel			
8		4.0	MT-SL-401-0511						VOC grab sample collected at 7' bgs	140/0.6
8		3.0	0910							
12		4.0	MT-SL-401-0511	11	Dense	Gray	Gravel, flat	GW	Strong odor, could be weathered rock	3.3/0.6
			no underlying soil sample collected				End of Boring Refusal at 12.5' bgs			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: Gravel at bottom appears contaminated, strong odor

BORING NO.: SL-401

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-402
START DATE: 8/30/01
COMPLETION: DATE: 8/30/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID/H2S]
0		3.7	0940 MT-SO-A4-OVCOMP	00	Loose	Brown	Fine sand	SP		41.7/bkgd*
4		4.0	portion for composite	03	Dense	Black	Sludge, moist		VOC grab sample collected at 2.2' bgs	
4		4.0	1000						VOC grab sample collected at 3.6' bgs	255.2/bkgd*
8		4.0	MT-SL-402-0311						VOC grab sample collected at 6.6' bgs	
8		4.0	1000 MT-SL-402-0311	08		Black	Sludge, saturated		VOC grab sample collected at 9' bgs	21.4/bkgd*
12		4.0		10		Black	Sludge, moist			
			1050	11		Gray	Gravel, weathered rock *strong odor*	GW	VOC grab sample collected at 11.5' bgs	
			MT-SL-A4-UNCOMP portion for composite (11-12' bgs)							
							End of Boring at 12' bgs			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: *Background H2S readings of 0.3-0.5 ppm

BORING NO.: SL-402

Tetra Tech NUS, Inc.

Ttnus Form 0018

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BORING LOG FOR:	Mohawk Tannery - DPT	BORING NO.:	SL-403
PROJECT NO.:	N4024/4111-0322	START DATE:	8/30/01
LOGGED BY:	M. Croot	COMPLETION: DATE:	8/30/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham	MON. WELL NO:	NA
GRD. SURFACE ELEVATION:		CHECKED BY:	

TRANSCRIBED BY: LJD

ELEVATION FROM:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID/H2S]
0	NA	3.0	1020	00	Loose	Brown	Fine sand, tiny black specs	SP		0.0/bkgd*
	NA		MT-SO-A4-OVCOMP							
4	NA	4.0	portion for composite	3.6	Loose	Brown	Moist-saturated, log (wood) material		VOC grab sample collected at 2.6' bgs	
	NA			3.8	Loose	Brown	Fine sand	SP		
4	NA	3.2								136/bkgd*
	NA		1030	05	Dense	Black	Sludge, moist			
8	NA	4.0	MT-SL-403-0510						VOC grab sample collected at 7' bgs	
	NA									
8	NA	4.0	1030						VOC grab sample collected at 9' bgs	91.7/bkgd*
	NA		MT-SL-403-0510							
12	NA	4.0	1040	10	Loose	Brown	Fine sand	SP	VOC grab sample collected at 11' bgs	
	NA		MT-SO-A4-UNCOMP							
			portion for composite							
			(10-12' bgs)							
							End of Boring at 12' bgs			

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	2" ID disposable plastic sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	
OTHER OBSERVATIONS:	*Background H2S readings of 0.3-0.5 ppm

BORING NO.: SL-403

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-501
START DATE: 9/4/01
COMPLETION: DATE: 9/4/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID/H2S]
0	NA	2.0		00	Loose	Tan	Sand, fine-medium, trace gravel	SW	VOC grab sample collected at 1' bgs	0.0/0.0
	NA		0945							
4	NA	4.0	MT-SL-501-0020							
	NA									
4	NA	3.5		04	Loose	Lgt Brn	Sand, very fine, poorly grated	SP		0.0/0.0
	NA		0945							
8	NA	4.0	MT-SL-501-0020						VOC grab sample collected at 6' bgs	
	NA									
8	NA	3.7								0.0/0.0
	NA		0945	09	Loose	Rusty	Fine sand	SP		
12	NA	4.0	MT-SL-501-0020	10	Loose	Brown	Sand, very fine, trace brown streaks	SP	VOC grab sample collected at 10' bgs	
	NA									
12	NA	3.5								0.0/0.0
	NA		0945	13	Dense	Beige	Very fine sand with brown stains, rust stain	SP		
16	NA	4.0	MT-SL-501-0020	14	Dense	Beige	Sand, very fine, poorly graded	SP	VOC grab sample collected at 14' bgs	
	NA									
16	NA	3.0		16	Loose	Gry/Bge	Sand, fine, poorly graded	SP		0.0/0.0
	NA		0945	17	Loose	Gry/Bge	Sand, medium-coarse, poorly graded	SP		
20	NA	4.0	MT-SL-501-0020						VOC grab sample collected at 18' bgs	
	NA									
20	NA	2.0								0.0/0.0
	NA									
24	NA	4.0		22	V. Loose	Gray	Sand, medium-coarse, poorly graded	SP		
	NA									
							End of Boring at 24' bgs			
							No Refusal			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: ~13" Elevation change from TP-4-03 and SL-501
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: No overlying or underlying soil samples collected

BORING NO.: SL-501

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-502
START DATE: 9/4/01
COMPLETION: DATE: 9/4/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID/H2S]
0	NA	3.0	1020	00	V. Loose	Brown	Fine-medium sand	SP		0.0/0.0
	NA									
4	NA	4.0	MT-SL-502-0012	02	Dense	Drk. Brn	Fine sand, damp, appears contaminated	SP	VOC grab sample	
	NA			03	Loose	Brown	Fine-medium sand	SP	collected at 3.9' bgs	
4	NA	4.0		04	Loose	Gry/Brn	Fine-medium sand, poorly graded	SP		0.0/0.0
	NA		1020						VOC grab sample	
8	NA	4.0	MT-SL-502-0012						collected at 5' bgs	
	NA								VOC grab sample collected at 7' bgs	
8	NA	4.0		08	Loose	Tan	Sand, medium, poorly graded	SP		0.0/0.0
	NA		1020						VOC grab sample	
12	NA	4.0	MT-SL-502-0012						collected at 9' bgs	
	NA									
12	NA	3.0		12	Loose	Rusty	Medium sand, stained, damp	SP		
	NA									
16	NA	4.0								
	NA			15	Dense	Gry/Brn	Very fine sand, poorly graded	SP		
16	NA	3.0		16	Dense	Beige	Sand, very fine	SP		
	NA									
20	NA	4.0								
	NA									
20	NA	3.5		20	Dense	Tan	Very fine sand, some silt	SP		
	NA									
24	NA	4.0								
	NA									
							End of Boring at 24' bgs No Refusal			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: No overlying or underlying soil samples collected

BORING NO.: SL-502

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
TRANSCRIBED BY: LJD
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:
ELEVATION FROM:

BORING NO.: SL-503
START DATE: 9/4/01
COMPLETION: DATE: 9/4/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* – [PID/H2S]
0	NA	2.6		00	Loose	Brown	Fine-medium sand, trace gravel	SP		0.0/0.0
	NA		1040							
4	NA	4.0	MT-SL-503-0012						VOC grab sample	
	NA			03	Loose	Drk. Brn	Sand with wood material, trace gravel	SP	collected at 3.9' bgs	
4	NA	3.0								0.0/0.0
	NA		1040							
8	NA	4.0	MT-SL-503-0012	06	V. Loose	Drk. Brn	Medium-coarse sand, trace gravel	SP	VOC grab sample collected at 6' bgs	
	NA									
8	NA	3.0		08	Dense	Drk. Brn	Very organic, trace silt, still poorly graded	SP	VOC grab sample	0.0/0.0
	NA		1040						collected at 9' bgs	
12	NA	4.0	MT-SL-503-0012							
	NA			11	Loose	Tan	Sand, medium-coarse	SP		
12	NA	2.0								
	NA									
16	NA	4.0		14	Loose	Tan	Sand, medium-coarse	SP		
	NA									
16	NA	2.0								
	NA									
20	NA	4.0		18	V. Loose	Rusty	Coarse grain, rusty stained	SP		
	NA			19	Loose	Beige	Sand, very fine	SP		
							End of Boring at 20' bgs			
							No Refusal			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: No overlying or underlying soil samples collected

BORING NO.: SL-503

Tetra Tech NUS, Inc.

PAGE: 1 OF 1

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-601
START DATE: 9/5/01
COMPLETION: DATE: 9/5/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID/H2S]
0	NA	3.0	0840	00	Loose	Brown	Sand, fine-medium, poorly graded	SP		0.0/0.0
	NA		MT-SO-A6-OVCOMP						VOC grab sample collected at 2' bgs	
4	NA	4.0	portion for composite							
	NA		(0-5' bgs)							
4	NA	3.0								104/0.0
	NA			05	Dense	Brn/Gry	Transitioning from sand to sludge	SP		(0.0 in BZ)
8	NA	4.0								
	NA			07	Dense	Black	Sludge, damp, cohesive		VOC grab sample collected at 7' bgs	
8	NA	3.0								30.2/0.0
	NA		0905						VOC grab sample collected at 9' bgs	
12	NA	4.0	MT-SL-601-0711							
	NA			11	Loose	Orange	Coarse sand	SP		
12	NA	2.0	0910	12	V. Loose	Orange	Coarse sand, trace gravel	SP		
	NA		MT-SO-A6-UNCOMP							
16	NA	4.0	portion for composite							
	NA								VOC grab sample collected at 15' bgs	
							End of Boring at 16' bgs			
							No Refusal			

TYPE OF DRILLING RIG: Track-MountedGeoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS:

BORING NO.: SL-601

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR:	Mohawk Tannery			BORING NO.:	SL-602
PROJECT NO.:	N4024/4111-0322			START DATE:	9/5/01
LOGGED BY:	M. Croot	TRANSCRIBED BY:	LJD	COMPLETION: DATE:	9/5/01
DRILLED BY (Company/Driller):	Technical Drilling Services/P. Newsham			MON. WELL NO:	NA
GRD. SURFACE ELEVATION:		ELEVATION FROM:		CHECKED BY:	

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [PID/H2S]
0	NA	3.0	0910	00	Loose	Tan	Fine-medium sand, poorly graded	SP		0.0/0.0
	NA		MT-SO-A6-OVCOMP						VOC grab sample collected at 2' bgs	
4	NA	4.0	portion for composite							
	NA									
4	NA	4.0								
	NA		0925	05	Dense	Black	Sludge, cohesive, moist, hair			63.1/0.0
8	NA	4.0	MT-SL-602-0509						VOC grab sample collected at 6' bgs	0.0 in BZ
	NA									
8	NA	4.0								
	NA		0935	09	Loose	Brown	Sand, coarse, round particles	SP		74.3/0.0
12	NA	4.0	MT-SO-A6-UNCOMP						VOC grab sample collected at 10' bgs and 11' bgs	0.0 in BZ
	NA		portion for composite							
							End of Boring at 12' bgs			
							No Refusal			

TYPE OF DRILLING RIG:	Track-Mounted Geoprobe
METHOD OF ADVANCING BORING:	DPT
METHOD OF SOIL SAMPLING:	2" ID disposable plastic sleeve
METHOD OF ROCK CORING:	NA
GROUNDWATER LEVELS:	
OTHER OBSERVATIONS:	

Tetra Tech NUS, Inc.

BORING NO.: SL-602

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: M. Croot
DRILLED BY (Company/Driller): Technical Drilling Services/ P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-603
START DATE: 9/5/01
COMPLETION: DATE: 9/5/01
MON. WELL NO: NA
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = [PID/H2S]
0	NA	4.0		00	Dense	Brown	Sand with hides, trace gravel, transitional	SW		0.0/0.0
	NA		0950							
4	NA	4.0	MT-SL-603-0007						VOC grab sample collected at 2' bgs	
	NA									
4	NA	4.0								0.0/0.0
	NA		0950							
8	NA	4.0	MT-SL-603-0007	06	Loose	Black	Sludge, medium-coarse grain lens		VOC grab sample collected at 6' bgs	
	NA			07	Dense	Brown	Sand, fine-medium, poorly graded	SP		
8	NA	4.0	1005							
	NA		MT-SO-A6-UNCOMP							
12	NA	4.0	portion for composite						VOC grab sample collected at 10' bgs	
	NA									
							End of Boring at 12' bgs No Refusal			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: No overlying soil sample collected due to apparent staining in surficial soils

BORING NO.: SL-603

Tetra Tech NUS, Inc.

Ttnus Form 0018

01/16/02BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: T. Dorgan
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-701
START DATE: 8/31/01
COMPLETION: DATE: 8/31/01
MON. WELL NO: None
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = PID
0	NA		0900	Sand		Tan/	0.0-1.2 gravelly, fine-coarse well graded sand,	SW		0.0
	NA	3.1	0-1.2 ft used as part of			Olive	gravel = subang. Coarse.			
2	NA		MT-SO-A7-OVCOMP			Drk Gry	1.2-2.0 sludge, sand, mostly fine-medium	Fill/SP	Fill	
	NA			Sludge						
2	NA			Fill		Black	2.0-4.0 Poorly graded, trace silt, trace hair, wood fragments	Fill/SP		
	NA		0900							
4	NA	4.0	MT-SL-701-0217							
	NA									
4	NA	2.8				Black	4.0-4.5 clayey silt size sludge, abundant hair fibers	Fill/ML	-Soft, easily rolled ¼" tube	0.0
	NA		0910						-TCLP VOC collected from	
8	NA	4.0	MT-SL-701-0217				4.5-6.8 sludge/fill – mostly fine-medium poorly graded sand	Fill/SP	4-8 foot interval	
	NA						size material. Abundant wood fragments			
8	NA	2.4					8.0-10.4 sludge/fill – mostly fine-medium poorly graded	Fill/SP		0.0
	NA		0915				sand size material. Abundant wood fragments.			
12	NA	4.0	MT-SL-701-0217	Sludge/						
	NA			Fill						
12	NA	1.8					12.0-13.8 sludge/fill – mostly fine-medium poorly graded	Fill/SP		0.0
	NA		0920				sand size material. Abundant wood fragments.			
16	NA	4.0	MT-SL-701-0217				Inc. trace coarse sub-rounded gravel.			
	NA									
16	NA	2.5	0926				16.0-16.5 sludge/fill – mostly fine-medium poorly graded	Fill/SP		0.0
	NA		MT-SL-701-0217				sand size material.			
20	NA	4.0	18-20 ft part of	Silty			16.5-18.5 silt and fine-medium sand, trace plant fiber/roots	SM		
	NA		MT-SO-A7-UNCOMP	Sand						
							End of Boring at 20 feet bgs			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: SL-701

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: T. Dorgan
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:
TRANSCRIBED BY: LJD
ELEVATION FROM:
BORING NO.: SL-702
START DATE: 8/31/01
COMPLETION: DATE: 8/31/01
MON. WELL NO: None
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = PID
0	NA	2.1		00		Brown	Fine-coarse sand, trace gravel, trace glass, plastic,	Fill/SW	Dry, abundant wood	0.0
	NA		0955				and wood. Mottled orange, trace light green spotting.		fragments, oxidation	
4	NA	4.0	MT-SL-702-0011						throughout.	
	NA									
4	NA	2.4								
	NA		1000							
8	NA	4.0	MT-SL-702-0011							
	NA									
8	NA	3.5								
	NA		1000	09		Black	Sludge and silty, fine-medium sand, trace gravel.	Fill/SM	Moist	0.0
12	NA	4.0	MT-SL-702-0011				Trace hair fibers, trace wood fragments.			
	NA			11		Lgt Brn	Fine, poorly graded sand	SP	Dry	
12	NA	2.8	1005							
	NA		Collected as part of	12.5	Loose	Brown	Fine-coarse sand, trace fine-coarse rounded gravel	SW	Dry	0.0
16	NA	4.0	MT-SO-A7-UNCOMP							
	NA									
16	NA	0.5	1010	16	Loose	Brown	Fine-coarse sand, trace fine-coarse rounded gravel	SW	Dry	0.0
	NA		Collected as part of				Possibly pushing cobble, driller noted stone in nose of			
20	NA	4.0	MT-SO-A7-UNCOMP				sampler			
	NA									
							End of Boring at 20 feet bgs. No refusal.			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS: VOC grab samples collected at 2', 7', and 10.5'

BORING NO.: SL-702

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: T. Dorgan
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-703
START DATE: 8/31/01
COMPLETION: DATE: 8/31/01
MON. WELL NO: None
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA METHOD = FID (ppm)
0	NA		1030	00		Brown/	Grass at surface. Sand, mostly fine-coarse well graded	SW		
	NA	3.6	Collected as part of			Tan	sand, grass roots and fibers.			
2	NA		MT-SO-A7-OVCOMP	1.8		Drk Gry	Sludge/fill. Mixture of fine-coarse sand, trace coarse gravel,	Fill/SW		
	NA						wood fragments		Fill	28 @ 2'
2	NA									
	NA		1030							
4	NA	4.0	MT-SL-703-0215							
	NA									48@ 4'
4	NA	2.3				Red/	Sludge/fill. Same as above. Fill inc. leather @ ~4.5'	Fill/SW		
	NA		1035			White/	White rubbery layer @ 4.6'		Very strong sewerage	250@ 6'
8	NA	4.0	MT-SL-703-0215			Black	Red pigment? @ 4.5 – 4.8		odor (raw), foul odor	424@ 6'
	NA								Saturated	320@ 8'
8	NA	3.1								
	NA		1045							
12	NA	4.0	MT-SL-703-0215							
	NA									
12	NA	3.5		12		Violet/	Fibrous material, possibly asbestos? ~ 4" thick	?	Similar to cellulose	FID=360
	NA		1050			Black	Wood fragments		insulation	PID=0.0
16	NA	4.0	MT-SL-703-0215							
	NA			15		Olive Gry	Silty, fine sand, trace root fibers	SM	Damp	
16	NA	3.8	1100	16		Lgt Gry/	Silty, clayey, mostly clay, some silt, trace fine sand.	CL?	Dry-Damp	7.0
	NA		Collected as part of			Yellow				
20	NA	4.0	MT-SO-A7-UNCOMP						Damp, not saturated	
	NA			19		Blck/Gry	Silty, fine sand	SM	Fine bedding at 19-20 ft.	
							End of Boring at 20 feet bgs. No refusal.			
							Backfill with bentonite chips and ensure hydrated.			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS: NA
OTHER OBSERVATIONS:

BORING NO.: SL-703

Tetra Tech NUS, Inc.

Ttnus Form 0018

BORING LOG FOR: Mohawk Tannery
PROJECT NO.: N4024/4111-0322
LOGGED BY: T. Dorgan
DRILLED BY (Company/Driller): Technical Drilling Services/P. Newsham
GRD. SURFACE ELEVATION:

TRANSCRIBED BY: LJD
ELEVATION FROM:

BORING NO.: SL-704
START DATE: 8/31/01
COMPLETION: DATE: 8/31/01
MON. WELL NO: None
CHECKED BY:

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = FID/PID
0	NA		1140			Lt. Brown	Grass at surface. 0-0-1.5 gravelly, fine-coarse sand,	SW		
	NA	3.0	Collected as part of	Sand			trace org. debris (leaves, roots)			
2	NA		MT-SO-A7-OVCOMP							
	NA			Sludge/fill		Dk. Gray	1.5-2.0 Sludge/fill. Silt, sand & wood frags.	Fill/SM	Trace hair fibers	
2	NA				Loose	Purple/	2.0-3.0 Fibrous material (pot. asbestos?)	Fill/SM	Dry	
	NA		1140	Fill/		Violet	Sludge?			
4	NA	4.0	MT-SL-704-0207	Sludge/						FID=4.8
	NA			Fibrous					Damp - moist	PID=48.9
4	NA	3.5		Mat.		Black/	Same as above. Yellow-paper inside fibrous mat. @ 4.5'	Fill/SM		
	NA		1145			Purple				
8	NA	4.0	MT-SL-704-0207	Sludge	Very Soft	Black	Silt and clay, mud. Loose and soft.	ML	Saturated	FID=17
	NA					Olive Gry	Mostly fine, poorly graded sand, trace silt, trace root fibers	SP	Readings 0.0 in B.Z.	PID=716
8	NA	3.6	1150			Yellow/	Mostly fine-coarse, well graded sand, trace fine-coarse	SW	Damp - Dry	
	NA		Sampled as part of			Brown	subrounded gravel.			
12	NA	4.0	MT-SO-A7-UNCOMP							
	NA			Sand						
12	NA	2.8	1200							
	NA		Sampled as part of							
16	NA	4.0	MT-SO-A7-UNCOMP							
	NA									
							End of Boring at 16 feet bgs. No refusal.			

TYPE OF DRILLING RIG: Track-Mounted Geoprobe
METHOD OF ADVANCING BORING: DPT
METHOD OF SOIL SAMPLING: 2" ID disposable plastic sleeve
METHOD OF ROCK CORING: NA
GROUNDWATER LEVELS:
OTHER OBSERVATIONS: SV & TD in level C for entire boring (~1145 – 1240). Both SV & TD occasionally getting odors through APR

BORING NO.: SL-704

Tetra Tech NUS, Inc.

Ttnus Form 0018

APPENDIX E

MONITORING WELL INVENTORY LOGS

TETRA TECH NUS, INC.

WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-1

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 0845

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) 78.50

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) 69.61

WELL STICK-UP 0.00

CASING STICK-UP (FEET) 0.00

WELL DIAMETER (INCHES) 2.0

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?		**YES**	NO	**(5-SIDED WELL KEY)**
LOCKED REPLACED?	**NA**	YES	NO	
OBSTRUCTIONS?		YES	**NO**	
WELL RELABELED?		**YES**	NO	
SLUG TEST CONDUCTED?		YES	**NO**	

GENERAL CONDITION/COMMENTS: Flush mounted well near chain link fence in tannery loading dock area

TtNUS Form 0021

TETRA TECH NUS, INC.	WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-4

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 0910

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) 18.85

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) 12.36

WELL STICK-UP 2.25

CASING STICK-UP (FEET) 2.38

WELL DIAMETER (INCHES) 2.0

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?	**YES**	NO
LOCKED REPLACED?	YES	**NO**
OBSTRUCTIONS?	YES	**NO**
WELL RELABELED?	**YES**	NO
SLUG TEST CONDUCTED?	YES	**NO**

GENERAL CONDITION/COMMENTS: Dedicated tubing in well, but was able to work around it. Needs new lock (long)

TtNUS Form 0021

TETRA TECH NUS, INC.	WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-6

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 1035

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) 30.85

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) 14.20

WELL STICK-UP 0.25

CASING STICK-UP (FEET) 0.36

WELL DIAMETER (INCHES) 2.0

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?	**YES**	NO
LOCKED REPLACED?	YES	**NO**
OBSTRUCTIONS?	YES	**NO**
WELL RELABELED?	**YES**	NO
SLUG TEST CONDUCTED?	YES	**NO**

GENERAL CONDITION/COMMENTS: Needs new lock (long). Sludge odor, nothing on probe.

TtNUS Form 0021

TETRA TECH NUS, INC.

WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-9

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 1020

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) 31.60

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) 14.35

WELL STICK-UP 0.92

CASING STICK-UP (FEET) 1.37

WELL DIAMETER (INCHES) 2.0

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?	**YES**	NO
LOCKED REPLACED?	YES	**NO**
OBSTRUCTIONS?	YES	**NO**
WELL RELABELED?	**YES**	NO
SLUG TEST CONDUCTED?	YES	**NO**

GENERAL CONDITION/COMMENTS: Needs new lock (long). Twine in well (tubing inside?).

TtNUS Form 0021

TETRA TECH NUS, INC.

WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-10

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 0930

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC)	17.45
WATER LEVEL DEPTH (FEET FROM TOP OF PVC)	7.75
WELL STICK-UP	0.86
CASING STICK-UP (FEET)	1.33
WELL DIAMETER (INCHES)	2.0
WELL CONSTRUCTION (PVC, STEEL, ETC.)	PVC

LOCKED UPON ARRIVAL?	**YES**	NO
LOCKED REPLACED?	YES	**NO**
OBSTRUCTIONS?	YES	**NO**
WELL RELABELED?	**YES**	NO
SLUG TEST CONDUCTED?	YES	**NO**

GENERAL CONDITION/COMMENTS: Needs new lock (long).

TtNUS Form 0021

TETRA TECH NUS, INC.

WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-11

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 0935

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) 20.05

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) 7.62

WELL STICK-UP 0.87

CASING STICK-UP (FEET) 0.90

WELL DIAMETER (INCHES) 2.0

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?	**YES**	NO
LOCKED REPLACED?	YES	**NO**
OBSTRUCTIONS?	YES	**NO**
WELL RELABELED?	**YES**	NO
SLUG TEST CONDUCTED?	YES	**NO**

GENERAL CONDITION/COMMENTS: Needs new lock (long).

TETRA TECH NUS, INC.	WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-12

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 1015

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: NA

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) NA

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) NA

WELL STICK-UP NA

CASING STICK-UP (FEET) NA

WELL DIAMETER (INCHES) NA

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?	**NA**	YES	NO
LOCKED REPLACED?	**NA**	YES	NO
OBSTRUCTIONS?	**NA**	YES	NO
WELL RELABELED?	**NA**	YES	NO
SLUG TEST CONDUCTED?	**NA**	YES	NO

GENERAL CONDITION/COMMENTS: Could not locate well, but discovered steel casing with PVC well on north side of upper trail. Well had been pinched off at ground surface. Not apparent where former well location is.

TETRA TECH NUS, INC.

WELL INSPECTION AND GROUNDWATER LEVEL MEASUREMENT SHEET

WELL NUMBER: MW-GZ-13

PROJECT NAME: Mohawk Tannery

DATE/TIME: 9/6/01 0940

PROJECT MANAGER: D. Baxter

INSPECTED BY: S. Vetere

M. Croot

AIR SCREENING

PHOTOIONIZATION DETECTOR (PID) READING: 0.0

LEL/02 READING: NA

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) obstructed

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) 7.33

WELL STICK-UP 1.88 (cover will not close)

CASING STICK-UP (FEET) 1.87

WELL DIAMETER (INCHES) 2.0

WELL CONSTRUCTION (PVC, STEEL, ETC.) PVC

LOCKED UPON ARRIVAL?	YES	**NO**
LOCKED REPLACED?	YES	**NO**
OBSTRUCTIONS?	**YES**	NO
WELL RELABELED?	**YES**	NO
SLUG TEST CONDUCTED?	YES	**NO**

GENERAL CONDITION/COMMENTS: Foul odor emanating from well, hair found on probe

TtNUS Form 0021

APPENDIX F

ANALYTICAL RESULTS FOR SURFACE WATER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1 New England
Office of Environmental Measurement and Evaluation
11 Technology Drive N. Chelmsford, MA 01863

Memorandum

COPY

Date: February 11, 2002
Subj: Mohawk Tannery Site
Nashua, NH
From: Daniel Granz, EIA
To: Neil Handler, HBO

On January 30, 2002, Dan Granz and Neil Handler visited the Mohawk Tannery Site in Nashua, NH to collect water samples from the old wastewater treatment lagoon. The water level was very low in the lagoon with only a few inches of water under the ice.

The following two water samples were collected for volatile organic compounds, pesticide/PCB, semi volatile organics (BNA), total metals, and dissolved metals. The dissolved metals samples were filtered (0.45 micron) on site prior to preservation.

SAMPLE #	STATION	LOCATION
95410	WATER1	~middle of lagoon
95359	WATER2	north edge of lagoon

The samples were analyzed at the USEPA Laboratory in N. Chelmsford, MA.

The volatile organic sample data are summarized in the following table and the laboratory report is attached. The laboratory report should be referenced for the entire list of volatile compounds analyzed and the reporting limits.

Parameter (ug/L) ppb	WATER1	WATER2
acetone	17 J	8.1 J, L
carbon disulfide	5.0 L	ND

ND not detected above detection limits
J approximate
L estimated value is below the calibration range

The BNA, pesticide/PCB, total metals, and dissolved metals data will be forwarded once they are released form the laboratory.

EPA
Region 1, New England

United States Environmental Protection Agency
Office of Environmental Measurement & Evaluation
11 Technology Drive
North Chelmsford, MA 01863-2431

Laboratory Report

February 04, 2002

Mr Dan Granz - EIA / OEME
U.S. EPA New England Laboratory
11 Technology Drive
N. Chelmsford, MA 01863-2431

Project Number: 02010033
Project: Mohawk Tannery - Nashua, NH
Analysis: VOAs in Water Med Level Method
Analyst: Joseph Montanaro 2/4/02

Analytical Procedure:

All samples were received and logged in by the laboratory according to the SOP for Sample Log-in (EIA-ADMLOGN7.SOP, 7/27/01).

Sample preparation and analysis was done following the EPA Region I SOP, VOAGCMS4.SOP.

Samples were analyzed by GC/MS. Samples were introduced to the GC via a Tekmar pre-concentrator and an Archon autosampler. The analysis SOP is based on US EPA Method 8260B, SW-846, Rev 2.0,1996. Method 624, 40CFR Part 136 Appendix A, July 1, 1992, and USEPA CLP SOW for Organic Analysis OLM04.2, 1999.

Date Samples Received by the Laboratory 1/30/02

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8333.

Sincerely, 02/06/02

Dr. William J. Andrade
Advanced Analytical Chemistry Specialist

Qualifiers: RL = Reporting limit
ND = Not Detected above Reporting limit
NA = Not Applicable due to high sample dilutions or sample interferences
NC = Not calculated since analyte concentration is ND.
J = Estimated value
E = Estimated value exceeds the calibration range
L = Estimated value is below the calibration range
B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 5 times the concentration in the blank.
R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

VOAs in Water Med Level Method

Client Sample ID:	95409		Lab Sample ID:	AA19749
Date of Collection:	1/30/02		Matrix	Water
Date of Extraction:	1/31/02		Volume Purged:	5.0 mL
Date of Analysis:	1/31/02		Percent Solids:	N/A
Dry Weight Extracted:	N/A		Extract Dilution:	1
Wet Weight Extracted:	N/A		pH:	<2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	
71-55-6	1,1,1-Trichloroethane	ND	5.0	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	
76-13-1	1,1,2-Trichloro-1,2,2-Trifluoroeth	ND	5.0	
79-00-5	1,1,2-Trichloroethane	ND	5.0	
75-35-4	1,1-Dichloroethylene	ND	5.0	
563-58-6	1,1-Dichloropropene	ND	5.0	
75-34-3	1,1-dichloroethane	ND	5.0	
87-61-6	1,2,3-Trichlorobenzene	ND	5.0	
96-18-4	1,2,3-Trichloropropane	ND	5.0	
120-82-1	1,2,4-Trichlorobenzene	ND	5.0	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	
96-12-8	1,2-Dibromo-3-Chloropropane	ND	5.0	
106-93-4	1,2-Dibromomethane	ND	5.0	
95-50-1	1,2-Dichlorobenzene	ND	5.0	
107-06-2	1,2-Dichloroethane	ND	5.0	
78-87-5	1,2-Dichloropropane	ND	5.0	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	
541-73-1	1,3-Dichlorobenzene	ND	5.0	
142-28-9	1,3-Dichloropropane	ND	5.0	
106-46-7	1,4-Dichlorobenzene	ND	5.0	
594-20-7	2,2-Dichloropropane	ND	5.0	
78-93-3	2-Butanone (MEK)	ND	20	
110-75-8	2-Chloroethylvinylether	ND	15	
95-49-8	2-Chlorotoluene	ND	5.0	
591-78-6	2-Hexanone	ND	3.0	
67-64-1	2-Propanone (acetone)	ND	10	
106-43-4	4-Chlorotoluene	ND	5.0	
108-10-1	4-Methyl-2-Pentanone(MIBK)	ND	2.5	
107-02-8	Acreolin	ND	50	
107-13-1	Acrylonitrile	ND	25	
71-43-2	Benzene	ND	5.0	
108-86-1	Bromobenzene	ND	5.0	
74-97-5	Bromochloromethane	ND	5.0	
75-27-4	Bromodichloromethane	ND	5.0	
75-25-2	Bromoform	ND	5.0	
74-83-9	Bromomethane	ND	5.0	
75-15-0	Carbon Disulfide	ND	15	

56-23-5	Carbon tetrachloride	ND	5.0
108-90-7	Chlorobenzene	ND	5.0
75-00-3	Chloroethane	ND	5.0
67-66-3	Chloroform	ND	5.0
74-87-3	Chloromethane	ND	5.0
124-48-1	Dibromochloromethane	ND	5.0
74-95-3	Dibromomethane	ND	5.0
75-71-8	Dichlorodifluoromethane	ND	5.0
60-29-7	Ethyl Ether	ND	15
100-41-4	Ethylbenzene	ND	5.0
462-06-6	Fluorobenzene	ND	5.0
87-68-3	Hexachlorobutadiene	ND	5.0
98-82-8	Isopropylbenzene	ND	5.0
100-41-4/106-42-	M/P Xylene	ND	10
1634-04-4	Methyl-t-Butyl Ether	ND	5.0
75-09-2	Methylene Chloride	ND	5.0
104-51-8	N-Butylbenzene	ND	5.0
103-65-1	N-Propylbenzene	ND	5.0
91-20-3	Naphthalene	ND	5.0
95-47-6	Ortho Xylene	ND	5.0
99-87-6	Para-Isopropyltoluene	ND	5.0
135-98-8	Sec-Butylbenzene	ND	5.0
100-42-5	Styrene	ND	5.0
98-06-6	Tert-Butylbenzene	ND	5.0
127-18-4	Tetrachloroethylene	ND	5.0
109-99-9	Tetrahydrofuran	ND	35
108-88-3	Toluene	ND	5.0
156-60-5	Trans-1,2-Dichloroethylene	ND	5.0
79-01-6	Trichloroethylene	ND	5.0
75-69-4	Trichlorofluoromethane	ND	5.0
108-05-4	Vinyl Acetate	ND	30
75-01-4	Vinyl Chloride	ND	5.0
10061-01-5	c-1,3-dichloropropene	ND	5.0
156-59-2	cis-1,2-Dichloroethylene	ND	5.0
10061-02-6	t-1,3-Dichloropropene	ND	5.0

Surrogate Compounds	**Recoveries (%)**	**QC Ranges**
1,2-Dichloroethane-D4	108	76 - 139
Toluene-D8	99	74 - 116
1,4-Bromofluorobenzene	93	79 - 117

Comments: 95409 TRIP BLANK

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

VOAs in Water Med Level Method

Client Sample ID:	95410	Lab Sample ID:	AA19750
Date of Collection:	1/30/02	Matrix	Water
Date of Extraction:	1/31/02	Volume Purged:	5.0 mL
Date of Analysis:	1/31/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	<2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	
71-55-6	1,1,1-Trichloroethane	ND	5.0	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	
76-13-1	1,1,2-Trichloro-1,2,2-Trifluoroeth	ND	5.0	
79-00-5	1,1,2-Trichloroethane	ND	5.0	
75-35-4	1,1-Dichloroethylene	ND	5.0	
563-58-6	1,1-Dichloropropene	ND	5.0	
75-34-3	1,1-dichloroethane	ND	5.0	
87-61-6	1,2,3-Trichlorobenzene	ND	5.0	
96-18-4	1,2,3-Trichloropropane	ND	5.0	
120-82-1	1,2,4-Trichlorobenzene	ND	5.0	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	
96-12-8	1,2-Dibromo-3-Chloropropane	ND	5.0	
106-93-4	1,2-Dibromomethane	ND	5.0	
95-50-1	1,2-Dichlorobenzene	ND	5.0	
107-06-2	1,2-Dichloroethane	ND	5.0	
78-87-5	1,2-Dichloropropane	ND	5.0	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	
541-73-1	1,3-Dichlorobenzene	ND	5.0	
142-28-9	1,3-Dichloropropane	ND	5.0	
106-46-7	1,4-Dichlorobenzene	ND	5.0	
594-20-7	2,2-Dichloropropane	ND	5.0	
78-93-3	2-Butanone (MEK)	ND	20	
110-75-8	2-Chloroethylvinylether	ND	15	
95-49-8	2-Chlorotoluene	ND	5.0	
591-78-6	2-Hexanone	ND	3.0	
67-64-1	2-Propanone (acetone)	17	10	J
106-43-4	4-Chlorotoluene	ND	5.0	
108-10-1	4-Methyl-2-Pentanone(MIBK)	ND	2.5	
107-02-8	Acreolin	ND	50	
107-13-1	Acrylonitrile	ND	25	
71-43-2	Benzene	ND	5.0	
108-86-1	Bromobenzene	ND	5.0	
74-97-5	Bromochloromethane	ND	5.0	
75-27-4	Bromodichloromethane	ND	5.0	
75-25-2	Bromoform	ND	5.0	
74-83-9	Bromomethane	ND	5.0	
75-15-0	Carbon Disulfide	5.0	15	L

56-23-5	Carbon tetrachloride	ND	5.0
108-90-7	Chlorobenzene	ND	5.0
75-00-3	Chloroethane	ND	5.0
67-66-3	Chloroform	ND	5.0
74-87-3	Chloromethane	ND	5.0
124-48-1	Dibromochloromethane	ND	5.0
74-95-3	Dibromomethane	ND	5.0
75-71-8	Dichlorodifluoromethane	ND	5.0
60-29-7	Ethyl Ether	ND	15
100-41-4	Ethylbenzene	ND	5.0
462-06-6	Fluorobenzene	ND	5.0
87-68-3	Hexachlorobutadiene	ND	5.0
98-82-8	Isopropylbenzene	ND	5.0
100-41-4/106-42-	M/P Xylene	ND	10
1634-04-4	Methyl-t-Butyl Ether	ND	5.0
75-09-2	Methylene Chloride	ND	5.0
104-51-8	N-Butylbenzene	ND	5.0
103-65-1	N-Propylbenzene	ND	5.0
91-20-3	Naphthalene	ND	5.0
95-47-6	Ortho Xylene	ND	5.0
99-87-6	Para-Isopropyltoluene	ND	5.0
135-98-8	Sec-Butylbenzene	ND	5.0
100-42-5	Styrene	ND	5.0
98-06-6	Tert-Butylbenzene	ND	5.0
127-18-4	Tetrachloroethylene	ND	5.0
109-99-9	Tetrahydrofuran	ND	35
108-88-3	Toluene	ND	5.0
156-60-5	Trans-1,2-Dichloroethylene	ND	5.0
79-01-6	Trichloroethylene	ND	5.0
75-69-4	Trichlorofluoromethane	ND	5.0
108-05-4	Vinyl Acetate	ND	30
75-01-4	Vinyl Chloride	ND	5.0
10061-01-5	c-1,3-dichloropropene	ND	5.0
156-59-2	cis-1,2-Dichloroethylene	ND	5.0
10061-02-6	t-1,3-Dichloropropene	ND	5.0

Surrogate Compounds	Recoveries (%)	QC Ranges
1,2-Dichloroethane-D4	123	76 - 139
Toluene-D8	101	74 - 116
1,4-Bromofluorobenzene	94	79 - 117

Comments: 95410

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

VOAs in Water Med Level Method

Client Sample ID:	95359	Lab Sample ID:	AA19751
Date of Collection:	1/30/02	Matrix	Water
Date of Extraction:	1/31/02	Volume Purged:	5.0 mL
Date of Analysis:	1/31/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	<2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	
71-55-6	1,1,1-Trichloroethane	ND	5.0	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	
76-13-1	1,1,2-Trichloro-1,2,2-Trifluoroeth	ND	5.0	
79-00-5	1,1,2-Trichloroethane	ND	5.0	
75-35-4	1,1-Dichloroethylene	ND	5.0	
563-58-6	1,1-Dichloropropene	ND	5.0	
75-34-3	1,1-dichloroethane	ND	5.0	
87-61-6	1,2,3-Trichlorobenzene	ND	5.0	
96-18-4	1,2,3-Trichloropropane	ND	5.0	
120-82-1	1,2,4-Trichlorobenzene	ND	5.0	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	
96-12-8	1,2-Dibromo-3-Chloropropane	ND	5.0	
106-93-4	1,2-Dibromomethane	ND	5.0	
95-50-1	1,2-Dichlorobenzene	ND	5.0	
107-06-2	1,2-Dichloroethane	ND	5.0	
78-87-5	1,2-Dichloropropane	ND	5.0	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	
541-73-1	1,3-Dichlorobenzene	ND	5.0	
142-28-9	1,3-Dichloropropane	ND	5.0	
106-46-7	1,4-Dichlorobenzene	ND	5.0	
594-20-7	2,2-Dichloropropane	ND	5.0	
78-93-3	2-Butanone (MEK)	ND	20	
110-75-8	2-Chloroethylvinylether	ND	15	
95-49-8	2-Chlorotoluene	ND	5.0	
591-78-6	2-Hexanone	ND	3.0	
67-64-1	2-Propanone (acetone)	**8.1**	10	J,L
106-43-4	4-Chlorotoluene	ND	5.0	
108-10-1	4-Methyl-2-Pentanone(MIBK)	ND	2.5	
107-02-8	Acreolin	ND	50	
107-13-1	Acrylonitrile	ND	25	
71-43-2	Benzene	ND	5.0	
108-86-1	Bromobenzene	ND	5.0	
74-97-5	Bromochloromethane	ND	5.0	
75-27-4	Bromodichloromethane	ND	5.0	
75-25-2	Bromoform	ND	5.0	
74-83-9	Bromomethane	ND	5.0	
75-15-0	Carbon Disulfide	ND	15	

56-23-5	Carbon tetrachloride	ND	5.0
108-90-7	Chlorobenzene	ND	5.0
75-00-3	Chloroethane	ND	5.0
67-66-3	Chloroform	ND	5.0
74-87-3	Chloromethane	ND	5.0
124-48-1	Dibromochloromethane	ND	5.0
74-95-3	Dibromomethane	ND	5.0
75-71-8	Dichlorodifluoromethane	ND	5.0
60-29-7	Ethyl Ether	ND	15
100-41-4	Ethylbenzene	ND	5.0
462-06-6	Fluorobenzene	ND	5.0
87-68-3	Hexachlorobutadiene	ND	5.0
98-82-8	Isopropylbenzene	ND	5.0
100-41-4/106-42-	M/P Xylene	ND	10
1634-04-4	Methyl-t-Butyl Ether	ND	5.0
75-09-2	Methylene Chloride	ND	5.0
104-51-8	N-Butylbenzene	ND	5.0
103-65-1	N-Propylbenzene	ND	5.0
91-20-3	Naphthalene	ND	5.0
95-47-6	Ortho Xylene	ND	5.0
99-87-6	Para-Isopropyltoluene	ND	5.0
135-98-8	Sec-Butylbenzene	ND	5.0
100-42-5	Styrene	ND	5.0
98-06-6	Tert-Butylbenzene	ND	5.0
127-18-4	Tetrachloroethylene	ND	5.0
109-99-9	Tetrahydrofuran	ND	35
108-88-3	Toluene	ND	5.0
156-60-5	Trans-1,2-Dichloroethylene	ND	5.0
79-01-6	Trichloroethylene	ND	5.0
75-69-4	Trichlorofluoromethane	ND	5.0
108-05-4	Vinyl Acetate	ND	30
75-01-4	Vinyl Chloride	ND	5.0
10061-01-5	c-1,3-dichloropropene	ND	5.0
156-59-2	cis-1,2-Dichloroethylene	ND	5.0
10061-02-6	t-1,3-Dichloropropene	ND	5.0

Surrogate Compounds	Recoveries (%)	QC Ranges
1,2-Dichloroethane-D4	114	76 - 139
Toluene-D8	95	74 - 116
1,4-Bromofluorobenzene	88	79 - 117

Comments: 95359

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Laboratory Blank for SVOAMW

Client Sample ID:	N/A	Lab Sample ID:	N/A
Date of Collection:	N/A	Matrix	Water
Date of Extraction:	1/31/02	Volume Purged:	5.0 mL
Date of Analysis:	1/31/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	<2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	
71-55-6	1,1,1-Trichloroethane	ND	5.0	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	
76-13-1	1,1,2-Trichloro-1,2,2-Trifluoroeth	ND	5.0	
79-00-5	1,1,2-Trichloroethane	ND	5.0	
75-35-4	1,1-Dichloroethylene	ND	5.0	
563-58-6	1,1-Dichloropropene	ND	5.0	
75-34-3	1,1-dichloroethane	ND	5.0	
87-61-6	1,2,3-Trichlorobenzene	ND	5.0	
96-18-4	1,2,3-Trichloropropane	ND	5.0	
120-82-1	1,2,4-Trichlorobenzene	ND	5.0	
95-63-6	1,2,4-Trimethylbenzene	ND	5.0	
96-12-8	1,2-Dibromo-3-Chloropropane	ND	5.0	
106-93-4	1,2-Dibromomethane	ND	5.0	
95-50-1	1,2-Dichlorobenzene	ND	5.0	
107-06-2	1,2-Dichloroethane	ND	5.0	
78-87-5	1,2-Dichloropropane	ND	5.0	
108-67-8	1,3,5-Trimethylbenzene	ND	5.0	
541-73-1	1,3-Dichlorobenzene	ND	5.0	
142-28-9	1,3-Dichloropropane	ND	5.0	
106-46-7	1,4-Dichlorobenzene	ND	5.0	
594-20-7	2,2-Dichloropropane	ND	5.0	
78-93-3	2-Butanone (MEK)	ND	20	
110-75-8	2-Chloroethylvinylether	ND	15	
95-49-8	2-Chlorotoluene	ND	5.0	
591-78-6	2-Hexanone	ND	3.0	
67-64-1	2-Propanone (acetone)	ND	10	
106-43-4	4-Chlorotoluene	ND	5.0	
108-10-1	4-Methyl-2-Pentanone(MIBK)	ND	2.5	
107-02-8	Acreolin	ND	50	
107-13-1	Acrylonitrile	ND	25	
71-43-2	Benzene	ND	5.0	
108-86-1	Bromobenzene	ND	5.0	
74-97-5	Bromochloromethane	ND	5.0	
75-27-4	Bromodichloromethane	ND	5.0	
75-25-2	Bromoform	ND	5.0	
74-83-9	Bromomethane	ND	5.0	
75-15-0	Carbon Disulfide	ND	15	

56-23-5	Carbon tetrachloride	ND	5.0
108-90-7	Chlorobenzene	ND	5.0
75-00-3	Chloroethane	ND	5.0
67-66-3	Chloroform	ND	5.0
74-87-3	Chloromethane	ND	5.0
124-48-1	Dibromochloromethane	ND	5.0
74-95-3	Dibromomethane	ND	5.0
75-71-8	Dichlorodifluoromethane	ND	5.0
60-29-7	Ethyl Ether	ND	15
100-41-4	Ethylbenzene	ND	5.0
462-06-6	Fluorobenzene	ND	5.0
87-68-3	Hexachlorobutadiene	ND	5.0
98-82-8	Isopropylbenzene	ND	5.0
100-41-4/106-42-	M/P Xylene	ND	10
1634-04-4	Methyl-t-Butyl Ether	ND	5.0
75-09-2	Methylene Chloride	ND	5.0
104-51-8	N-Butylbenzene	ND	5.0
103-65-1	N-Propylbenzene	ND	5.0
91-20-3	Naphthalene	ND	5.0
95-47-6	Ortho Xylene	ND	5.0
99-87-6	Para-Isopropyltoluene	ND	5.0
135-98-8	Sec-Butylbenzene	ND	5.0
100-42-5	Styrene	ND	5.0
98-06-6	Tert-Butylbenzene	ND	5.0
127-18-4	Tetrachloroethylene	ND	5.0
109-99-9	Tetrahydrofuran	ND	35
108-88-3	Toluene	ND	5.0
156-60-5	Trans-1,2-Dichloroethylene	ND	5.0
79-01-6	Trichloroethylene	ND	5.0
75-69-4	Trichlorofluoromethane	ND	5.0
108-05-4	Vinyl Acetate	ND	30
75-01-4	Vinyl Chloride	ND	5.0
10061-01-5	c-1,3-dichloropropene	ND	5.0
156-59-2	cis-1,2-Dichloroethylene	ND	5.0
10061-02-6	t-1,3-Dichloropropene	ND	5.0

Surrogate Compounds	**Recoveries (%)**	**QC Ranges**
1,2-Dichloroethane-D4	122	76 - 139
Toluene-D8	96	74 - 116
1,4-Bromofluorobenzene	88	79 - 117

Comments: METHOD BLANK ASSOCIATED WITH SAMPLES 95409, 95410, 95359.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

VOA MATRIX SPIKE (MS) / MATRIX SPIKE DUPLICATE (MSD) RECOVERY

Mohawk Tannery - Nashua, NH

Sample ID AA19751

PARAMETER	SPIKE ADDED ug/L	SAMPLE CONCENTRATION ug/L	MS CONCENTRATION ug/L	MS % REC	QC LIMITS (% REC)
1,1,1-Trichloroethane	20.0	ND	23.0	115	48 - 154
1,1-Dichloroethylene	20.0	ND	25.7	128	48 - 161
1,2-Dichloroethane	20.0	ND	21.5	108	66 - 134
1,4-Dichlorobenzene	20.0	ND	19.5	98	67 - 119
Benzene	20.0	ND	19.5	98	68 - 129
Bromodichloromethane	20.0	ND	22.2	111	55 - 129
Bromoform	20.0	ND	17.5	88	46 - 105
Carbon tetrachloride	20.0	ND	22.5	112	65 - 140
Chloroform	20.0	ND	22.5	112	58 - 140
Dibromochloromethane	20.0	ND	17.1	86	50 - 114
Trichloroethylene	20.0	ND	20.9	104	49 - 154
Vinyl Chloride	20.0	ND	21.1	106	78 - 200

Comments:

PARAMETER	MSD SPIKE ADDED	MSD CONCENTRATION ug/L	MSD % REC	RPD %	QC LIMITS RPD
1,1,1-Trichloroethane	20.0	22.6	113	2	22
1,1-Dichloroethylene	20.0	25.5	128	0	29
1,2-Dichloroethane	20.0	22.3	112	4	23
1,4-Dichlorobenzene	20.0	20.2	101	4	22
Benzene	20.0	20.5	102	5	16
Bromodichloromethane	20.0	20.6	103	7	16
Bromoform	20.0	18.0	90	3	15
Carbon tetrachloride	20.0	22.8	114	2	12
Chloroform	20.0	23.6	118	5	14
Dibromochloromethane	20.0	17.9	90	5	30
Trichloroethylene	20.0	20.9	104	0	22
Vinyl Chloride	20.0	23.2	116	9	23

Comments:

Samples in Batch: AA19749 AA19750 AA19751

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Laboratory Duplicate Results

Mohawk Tannery - Nashua, NH

Sample ID: AA19751

PARAMETER	SAMPLE RESULT ug/L	SAMPLE DUPLICATE RESULT ug/L	PRECISION RPD %	QC LIMITS
1,1,1,2-Tetrachloroethane	ND	ND	ND	30
1,1,1-Trichloroethane	ND	ND	ND	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	30
1,1,2-Trichloro-1,2,2-Trifluoroeth	ND	ND		30
1,1,2-Trichloroethane	ND	ND	ND	30
1,1-Dichloroethylene	ND	ND	ND	30
1,1-Dichloropropene	ND	ND	ND	30
1,1-dichloroethane	ND	ND	ND	30
1,2,3-Trichlorobenzene	ND	ND	ND	30
1,2,3-Trichloropropane	ND	ND	ND	30
1,2,4-Trichlorobenzene	ND	ND	ND	30
1,2,4-Trimethylbenzene	ND	ND	ND	30
1,2-Dibromo-3-Chloropropane	ND	ND	ND	30
1,2-Dibromomethane	ND	ND	ND	30
1,2-Dichlorobenzene	ND	ND	ND	30
1,2-Dichloroethane	ND	ND	ND	30
1,2-Dichloropropane	ND	ND	ND	30
1,3,5-Trimethylbenzene	ND	ND	ND	30
1,3-Dichlorobenzene	ND	ND	ND	30
1,3-Dichloropropane	ND	ND	ND	30
1,4-Dichlorobenzene	ND	ND	ND	30
2,2-Dichloropropane	ND	ND	ND	30
2-Butanone (MEK)	ND	ND	ND	30
2-Chloroethylvinylether	ND	ND	ND	30
2-Chlorotoluene	ND	ND	ND	30
2-Hexanone	ND	ND	ND	30
2-Propanone (acetone)	8.1	7.9	2.50	30
4-Chlorotoluene	ND	ND	ND	30
4-Methyl-2-Pentanone(MIBK)	ND	ND	ND	30
Acreolin	ND	ND	ND	30
Acrylonitrile	ND	ND	ND	30
Benzene	ND	ND	ND	30
Bromobenzene	ND	ND	ND	30
Bromochloromethane	ND	ND	ND	30
Bromodichloromethane	ND	ND	ND	30
Bromoform	ND	ND	ND	30
Bromomethane	ND	ND	ND	30
Carbon Disulfide	ND	ND	ND	30
Carbon tetrachloride	ND	ND	ND	30
Chlorobenzene	ND	ND	ND	30
Chloroethane	ND	ND	ND	30
Chloroform	ND	ND	ND	30
Chloromethane	ND	ND	ND	30
Dibromochloromethane	ND	ND	ND	30
Dibromomethane	ND	ND	ND	30
Dichlorodifluoromethane	ND	ND	ND	30
Ethyl Ether	ND	ND	ND	30
Ethylbenzene	ND	ND	ND	30
Fluorobenzene	ND	ND	ND	30

Hexachlorobutadiene	ND	ND	ND	30
Isopropylbenzene	ND	ND	ND	30
M/P Xylene	ND	ND	ND	30
Methyl-t-Butyl Ether	ND	ND	ND	30
Methylene Chloride	ND	ND	ND	30
N-Butylbenzene	ND	ND	ND	30
N-Propylbenzene	ND	ND	ND	30
Naphthalene	ND	ND	ND	30
Ortho Xylene	ND	ND	ND	30
Para-Isopropyltoluene	ND	ND	ND	30
Sec-Butylbenzene	ND	ND	ND	30
Styrene	ND	ND	ND	30
Tert-Butylbenzene	ND	ND	ND	30
Tetrachloroethylene	ND	ND	ND	30
Tetrahydrofuran	ND	ND	ND	30
Toluene	ND	ND	ND	30
Trans-1,2-Dichloroethylene	ND	ND	ND	30
Trichloroethylene	ND	ND	ND	30
Trichlorofluoromethane	ND	ND	ND	30
Vinyl Acetate	ND	ND	ND	30
Vinyl Chloride	ND	ND	ND	30
c-1,3-dichloropropene	ND	ND	ND	30
cis-1,2-Dichloroethylene	ND	ND	ND	30
t-1,3-Dichloropropene	ND	ND	ND	30

EPA
gion 1, New England

United States Environmental Protection Agency
Office of Environmental Measurement & Evaluation
11 Technology Drive
North Chelmsford, MA 01863-2431

Laboratory Report

February 26, 2002

Mr Dan Granz - EIA / OEME
U.S. EPA New England Laboratory
11 Technology Drive
N. Chelmsford, MA 01863-2431

Project Number: 02010033
Project: Mohawk Tannery - Nashua, NH
Analysis: Semivolatile Organic Compounds by GC/MS
Analyst: Dan Boudreau DB 2/26/02

Analytical Procedure:

All samples were received and logged in by the laboratory according to the SOP for Sample Log-in (EIA-ADMLOGN6.SOP, 3/2000).

Sample preparation and analysis was done following the EPA Region I SOP, BNAWCLP1.SOP.

The SOP for this method is based on the US EPA Contract Laboratory Program, Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Exhibit B, Analytical Methods for Semivolatiles, Revision OLM04.2, 1999.

The analysis was performed by ESAT contractors working at the EPA New England Laboratory.

Date Samples Received by the Laboratory 1/30/02

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8333.

Sincerely,
W J Andrade 02/27/02
Dr. William J. Andrade
Advanced Analytical Chemistry Specialist

Qualifiers:

RL = Reporting limit
ND = Not Detected above Reporting limit
NA = Not Applicable due to high sample dilutions or sample interferences
NC = Not calculated since analyte concentration is ND.
J = Estimated value
E = Estimated value exceeds the calibration range
L = Estimated value is below the calibration range
B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 5 times the concentration in the blank.
R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Semivolatile Organic Compounds by GC/MS

Client Sample ID:	95410	Lab Sample ID:	AA19750
Date of Collection:	1/30/02	Matrix	Water
Date of Extraction:	2/6/02	Volume Extracted:	1000 mL
Date of Analysis:	2/8/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	7.3

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
92-52-4	1,1'-Biphenyl	ND	10	
108-60-1	2,2'-oxybis(1-chloropropane)	ND	10	
95-95-4	2,4,5-Trichorophenol	ND	10	
88-06-2	2,4,6-Trichlorophenol	ND	10	
120-83-2	2,4-Dichlorophenol	ND	10	
51-28-5	2,4-Dinitrophenol	ND	10	
121-14-2	2,4-Dinitrotoluene	ND	10	
105-67-9	2,4-dimethylphenol	ND	10	
606-20-2	2,6-Dinitrotoluene	ND	10	
91-58-7	2-Chloronaphthalene	ND	10	
95-57-8	2-Chlorophenol	ND	10	
91-57-6	2-Methylnaphthalene	ND	10	
95-48-7	2-Methylphenol	0.8	10	L
88-74-4	2-Nitroaniline	ND	10	
88-75-5	2-Nitrophenol	ND	10	
91-94-1	3,3'-Dichlorobenzidine	ND	10	
99-09-2	3-Nitroaniline	ND	10	
534-52-1	4,6-Dinitro-2-methylphenol	ND	10	
101-55-3	4-Bromophenyl-phenylether	ND	10	
59-50-7	4-Chloro-3-methylphenol	ND	10	
106-47-8	4-Chloroaniline	ND	10	
7005-72-3	4-Chlorophenyl-phenylether	ND	10	
106-44-5	4-Methylphenol	11	10	
100-01-6	4-Nitroaniline	ND	10	
100-02-7	4-Nitrophenol	ND	10	
83-32-9	Acenaphthene	ND	10	
208-96-8	Acenaphthylene	ND	10	
98-86-2	Acetophenone	ND	10	
120-12-7	Anthracene	ND	10	
1912-24-9	Atrazine	ND	10	
100-52-7	Benzaldehyde	ND	10	
56-55-3	Benzo(a)anthracene	ND	10	
50-32-8	Benzo(a)pyrene	ND	10	
205-99-2	Benzo(b)fluoranthene	ND	10	
191-24-2	Benzo(g,h,i)perylene	ND	10	
207-08-9	Benzo(k)fluoranthene	ND	10	
111-44-4	Bis(2-Chloroethyl)ether	ND	10	
117-81-7	Bis(2-ethylhexyl)phthalate	ND	10	
85-68-7	Butylbenzylphthalate	ND	10	
86-74-8	Carbazole	ND	10	
218-01-9	Chrysene	ND	10	
84-74-2	Di-n-buytylphthalate	ND	10	

117-84-0	Di-n-octyl phthalate	ND	10	
53-70-3	Dibenz(a,h)anthracene	ND	10	
132-64-9	Dibenzofuran	ND	10	
84-66-2	Diethylphthalate	ND	10	
131-11-3	Dimethyl phthalate	ND	10	
206-44-0	Fluoranthene	ND	10	
86-73-7	Fluorene	ND	10	
118-74-1	Hexachlorobenzene	ND	10	
87-68-3	Hexachlorobutadiene	ND	10	
77-47-4	Hexachlorocyclopentadiene	ND	10	
67-72-1	Hexachloroethane	ND	10	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	10	
78-59-1	Isophorone	ND	10	
86-30-6	N-Nitrosodiphenylamine	ND	10	
621-64-7	N-nitroso-di-n-propylamine	ND	10	
91-20-3	Naphthalene	ND	10	
98-95-3	Nitrobenzene	ND	10	
87-86-5	Pentachlorophenol	ND	10	
85-01-8	Phenanthrene	ND	10	
108-95-2	Phenol	2	10	L
129-00-0	Pyrene	ND	10	
111-91-1	bis(-2-Chloroethoxy)methane	ND	10	
105-60-2	e-Caprolactam	ND	10	

Surrogate Compounds	Recoveries (%)	QC Ranges
2-Fluorophenol	90	21 - 110
Phenol-d5	90	10 - 110
2-Chlorophenol-d4	91	33 - 110
1,2-Dichlorobenzene-d4	78	16 - 110
Nitrobenzene-d5	92	35 - 114
2-Fluorobiphenyl	87	43 - 116
2,4,6-Tribromophenol	107	10 - 123
Terphenyl	81	33 - 141

Comments:

Tentatively Identified Non-Target Compounds

4-methyl Pentanoic acid	4 ppb	J
Benzenacetic acid	35 ppb	J
5,6-Dimethyl-1H-benzotriazole	9 ppb	J
(1,1,3,3-tetramethylbutyl) Phenol	6 ppb	J
2(3H)-Benzothiazolone	19 ppb	J
4-(1,1,3,3-tetramethylbutyl) Phenol	7 ppb	J

Seven unknown compounds ranging from 5 - 9 ppb.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Laboratory Blank Results

Client Sample ID:	N/A	Lab Sample ID:	N/A
Date of Collection:	N/A	Matrix	Water
Date of Extraction:	2/7/02	Volume Extracted:	1000 mL
Date of Analysis:	2/7/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	6.2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
92-52-4	1,1'-Biphenyl	ND	10	
108-60-1	2,2'-oxybis(1-chloropropane)	ND	10	
95-95-4	2,4,5-Trichorophenol	ND	10	
88-06-2	2,4,6-Trichlorophenol	ND	10	
120-83-2	2,4-Dichlorophenol	ND	10	
51-28-5	2,4-Dinitrophenol	ND	10	
121-14-2	2,4-Dinitrotoluene	ND	10	
105-67-9	2,4-dimethylphenol	ND	10	
606-20-2	2,6-Dinitrotoluene	ND	10	
91-58-7	2-Chloronaphthalene	ND	10	
95-57-8	2-Chlorophenol	ND	10	
91-57-6	2-Methylnaphthalene	ND	10	
95-48-7	2-Methylphenol	ND	10	
88-74-4	2-Nitroaniline	ND	10	
88-75-5	2-Nitrophenol	ND	10	
91-94-1	3,3'-Dichlorobenzidine	ND	10	
99-09-2	3-Nitroaniline	ND	10	
534-52-1	4,6-Dinitro-2-methylphenol	ND	10	
101-55-3	4-Bromophenyl-phenylether	ND	10	
59-50-7	4-Chloro-3-methylphenol	ND	10	
106-47-8	4-Chloroaniline	ND	10	
7005-72-3	4-Chlorophenyl-phenylether	ND	10	
106-44-5	4-Methylphenol	ND	10	
100-01-6	4-Nitroaniline	ND	10	
100-02-7	4-Nitrophenol	ND	10	
83-32-9	Acenaphthene	ND	10	
208-96-8	Acenaphthylene	ND	10	
98-86-2	Acetophenone	ND	10	
120-12-7	Anthracene	ND	10	
1912-24-9	Atrazine	ND	10	
100-52-7	Benzaldehyde	ND	10	
56-55-3	Benzo(a)anthracene	ND	10	
50-32-8	Benzo(a)pyrene	ND	10	
205-99-2	Benzo(b)fluoranthene	ND	10	
191-24-2	Benzo(g,h,i)perylene	ND	10	
207-08-9	Benzo(k)fluoranthene	ND	10	
111-44-4	Bis(2-Chloroethyl)ether	ND	10	
117-81-7	Bis(2-ethylhexyl)phthalate	0.7	10	L
85-68-7	Butylbenzylphthalate	ND	10	
86-74-8	Carbazole	ND	10	
218-01-9	Chrysene	ND	10	
84-74-2	Di-n-buytylphthalate	ND	10	

117-84-0	Di-n-octyl phthalate	ND	10	
53-70-3	Dibenz(a,h)anthracene	ND	10	
132-64-9	Dibenzofuran	ND	10	
84-66-2	Diethylphthalate	**0.7**	10	L
131-11-3	Dimethyl phthalate	ND	10	
206-44-0	Fluoranthene	ND	10	
86-73-7	Fluorene	ND	10	
118-74-1	Hexachlorobenzene	ND	10	
87-68-3	Hexachlorobutadiene	ND	10	
77-47-4	Hexachlorocyclopentadiene	ND	10	
67-72-1	Hexachloroethane	ND	10	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	10	
78-59-1	Isophorone	ND	10	
86-30-6	N-Nitrosodiphenylamine	ND	10	
621-64-7	N-nitroso-di-n-propylamine	ND	10	
91-20-3	Naphthalene	ND	10	
98-95-3	Nitrobenzene	ND	10	
87-86-5	Pentachlorophenol	ND	10	
85-01-8	Phenanthrene	ND	10	
108-95-2	Phenol	ND	10	
129-00-0	Pyrene	ND	10	
111-91-1	bis(-2-Chloroethoxy)methane	ND	10	
105-60-2	e-Caprolactam	**822**	10	E

Surrogate Compounds	**Recoveries (%)**	**QC Ranges**
2-Fluorophenol	51	21 - 110
Phenol-d5	55	10 - 110
2-Chlorophenol-d4	95	33 - 110
1,2-Dichlorobenzene-d4	69	16 - 110
Nitrobenzene-d5	92	35 - 114
2-Fluorobiphenyl	87	43 - 116
2,4,6-Tribromophenol	92	10 - 123
Terphenyl	97	33 - 141

Comments: The target analyte , e-caprolactam that is repoted in he lab blank is a plasticizer that has been detected at various levels in other blanks. It is associated with the lab DI system.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Semivolatile Organic Compounds by GC/MS

Client Sample ID:	95359	Lab Sample ID:	AA19751
Date of Collection:	1/30/02	Matrix	Water
Date of Extraction:	2/6/02	Volume Extracted:	920 mL
Date of Analysis:	2/8/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	7.5

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
92-52-4	1,1'-Biphenyl	ND	11	
108-60-1	2,2'-oxybis(1-chloropropane)	ND	11	
95-95-4	2,4,5-Trichorophenol	ND	11	
88-06-2	2,4,6-Trichlorophenol	ND	11	
120-83-2	2,4-Dichlorophenol	ND	11	
51-28-5	2,4-Dinitrophenol	ND	11	
121-14-2	2,4-Dinitrotoluene	ND	11	
105-67-9	2,4-dimethylphenol	ND	11	
606-20-2	2,6-Dinitrotoluene	ND	11	
91-58-7	2-Chloronaphthalene	ND	11	
95-57-8	2-Chlorophenol	ND	11	
91-57-6	2-Methylnaphthalene	ND	11	
95-48-7	2-Methylphenol	ND	11	
88-74-4	2-Nitroaniline	ND	11	
88-75-5	2-Nitrophenol	ND	11	
91-94-1	3,3'-Dichlorobenzidine	ND	11	
99-09-2	3-Nitroaniline	ND	11	
534-52-1	4,6-Dinitro-2-methylphenol	ND	11	
101-55-3	4-Bromophenyl-phenylether	ND	11	
59-50-7	4-Chloro-3-methylphenol	ND	11	
106-47-8	4-Chloroaniline	ND	11	
7005-72-3	4-Chlorophenyl-phenylether	ND	11	
106-44-5	4-Methylphenol	ND	11	
100-01-6	4-Nitroaniline	ND	11	
100-02-7	4-Nitrophenol	ND	11	
83-32-9	Acenaphthene	ND	11	
208-96-8	Acenaphthylene	ND	11	
98-86-2	Acetophenone	ND	11	
120-12-7	Anthracene	ND	11	
1912-24-9	Atrazine	ND	11	
100-52-7	Benzaldehyde	ND	11	
56-55-3	Benzo(a)anthracene	ND	11	
50-32-8	Benzo(a)pyrene	ND	11	
205-99-2	Benzo(b)fluoranthene	ND	11	
191-24-2	Benzo(g,h,i)perylene	ND	11	
207-08-9	Benzo(k)fluoranthene	ND	11	
111-44-4	Bis(2-Chloroethyl)ether	ND	11	
117-81-7	Bis(2-ethylhexyl)phthalate	ND	11	
85-68-7	Butylbenzylphthalate	ND	11	
86-74-8	Carbazole	ND	11	
218-01-9	Chrysene	ND	11	
84-74-2	Di-n-buytylphthalate	ND	11	

117-84-0	Di-n-octyl phthalate	ND	11	
53-70-3	Dibenz(a,h)anthracene	ND	11	
132-64-9	Dibenzofuran	ND	11	
84-66-2	Diethylphthalate	ND	11	
131-11-3	Dimethyl phthalate	ND	11	
206-44-0	Fluoranthene	ND	11	
86-73-7	Fluorene	ND	11	
118-74-1	Hexachlorobenzene	ND	11	
87-68-3	Hexachlorobutadiene	ND	11	
77-47-4	Hexachlorocyclopentadiene	ND	11	
67-72-1	Hexachloroethane	ND	11	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	11	
78-59-1	Isophorone	ND	11	
86-30-6	N-Nitrosodiphenylamine	ND	11	
621-64-7	N-nitroso-di-n-propylamine	ND	11	
91-20-3	Naphthalene	ND	11	
98-95-3	Nitrobenzene	ND	11	
87-86-5	Pentachlorophenol	ND	11	
85-01-8	Phenanthrene	ND	11	
108-95-2	Phenol	ND	11	
129-00-0	Pyrene	**0.9**	11	L
111-91-1	bis(-2-Chloroethoxy)methane	ND	11	
105-60-2	e-Caprolactam	ND	11	

Surrogate Compounds	**Recoveries (%)**	**QC Ranges**
2-Fluorophenol	92	21 - 110
Phenol-d5	93	10 - 110
2-Chlorophenol-d4	95	33 -.110
1,2-Dichlorobenzene-d4	81	16 - 110
Nitrobenzene-d5	92	35 - 114
2-Fluorobiphenyl	89	43 - 116
2,4,6-Tribromophenol	110	10 - 123
Terphenyl	52	33 - 141

Comments:

Tentatively Identified Compounds

Triphenylphosphine oxide 4 ppb J

Six unknown compounds ranging from 2 -28 ppb.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

BNA MATRIX SPIKE (MS) / MATRIX SPIKE DUPLICATE (MSD) RECOVERY

Mohawk Tannery - Nashua, NH

Sample ID AA19750

PARAMETER	SPIKE ADDED ug/L	SAMPLE CONCENTRATION ug/L	MS CONCENTRATION ug/L	MS % REC	QC LIMITS (% REC)
2,4-Dinitrotoluene	50.000	ND	44.9	90	24 - 96
2-Chlorophenol	75.000	ND	68.0	91	27 - 123
4-Chloro-3-methylphenol	75.000	ND	73.3	98	23 - 97
4-Nitrophenol	75.000	ND	92.4	123	10 - 80
Acenaphthene	50.000	ND	41.9	84	46 - 118
-nitroso-di-n-propylamine	50.000	ND	41.6	83	36 - 97
Pentachlorophenol	75.000	ND	111.0	148	9 - 103
Phenol	75.000	2	68.1	88	12 - 110
Pyrene	50.000	ND	45.2	90	26 - 127

PARAMETER	MSD SPIKE ADDED	MSD CONCENTRATION ug/L	MSD % REC	RPD %	QC LIMITS RPD
2,4-Dinitrotoluene	50	90.3	181	67	25
2-Chlorophenol	75	135.1	180	66	25
4-Chloro-3-methylphenol	75	145.0	193	66	25
-Nitrophenol	75	190.1	254	69	25
phthene	50	86.4	173	69	25
so-di-n-propylamine	50	85.7	171	69	25
entachlorophenol	75	213.6	285	63	25
Phenol	75	136.5	179	68	25
Pyrene	50	99.6	199	75	25

Samples in Batch: AA19750 AA19751

EPA Region 1, New England

United States Environmental Protection Agency
Office of Environmental Measurement & Evaluation
11 Technology Drive
North Chelmsford, MA 01863-2431

Laboratory Report

March 04, 2002

Mr Dan Granz - EIA/ OEME
U.S. EPA New England Laboratory
11 Technology Drive
N. Chelmsford, MA 01863-2431

Project Number: 02010033
Project: Mohawk Tannery - Nashua, NH
Analysis: Pesticides and PCBs in Water
Analyst: Peter Philbrook PEP 3-4-02

Analytical Procedure:

All samples were received and logged in by the laboratory according to the SOP for Sample Log-in (EIA-ADMLOGN7.SOP, 7/2001).

Sample preparation and analysis was done following the EPA Region I SOP, PESWALL3.SOP.

The analysis was carried out using high resolution capillary column chromatography. The 30 meter dual capillary system consists of J&W DB-5 and J&W DB-1701 columns both with a 0.25 mm ID.

Date Samples Received by the Laboratory: 1/30/02

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8333.

Sincerely,
W J Andrade 03/04/02
Dr. William J. Andrade
Advanced Analytical Chemistry Specialist

Qualifiers:

RL = Reporting limit
ND = Not Detected above Reporting limit
NA = Not Applicable due to high sample dilutions or sample interferences
J = Estimated value
E = Estimated value exceeds the calibration range
L = Estimated value is below the calibration range
B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 10 times the concentration in the blank.
P = The confirmation value exceeded 35% difference and is less than 100%. The lower value is reported.
C = The identification has been confirmed by GC/MS.
A = Suspected Aldol condensation product.
N = Tentatively identified compound.
R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Pesticides and PCBs in Water

Client Sample ID:	95410	Lab Sample ID:	AA19750
Date of Collection:	1/30/02	Matrix	Water
Date of Extraction:	2/4/02	Final Volume:	5 mL
Date of Analysis:	2/27/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	8.26
Volume Extracted:	960 mL	GPC Factor:	2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
12674-11-2	Aroclor-1016	ND	1.000	
11104-28-2	Aroclor-1221	ND	1.000	
11141-16-5	Aroclor-1232	ND	1.000	
53469-21-9	Aroclor-1242	ND	1.000	
12672-29-6	Aroclor-1248	ND	1.000	
11097-69-1	Aroclor-1254	ND	1.000	
11096-82-5	Aroclor-1260	ND	1.000	
11100-14-4	Aroclor-1262	ND	1.000	
37324-23-5	Aroclor-1268	ND	1.000	
57-74-9	Technical Chlordane	ND	1.000	
8001-35-2	Toxaphene	ND	1.000	
309-00-2	Aldrin	ND	0.100	
50-29-3	4,4'-DDT	ND	0.059	
76-44-8	Heptachlor	ND	0.059	
72-54-8	4,4'-DDD	ND	0.052	
72-55-9	4,4'-DDE	ND	0.052	
5103-71-9	Alpha Chlordane	ND	0.052	
319-84-6	Alpha-BHC	ND	0.052	
319-85-7	Beta-BHC	ND	0.052	
319-86-8	Delta-BHC	ND	0.052	
60-57-1	Dieldrin	ND	0.052	
959-98-8	Endosulfan I	ND	0.052	
33212-65-9	Endosulfan II	ND	0.052	
1031-07-8	Endosulfan Sulfate	ND	0.052	
72-20-8	Endrin	ND	0.052	
7421-93-4	Endrin Aldehyde	ND	0.052	
53494-70-5	Endrin Ketone	ND	0.052	
5103-74-2	Gamma Chlordane	ND	0.052	
58-89-9	Gamma-BHC	ND	0.052	
1024-57-3	Heptachlor Epoxide	ND	0.052	
72-43-5	Methoxychlor	ND	0.052	

Surrogate Compounds	Recoveries (%)	QC Ranges
2,4,5;6-Tetrachloro-m-xylene	56	25 - 123
Decachlorobiphenyl	94	32 - 145

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Pesticides and PCBs in Water

Client Sample ID:	95359	Lab Sample ID:	AA19751
Date of Collection:	1/30/02	Matrix	Water
Date of Extraction:	2/4/02	Final Volume:	5 mL
Date of Analysis:	2/27/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	7.66
Volume Extracted:	940 mL	GPC Factor:	2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
12674-11-2	Aroclor-1016	ND	1.000	
11104-28-2	Aroclor-1221	ND	1.000	
11141-16-5	Aroclor-1232	ND	1.000	
53469-21-9	Aroclor-1242	ND	1.000	
12672-29-6	Aroclor-1248	ND	1.000	
11097-69-1	Aroclor-1254	ND	1.000	
11096-82-5	Aroclor-1260	ND	1.000	
11100-14-4	Aroclor-1262	ND	1.000	
37324-23-5	Aroclor-1268	ND	1.000	
57-74-9	Technical Chlordane	ND	1.000	
8001-35-2	Toxaphene	ND	1.000	
309-00-2	Aldrin	ND	0.100	
50-29-3	4,4'-DDT	ND	0.059	
76-44-8	Heptachlor	ND	0.059	
72-54-8	4,4'-DDD	ND	0.052	
72-55-9	4,4'-DDE	ND	0.052	
5103-71-9	Alpha Chlordane	ND	0.052	
319-84-6	Alpha-BHC	ND	0.052	
319-85-7	Beta-BHC	ND	0.052	
319-86-8	Delta-BHC	ND	0.052	
60-57-1	Dieldrin	ND	0.052	
959-98-8	Endosulfan I	ND	0.052	
33212-65-9	Endosulfan II	ND	0.052	
1031-07-8	Endosulfan Sulfate	ND	0.052	
72-20-8	Endrin	ND	0.052	
7421-93-4	Endrin Aldehyde	ND	0.052	
53494-70-5	Endrin Ketone	ND	0.052	
5103-74-2	Gamma Chlordane	ND	0.052	
58-89-9	Gamma-BHC	ND	0.052	
1024-57-3	Heptachlor Epoxide	ND	0.052	
72-43-5	Methoxychlor	ND	0.052	

Surrogate Compounds	Recoveries (%)	QC Ranges
2,4,5,6-Tetrachloro-m-xylene	57	25 - 123
Decachlorobiphenyl	88	32 - 145

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Laboratory Blank

Client Sample ID:	N/A	Lab Sample ID:	N/A
Date of Collection:	N/A	Matrix	Water
Date of Extraction:	2/4/02	Final Volume:	5 mL
Date of Analysis:	2/26/02	Percent Solids:	N/A
Dry Weight Extracted:	N/A	Extract Dilution:	1
Wet Weight Extracted:	N/A	pH:	7.67
Volume Extracted:	1000 mL	GPC Factor:	2

CAS Number	Compound	Concentration ug/L	RL ug/L	Qualifier
12674-11-2	Aroclor-1016	ND	1.000	
11104-28-2	Aroclor-1221	ND	1.000	
11141-16-5	Aroclor-1232	ND	1.000	
53469-21-9	Aroclor-1242	ND	1.000	
12672-29-6	Aroclor-1248	ND	1.000	
11097-69-1	Aroclor-1254	ND	1.000	
11096-82-5	Aroclor-1260	ND	1.000	
11100-14-4	Aroclor-1262	ND	1.000	
37324-23-5	Aroclor-1268	ND	1.000	
57-74-9	Technical Chlordane	ND	1.000	
8001-35-2	Toxaphene	ND	1.000	
309-00-2	Aldrin	ND	0.100	
50-29-3	4,4'-DDT	ND	0.056	
76-44-8	Heptachlor	ND	0.056	
72-54-8	4,4'-DDD	ND	0.050	
72-55-9	4,4'-DDE	ND	0.050	
5103-71-9	Alpha Chlordane	ND	0.050	
319-84-6	Alpha-BHC	ND	0.050	
319-85-7	Beta-BHC	ND	0.050	
319-86-8	Delta-BHC	ND	0.050	
60-57-1	Dieldrin	ND	0.050	
959-98-8	Endosulfan I	ND	0.050	
33212-65-9	Endosulfan II	ND	0.050	
1031-07-8	Endosulfan Sulfate	ND	0.050	
72-20-8	Endrin	ND	0.050	
7421-93-4	Endrin Aldehyde	ND	0.050	
53494-70-5	Endrin Ketone	ND	0.050	
5103-74-2	Gamma Chlordane	ND	0.050	
58-89-9	Gamma-BHC	ND	0.050	
1024-57-3	Heptachlor Epoxide	ND	0.050	
72-43-5	Methoxychlor	ND	0.050	

Surrogate Compounds	Recoveries (%)	QC Ranges
2,4,5,6-Tetrachloro-m-xylene	63	25 - 123
Decachlorobiphenyl	72	32 - 145

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

PESTICIDES MATRIX SPIKE (MS) / MATRIX SPIKE DUPLICATE (MSD) RECOVERY

Mohawk Tannery - Nashua, NH

Sample ID: AA19750

PARAMETER	SPIKE ADDED ug/L	SAMPLE CONCENTRATION ug/L	MS CONCENTRATION ug/L	MS % REC	QC LIMITS (% REC)
4,4'-DDT	0.521	ND	0.497	95	38 - 127
Aldrin	0.260	ND	0.141	54	40 - 120
Dieldrin	0.521	ND	0.500	96	52 - 126
Endrin	0.521	ND	0.441	85	56 - 121
Gamma-BHC	0.260	ND	0.192	74	56 - 123
Heptachlor	0.260	ND	0.174	67	40 - 131

PARAMETER	MSD SPIKE ADDED	MSD CONCENTRATION ug/L	MSD % REC	RPD %	QC LIMITS RPD
4,4'-DDT	0.521	0.327	63	41	27
Aldrin	0.260	0.092	35	42	22
Dieldrin	0.521	0.319	61	44	18
Endrin	0.521	0.309	59	35	21
Gamma-BHC	0.260	0.146	56	27	15
Heptachlor	0.260	0.121	47	36	20

Samples in Batch: AA19750 AA19751

REGION I

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
02010033	Mohawk Tannery Nashua, NH Superfund

SAMPLERS: (Signature) [signature]

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	VOA	Pest/PCB	BNA	TM Metals	Dissolved Metals		REMARKS LAB SAMPLE #
TRPV1	1/30/02	720		X	TRIP VOA	2	2						95409
WATR1	1/30/02	1125		X	middle of Lagoon	13	5	3	3	1	1		95410
WATR2	1/30/02	1145		X	North side of Lagoon	9	5	1	1	1	1		95359

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	1/30/02 1630				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
		[signature] ESAT	1/30/02 16:30	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

1-12607

EPA
Region 1, New England

United States Environmental Protection Agency
Office of Environmental Measurement & Evaluation
11 Technology Drive
North Chelmsford, MA 01863-2431

Laboratory Report

March 06, 2002

Mr Dan Granz - EIA / OEME
U.S. EPA New England Laboratory
11 Technology Drive
N. Chelmsford, MA 01863-2431

Project Number: 02010033
Project: Mohawk Tannery - Nashua, NH
Analysis: Dissolved Metals in Water by ICP/MS
Analyst: Michael Dowling
MD 3/6/02

Analytical Procedure:

All samples were received and logged in by the laboratory according to the SOP for Sample Log-in (EIA-ADMLOGN5.SOP, 4/99).

Sample analysis was done following the EPA Region I SOP, INGICPMS1.SOP.

Samples were prepared following the EPA Region I SOP, INGPREP3.SOP.

Samples were analyzed by inductively coupled plasma mass spectrometry. Preparation and analysis SOP's are based on Methods 200.2 and 200.8, respectively, as stated in "Methods for the Determination of Metals in Environmental Samples, Supplement I (EPA/600/R-94/111), Rev. 5.4, May 1994."

Date Samples Received by the Laboratory: 1/30/02

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8333.

Sincerely,
WJ Andrade 03/08/02

Dr. William J. Andrade
Advanced Analytical Chemistry Specialist

Qualifiers: RL = Reporting limit
ND = Not detected above reporting limit
NA = Not applicable
NC = Not calculated since the analyte concentration is ND
J = Estimated value
B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 10 times the concentration in the blank.
R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Dissolved Metals in Water by ICP/MS

Client Sample ID:	95410	Lab Sample ID:	AA19750
Date of Collection:	1/30/02	Matrix	Water
Date of Preparation:	3/5/02	Final Volume:	50.5 mL
Date of Analysis:	3/5/02	Dilution Factor:	1.01
Volume Digested:	N/A	pH:	<2

CAS Number	Parameter	Concentration ug/L	RL ug/L	Qualifier
7429-90-5	Aluminum	**6.7**	5.0	
7440-36-0	Antimony	ND	0.50	
7440-38-2	Arsenic	**2.6**	0.50	
7440-39-3	Barium	**2.5**	0.20	
7440-41-7	Beryllium	ND	0.20	
7440-43-9	Cadmium	ND	0.20	
7440-70-2	Calcium (mg/L)	**82**	0.10	
7440-47-3	Chromium	**22**	0.50	
7440-48-4	Cobalt	**0.50**	0.20	
7440-50-8	Copper	**0.82**	0.20	
7439-89-6	Iron	**277**	50	
7439-92-1	Lead	ND	0.20	J
7439-95-4	Magnesium (mg/L)	**1.6**	0.10	
7439-96-5	Manganese	**4990**	0.20	
7439-98-7	Molybdenum	ND	0.50	
7440-02-0	Nickel	**4.7**	0.20	
7782-49-2	Selenium	**10**	1.0	J
7440-22-4	Silver	ND	0.20	
7440-28-0	Thallium	ND	0.50	J
7440-62-2	Vanadium	**0.49**	0.20	
7440-66-6	Zinc	ND	5.0	

Comments: J = Estimated values due to MS recoveries outside acceptance criteria.

The reported result for Mn is by ICP Method 200.7.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Dissolved Metals in Water by ICP/MS

Client Sample ID:	95359	Lab Sample ID:	AA19751
Date of Collection:	1/30/02	Matrix	Water
Date of Preparation:	3/5/02	Final Volume:	50.5 mL
Date of Analysis:	3/5/02	Dilution Factor:	1.01
Volume Digested:	N/A	pH:	<2

CAS Number	Parameter	Concentration ug/L	RL ug/L	Qualifier
7429-90-5	Aluminum	9.6	5.0	
7440-36-0	Antimony	ND	0.50	
7440-38-2	Arsenic	0.62	0.50	
7440-39-3	Barium	1.1	0.20	
7440-41-7	Beryllium	ND	0.20	
7440-43-9	Cadmium	ND	0.20	
7440-70-2	Calcium (mg/L)	52	0.10	
7440-47-3	Chromium	6.0	0.50	
7440-48-4	Cobalt	0.39	0.20	
7440-50-8	Copper	1.1	0.20	
7439-89-6	Iron	79	50	
7439-92-1	Lead	0.22	0.20	
7439-95-4	Magnesium (mg/L)	0.57	0.10	
7439-96-5	Manganese	1465	0.20	
7439-98-7	Molybdenum	0.91	0.50	
7440-02-0	Nickel	3.0	0.20	
7782-49-2	Selenium	1.9	1.0	
7440-22-4	Silver	ND	0.20	
7440-28-0	Thallium	ND	0.50	
7440-62-2	Vanadium	0.21	0.20	
7440-66-6	Zinc	ND	5.0	

Comments: The reported result for Mn is by ICP Method 200.7.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

METALS MATRIX SPIKE (MS) RESULTS

Mohawk Tannery - Nashua, NH

Sample ID: AA19750

OMPOUND	SPIKE ADDED ug/L	SAMPLE CONCENTRATION ug/L	MS CONCENTRATION ug/L	MS % REC	QC LIMITS (% REC)
luminum	37.7	6.74	43.2	96.7	70 - 130
ntimony	37.7	ND	30.9	82.0	70 - 130
rsenic	37.7	2.57	40.0	99.3	70 - 130
arium	37.7	2.54	39.4	97.8	70 - 130
eryllium	37.7	ND	38.5	102	70 - 130
admium	37.7	ND	38.3	102	70 - 130
hromium	37.7	22.2	57.3	93.1	70 - 130
obalt	37.7	0.502	38.5	101	70 - 130
opper	37.7	0.824	35.4	91.7	70 - 130
ron	377	277	601	85.9	70 - 130
ead	37.7	ND	53.9	143	70 - 130
anganese	37.7	4990	4700	R	70 - 130
olybdenum	37.7	ND	40.2	107	70 - 130
ickel	37.7	4.69	41.2	96.8	70 - 130
elenium	189	10.3	122	59.1	70 - 130
	37.7	ND	28.6	75.9	70 - 130
	37.7	ND	55.4	147	70 - 130
	37.7	0.487	38.3	100	70 - 130
Zinc	37.7	ND	39.1	104	70 - 130

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Laboratory Duplicate Results

Mohawk Tannery - Nashua, NH

Sample ID: AA19751

COMPOUND	SAMPLE RESULT ug/L	SAMPLE DUPLICATE RESULT ug/L	PRECISION RPD %	QC LIMITS RPD (%)
Aluminum	9.57	9.80	2.4	20
Antimony	ND	ND	NC	20
Arsenic	0.622	0.588	5.6	20
Barium	1.06	1.07	0.94	20
Beryllium	ND	ND	NC	20
Cadmium	ND	ND	NC	20
Calcium (mg/L)	51.8	50.7	2.1	20
Chromium	6.00	5.95	0.84	20
Cobalt	0.385	0.359	7.0	20
Copper	1.10	1.06	3.7	20
Iron	78.8	73.1	7.5	20
Lead	0.223	0.227	1.8	20
Magnesium (mg/L)	0.568	0.573	0.88	20
Manganese	1465	1424	1.1	20
Molybdenum	0.910	0.776	16	20
Nickel	2.98	2.91	2.4	20
Selenium	1.93	ND	NC	20
Silver	ND	ND	NC	20
Thallium	ND	ND	NC	20
Vanadium	0.210	ND	NC	20
Zinc	ND	ND	NC	20

Comments:

EPA
Region 1, New England

United States Environmental Protection Agency
Office of Environmental Measurement & Evaluation
11 Technology Drive
North Chelmsford, MA 01863-2431

Laboratory Report

March 07, 2002

Mr Dan Granz - EIA / OEME
U.S. EPA New England Laboratory
11 Technology Drive
N. Chelmsford, MA 01863-2431

Project Number: 02010033
Project: Mohawk Tannery - Nashua, NH
Analysis: Total Recoverable Metals in Water
Analyst: Michael Dowling
MD 3/7/02

Analytical Procedure:

All samples were received and logged in by the laboratory according to the SOP for Sample Log-in (EIA-ADMLOGN5.SOP, 4/99).

Sample analysis was done following the EPA Region I SOP, INGICPMS1.SOP.

Samples were prepared and analyzed following EPA Region I Sample Prep SOP: EIA-INGPREP3.SOP and ICP-MS SOP: EIA-INGICPMS1.SOP, respectively.

Samples were analyzed by inductively coupled plasma mass spectrometry. Preparation and analysis SOP's are based on Methods 200.2 and 200.8, respectively, as stated in "Methods for the Determination of Metals in Environmental Samples, Supplement I (EPA/600/R-94/111), Rev. 5.4, May 1994."

Date Samples Received by the Laboratory: 1/30/02

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8333.

Sincerely,
W J Andrade 03/08/02
Dr. William J. Andrade
Advanced Analytical Chemistry Specialist

Qualifiers: RL = Reporting limit
ND = Not detected above reporting limit
NA = Not applicable
NC = Not calculated since the analyte concentration is ND
J = Estimated value
B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 10 times the concentration in the blank.
R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Total Recoverable Metals in Water

Client Sample ID:	95410	Lab Sample ID:	AA19750
Date of Collection:	1/30/02	Matrix	Water
Date of Preparation:	3/1/02	Final Volume:	50 mL
Date of Analysis:	3/5/02	Dilution Factor:	1
Volume Digested:	50 mL	pH:	<2

CAS Number	Parameter	Concentration ug/L	RL ug/L	Qualifier
7429-90-5	Aluminum	39	5.0	
7440-36-0	Antimony	ND	2.0	
7440-38-2	Arsenic	2.3	0.50	
7440-39-3	Barium	3.7	0.20	
7440-41-7	Beryllium	ND	0.20	
7440-43-9	Cadmium	ND	0.20	
7440-70-2	Calcium (mg/L)	78	0.10	
7440-47-3	Chromium	113	0.50	
7440-48-4	Cobalt	0.54	0.20	
7440-50-8	Copper	ND	5.0	
7439-89-6	Iron	626	50	
7439-92-1	Lead	0.66	0.20	
7439-95-4	Magnesium (mg/L)	1.4	0.10	
7439-96-5	Manganese	4765	0.20	
7439-98-7	Molybdenum	ND	0.50	
7440-02-0	Nickel	4.5	0.20	
7782-49-2	Selenium	ND	1.0	J
7440-22-4	Silver	ND	0.20	
7440-28-0	Thallium	ND	0.50	
7440-62-2	Vanadium	ND	0.20	
7440-66-6	Zinc	4.2	2.0	

Comments: The reported Mn result is by ICP Method 200.7.

The Se value is estimated due to the low MS recovery.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Total Recoverable Metals in Water

Client Sample ID:	95359	Lab Sample ID:	AA19751
Date of Collection:	1/30/02	Matrix	Water
Date of Preparation:	3/1/02	Final Volume:	50 mL
Date of Analysis:	3/5/02	Dilution Factor:	1
Volume Digested:	50 mL	pH:	<2

CAS Number	Parameter	Concentration ug/L	RL ug/L	Qualifier
7429-90-5	Aluminum	**23**	5.0	
7440-36-0	Antimony	ND	2.0	
7440-38-2	Arsenic	ND	0.50	
7440-39-3	Barium	**1.3**	0.20	
7440-41-7	Beryllium	ND	0.20	
7440-43-9	Cadmium	ND	0.20	
7440-70-2	Calcium (mg/L)	**48**	0.10	
7440-47-3	Chromium	**21**	0.50	
7440-48-4	Cobalt	**0.32**	0.20	
7440-50-8	Copper	ND	5.0	
7439-89-6	Iron	**130**	50	
7439-92-1	Lead	**0.59**	0.20	
7439-95-4	Magnesium (mg/L)	**0.53**	0.10	
7439-96-5	Manganese	**1268**	0.20	
7439-98-7	Molybdenum	**0.78**	0.50	
7440-02-0	Nickel	**2.9**	0.20	
7782-49-2	Selenium	ND	1.0	
7440-22-4	Silver	ND	0.20	
7440-28-0	Thallium	ND	0.50	
7440-62-2	Vanadium	ND	0.20	
7440-66-6	Zinc	**6.5**	2.0	

Comments: The reported Mn result is by ICP Method 200.7.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Mohawk Tannery - Nashua, NH

Laboratory Reagent Blank Result (ug/L)

Client Sample ID:	N/A	Lab Sample ID:	N/A
Date of Collection:	N/A	Matrix	Water
Date of Preparation:	3/1/02	Final Volume:	N/A
Date of Analysis:	3/5/02	Dilution Factor:	N/A
Volume Digested:	N/A	pH:	N/A

CAS Number	Parameter	Concentration ug/L	RL ug/L	Qualifier
7429-90-5	Aluminum	ND	5.0	
7440-36-0	Antimony	ND	0.50	
7440-38-2	Arsenic	ND	0.50	
7440-39-3	Barium	ND	0.20	
7440-41-7	Beryllium	ND	0.20	
7440-43-9	Cadmium	ND	0.20	
7440-70-2	Calcium (mg/L)	ND	0.10	
7440-47-3	Chromium	1.2	0.50	
7440-48-4	Cobalt	ND	0.20	
7440-50-8	Copper	ND	5.0	
7439-89-6	Iron	ND	20	
7439-92-1	Lead	ND	0.20	
7439-95-4	Magnesium (mg/L)	ND	0.10	
7439-96-5	Manganese	ND	0.20	
7439-98-7	Molybdenum	ND	0.50	
7440-02-0	Nickel	ND	0.20	
7782-49-2	Selenium	ND	2.5	
7440-22-4	Silver	ND	0.20	
7440-28-0	Thallium	ND	0.20	
7440-62-2	Vanadium	ND	0.20	
7440-66-6	Zinc	ND	2.0	

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

METALS MATRIX SPIKE (MS) RESULTS

Mohawk Tannery - Nashua, NH

Sample ID: AA19750

COMPOUND	SPIKE ADDED ug/L	SAMPLE CONCENTRATION ug/L	MS CONCENTRATION ug/L	MS % REC	QC LIMITS (% REC)
Aluminum	40.0	38.5	76.2	94	70 - 130
Antimony	40.0	ND	42.9	110	70 - 130
Arsenic	40.0	2.26	43.3	100	70 - 130
Barium	40.0	3.66	42.2	96	70 - 130
Beryllium	40.0	ND	41.4	100	70 - 130
Cadmium	40.0	ND	41.3	100	70 - 130
Chromium	40.0	113	152	98	70 - 130
Cobalt	40.0	0.535	42.2	100	70 - 130
Copper	40.0	ND	41.5	100	70 - 130
Iron	400	626	1030	100	70 - 130
Lead	40.0	0.661	44.2	110	70 - 130
Manganese	40.0	4765	4780	R	70 - 130
Molybdenum	40.0	ND	45.1	110	70 - 130
Nickel	40.0	4.51	44.2	99	70 - 130
Selenium	200	ND	107	54	70 - 130
Silver	40.0	ND	42.4	110	70 - 130
[illegible]	40.0	ND	43.6	110	70 - 130
Vanadium	40.0	ND	37.8	94	70 - 130
Zinc	40.0	4.20	48.1	110	70 - 130

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Laboratory Duplicate Results

Mohawk Tannery - Nashua, NH

Sample ID: AA19751

COMPOUND	SAMPLE RESULT ug/L	SAMPLE DUPLICATE RESULT ug/L	PRECISION RPD %	QC LIMITS RPD (%)
Aluminum	22.5	23.0	2.2	20
Antimony	ND	ND	NC	20
Arsenic	ND	ND	NC	20
Barium	1.25	1.22	2.4	20
Beryllium	ND	ND	NC	20
Cadmium	ND	ND	NC	20
Calcium (mg/L)	47.8	48.4	1.2	20
Chromium	21.3	21.4	0.47	20
Cobalt	0.322	0.318	1.2	20
Copper	ND	5.28	NC	20
Iron	130	134	3.0	20
Lead	0.589	0.598	1.5	20
Magnesium (mg/L)	0.528	0.527	0.19	20
Manganese	1268	1288	1.6	20
Molybdenum	0.777	ND	NC	20
Nickel	2.85	3.01	5.5	20
Selenium	ND	ND	NC	20
Silver	ND	ND	NC	20
Thallium	ND	ND	NC	20
Vanadium	ND	ND	NC	20
Zinc	6.51	6.26	3.9	20

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Laboratory Fortified Blank (LFB) Results

Mohawk Tannery - Nashua, NH

COMPOUND	LFB AMOUNT SPIKED ug/L	LFB RESULT ug/L	LFB RECOVERY %	QC LIMITS %
Aluminum	40.0	44.1	110	85 - 115
Antimony	40.0	43.2	108	85 - 115
Arsenic	40.0	41.9	105	85 - 115
Barium	40.0	40.9	102	85 - 115
Beryllium	40.0	39.6	99	85 - 115
Cadmium	40.0	43.0	108	85 - 115
Chromium	40.0	44.0	110	85 - 115
Cobalt	40.0	44.9	112	85 - 115
Copper	40.0	45.4	114	85 - 115
Iron	400	452	113	85 - 115
Lead	40.0	43.1	108	85 - 115
Manganese	40.0	44.8	112	85 - 115
Molybdenum	40.0	45.0	112	85 - 115
Nickel	40.0	45.0	112	85 - 115
Selenium	200	213	106	85 - 115
Silver	40.0	45.2	113	85 - 115
Thallium	40.0	43.3	108	85 - 115
Vanadium	40.0	41.4	104	85 - 115
Zinc	40.0	45.3	113	85 - 115

The LFB recoveries for Ca and Mg are 94 and 108%, respectively.

Samples in Batch: AA19750 AA19751

APPENDIX G

ANALYTICAL RESULTS FOR SLUDGE, SOIL, AND AIR SAMPLES

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Volatile Organic Analysis (UG/KG)																								
1,1,1-Trichloroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,1,2,2-Tetrachloroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,1,2-Trichloro-1,2,2-trifluoroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,1,2-Trichloroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,1-Dichloroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,1-Dichloroethene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,2,4-Trichlorobenzene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	39	J	35	J
1,2-Dibromo-3-chloropropane		R		R		R		R		R		NA		NA		R		R		R		R		R
1,2-Dibromoethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,2-Dichlorobenzene	820	J	960	J	3200	J	940	J	440	J		NA		NA	200	U	960		620		720		940	
1,2-Dichloroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,2-Dichloropropane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,3-Dichlorobenzene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
1,4-Dichlorobenzene	1200	U	150	J	370	J	130	J	1200	U		NA		NA	200	U	230		150	J	53	J	140	J
2-Butanone	2200		1300	U	1500		1700		2000			NA		NA	200	U	230	U	250	U	180	U	190	U
2-Hexanone	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
4-Methyl-2-Pentanone	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Acetone	1700	EB	1900	EB	1100	EB	1500	EB	1700	EB		NA		NA	200	U	790		850		180	U	210	
Benzene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Bromodichloromethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Bromoform	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Bromomethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Carbon Disulfide	1500		6100		1800		1800		2100			NA		NA	200	U	450	J	210	J	1900		60	J
Carbon Tetrachloride	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Chlorobenzene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	120	J
Chloroethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Chloroform	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	27	J	28	J	28	J	20	J	25	J
Chloromethane	1200	UJ	1300	UJ	840	UJ	860	UJ	1200	UJ		NA		NA	200	UJ	230	UJ	250	UJ	180	UJ	190	UJ
cis-1,2-Dichloroethene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
cis-1,3-Dichloropropene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Cyclohexane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Dibromochloromethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Dichlorodifluoromethane	1200	UJ	1300	UJ	840	UJ	860	UJ	1200	UJ		NA		NA	200	UJ	230	UJ	250	UJ	180	UJ	190	UJ
Ethylbenzene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Isopropylbenzene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Methyl Acetate	5700		8900		5800		4500		2800			NA		NA	200	U	170	J	280	J	64	J	490	
Methyl tert-Butyl Ether	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Methylcyclohexane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Methylene Chloride	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Styrene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Tetrachloroethene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Toluene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Total Xylenes		R		R		R		R		R		NA		NA	200	U	230	U	250	U	180	U	190	U
trans-1,2-Dichloroethene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
trans-1,3-Dichloropropene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Trichloroethene	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Trichlorofluoromethane	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	U	230	U	250	U	180	U	190	U
Vinyl Chloride	1200	U	1300	U	840	U	860	U	1200	U		NA		NA	200	UJ	230	UJ	250	UJ	180	UJ	190	UJ
Volatile Headspace Analysis (PPBV)																										
1,1,1-Trichloroethane		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
1,1,2-Trichloro-1,2,2-trifluoroethane		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
1,1-Dichloroethane		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
1,1-Dichloroethene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Benzene		NA		NA		NA		NA	11	J		NA		NA		NA		NA		NA		NA		NA
Carbon Tetrachloride		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Chlorobenzene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Chloroform		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
cis-1,2-Dichloroethene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Dichlorodifluoromethane		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Ethylbenzene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Freon 114		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
m&p-Xylene		NA		NA		NA		NA	5	J		NA		NA		NA		NA		NA		NA		NA
Methyl tert-Butyl Ether		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Methylene Chloride		NA		NA		NA		NA	17	J		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene		NA		NA		NA		NA	21	J		NA		NA		NA		NA		NA		NA		NA
Toluene		NA		NA		NA		NA	110	UJ		NA		NA		NA		NA		NA		NA		NA
trans-1,2-Dichloroethene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Trichloroethene		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Trichlorofluoromethane		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
Vinyl Chloride		NA		NA		NA		NA	5	UJ		NA		NA		NA		NA		NA		NA		NA
TCLP Volatile Organic Analysis (UG/L)																								
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
1,2-Dichloroethane		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
2-Butanone		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Benzene		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Carbon Tetrachloride		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Chlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Chloroform		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Trichloroethene		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Vinyl Chloride		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA
Sulfur Compounds Analysis (PPBV)																								
2,5-Dimethylthiophene		NA		NA		NA		NA	10	J		NA		NA		NA		NA		NA		NA		NA
2-Ethylthiophene		NA		NA		NA		NA	6.2	J		NA		NA		NA		NA		NA		NA		NA
3-Methylthiophene		NA		NA		NA		NA	100	J		NA		NA		NA		NA		NA		NA		NA
Butyl Mercaptan		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Carbon Disulfide		NA		NA		NA		NA	370	J		NA		NA		NA		NA		NA		NA		NA
Carbonyl Sulfide		NA		NA		NA		NA	26	J		NA		NA		NA		NA		NA		NA		NA
Diethyl Disulfide		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Diethyl Sulfide		NA		NA		NA		NA	9.2	J		NA		NA		NA		NA		NA		NA		NA
Dimethyl Disulfide		NA		NA		NA		NA	100	J		NA		NA		NA		NA		NA		NA		NA
Dimethyl Sulfide		NA		NA		NA		NA	650	*J		NA		NA		NA		NA		NA		NA		NA
Ethyl Mercaptan		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Ethyl Methyl Sulfide		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Hydrogen Sulfide		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Isobutyl Mercaptan		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Isopropyl Mercaptan		NA		NA		NA		NA	14	J		NA		NA		NA		NA		NA		NA		NA
Methyl Mercaptan		NA		NA		NA		NA	4.3	J		NA		NA		NA		NA		NA		NA		NA
n-Propyl Mercaptan		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
tert-Butyl Mercaptan		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Tetrahydrothiophene		NA		NA		NA		NA	4.0	UJ		NA		NA		NA		NA		NA		NA		NA
Thiophene		NA		NA		NA		NA	19	J		NA		NA		NA		NA		NA		NA		NA
Semivolatile Organic Analysis (UG/KG)																								
1,1'-Biphenyl	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2,2'-oxybis(1-Chloropropane)	16000	UJ	65000	UJ	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2,4,5-Trichlorophenol	5000	J	22000	J	24000	J	19000	J	85000	U		NA		NA	63000	U	3600	J	38000	U	39000	U	59000	U
2,4,6-Trichlorophenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2,4-Dichlorophenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2,4-Dimethylphenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2,4-Dinitrophenol	41000	U	160000	U	84000	U	85000	U	85000	U		NA		NA	63000	U	37000	U	38000	U	39000	U	59000	U
2,4-Dinitrotoluene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2,6-Dinitrotoluene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2-Chloronaphthalene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	5200	J	15000	U	15000	U	1700	J	24000	U
2-Chlorophenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2-Methylnaphthalene	16000	U	21000	J	34000	U	34000	U	34000	U		NA		NA	25000	U	1700	J	2000	J	16000	U	24000	U
2-Methylphenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
2-Nitroaniline	41000	U	160000	U	84000	U	85000	U	85000	U		NA		NA	63000	U	37000	U	38000	U	39000	U	59000	U
2-Nitrophenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
3,3'-Dichlorobenzidine	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
3-Nitroaniline	41000	U	160000	U	84000	U	85000	U	85000	U		NA		NA	63000	U	37000	U	38000	U	39000	U	59000	U
4,6-Dinitro-2-methylphenol	41000	U	160000	U	84000	U	85000	U	85000	U		NA		NA	63000	U	37000	U	38000	U	39000	U	59000	U
4-Bromophenyl-phenylether	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
4-Chloro-3-methylphenol	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
4-Chloroaniline	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
4-Chlorophenyl-phenylether	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
4-Methylphenol	630000	*	1300000	*	530000	*	580000	*	700000	*		NA		NA		R	12000	J	11000	J	3100	J		R
4-Nitroaniline	41000	U	160000	U	84000	U	85000	U	85000	U		NA		NA	63000	UJ	37000	UJ	38000	UJ	39000	UJ	59000	UJ
4-Nitrophenol	41000	U	160000	U	84000	UJ	85000	UJ	85000	UJ		NA		NA	63000	U	37000	U	38000	U	39000	U	59000	U
Acenaphthene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Acenaphthylene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Acetophenone	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Anthracene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Atrazine	16000	UJ	65000	UJ	34000	UJ	34000	UJ	34000	UJ		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Benzaldehyde	16000	UJ	65000	UJ	34000	UJ	34000	UJ	34000	UJ		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Benzo(a)anthracene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Benzo(a)pyrene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Benzo(b)fluoranthene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Benzo(g,h,i)perylene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	UJ	15000	UJ	15000	UJ	16000	UJ	24000	UJ
Benzo(k)fluoranthene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Bis(2-Chloroethoxy)methane	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Bis(2-Chloroethyl)ether	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
bis(2-Ethylhexyl)phthalate	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	UJ	15000	UJ	15000	UJ	16000	UJ	24000	UJ
Butylbenzylphthalate	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Caprolactam	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Carbazole	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Chrysene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Di-n-Butylphthalate	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Di-n-octylphthalate	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	UJ	15000	UJ	15000	UJ	16000	UJ	24000	UJ
Dibenzo(a,h)anthracene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Dibenzofuran	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Diethylphthalate	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Dimethylphthalate	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Fluoranthene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Fluorene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Hexachlorobenzene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Hexachlorobutadiene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Hexachlorocyclopentadiene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Hexachloroethane	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Indeno(1,2,3-cd)pyrene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Isophorone	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
N-Nitroso-di-n-propylamine	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
N-Nitroso-diphenylamine	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Naphthalene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	9000	J	75000		47000		3700	J	24000	U
Nitrobenzene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Pentachlorophenol	14000	J	160000	U	32000	J	32000	J	9100	J		NA		NA	63000	U	61000	J	24000	J	28000	J	12000	J
Phenanthrene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
Phenol	9000	J	23000	J	7200	J	7300	J	6300	J		NA		NA	25000	U	67000	J	37000	J	16000	U	24000	U
Pyrene	16000	U	65000	U	34000	U	34000	U	34000	U		NA		NA	25000	U	15000	U	15000	U	16000	U	24000	U
TCLP Semivolatile Organic Analysis (UG/L)																										
2,4,5-Trichlorophenol		NA		NA		NA		NA		NA	26	J	13	J		NA		NA		NA		NA		NA
2,4,6-Trichlorophenol		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
2,4-Dinitrotoluene		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
2-Methylphenol		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
4-Methylphenol		NA		NA		NA		NA		NA	10000	*J	7200	*		NA		NA		NA		NA		NA
Hexachlorobenzene		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
Hexachlorobutadiene		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
Hexachloroethane		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
Nitrobenzene		NA		NA		NA		NA		NA	50	UJ	50	U		NA		NA		NA		NA		NA
Pentachlorophenol		NA		NA		NA		NA		NA	130	UJ	130	U		NA		NA		NA		NA		NA
Pesticide/PCB Analysis (UG/KG)																										
4,4'-DDD	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	5.9	J		NA		NA	4.9	U	5.7	U	29	U	6.1	U	4.6	U
4,4'-DDE	10	J	5.7	J	6.8	J	7.0	J	4.8	J		NA		NA	6.1		51		51		20		10	
4,4'-DDT	4.4	J	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U		NA		NA	4.9	U	5.7	U	29	U	6.1	U	4.6	U
Aldrin	1.7	UJ	1.7	UJ	1.7	UJ	1.7	UJ	6.1	J		NA		NA	2.5	U	14	J	43		3.1	U	2.4	U
alpha-BHC	4.9	J	1.7	UJ	4.3	J	19	*J	24	J		NA		NA	2.5	U	2.9	U	15	U	3.1	U	2.4	U
alpha-Chlordane	8.2	J	3.5	J	11	J	1.7	UJ	62	*J		NA		NA	6.0	EB	220	*JEB	450	*JEB	16	EB	22	EB
Aroclor-1016	33	U	33	U	33	U	33	U	33	U		NA		NA	49	U	57	U	290	U	61	U	46	U
Aroclor-1221	67	U	67	U	67	U	67	U	67	U		NA		NA	99	U	120	U	600	U	120	U	93	U
Aroclor-1232	33	U	33	U	33	U	33	U	33	U		NA		NA	49	U	57	U	290	U	61	U	46	U
Aroclor-1242	33	U	33	U	33	U	33	U	33	U		NA		NA	49	U	57	U	290	U	61	U	46	U

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Aroclor-1248	33	U	33	U	33	U	33	U	33	U		NA		NA	49	U	57	U	290	U	61	U	46	U
Aroclor-1254	33	U	33	U	33	U	33	U	33	U		NA		NA	49	U	110		290	U	61	U	38	J
Aroclor-1260	33	U	33	U	33	U	33	U	33	U		NA		NA	49	U	57	U	290	U	61	U	46	U
beta-BHC	1.7	UJ	1.7	UJ	1.7	UJ	7.3	J	1.7	U		NA		NA	2.5	U	13		15	U	18		9.7	
delta-BHC	1.7	UJ	1.7	UJ	1.7	UJ	1.7	UJ	1.7	U		NA		NA	2.5	U	2.9	UJ	35		3.1	U	3.2	
Dieldrin	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	7.0	J		NA		NA	4.9	U	8.5	J	29	U	6.1	U	4.6	U
Endosulfan I	1.7	UJ	1.7	UJ	1.7	UJ	1.7	UJ	1.7	U		NA		NA	2.5	U	2.9	U	15	U	3.1	U	2.4	U
Endosulfan II	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U		NA		NA	4.9	U	5.7	U	29	U	6.1	U	4.6	U
Endosulfan Sulfate	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U		NA		NA	4.9	U	5.7	U	29	U	6.1	U	4.6	U
Endrin	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U		NA		NA	4.9	U	5.7	U	29	U	6.1	U	4.6	U
Endrin Aldehyde	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U		NA		NA	4.9	U	5.7	U	29	U	6.1	U	4.6	U
Endrin Ketone	3.3	UJ	3.3	UJ	3.3	UJ	3.3	UJ	3.3	U		NA		NA	4.9	U	5.7	U	29	U	6.1	U	5.8	
gamma-BHC	1.7	UJ	1.7	UJ	1.7	UJ	1.7	UJ	1.7	U		NA		NA	2.5	UJ	2.9	UJ	15	UJ	3.1	UJ	2.4	UJ
gamma-Chlordane	3.3	J	3.9	J	15	J	5.9	J	48	*J		NA		NA	2.5	U	330	*J	660	*J	4.5		13	
Heptachlor	28	*J	1.7	UJ	1.7	UJ	1.7	UJ	56	*J		NA		NA	2.5	U	2.9	U	15	U	3.1	U	2.4	U
Heptachlor Epoxide	1.7	UJ	1.7	UJ	1.7	UJ	1.7	UJ	1.7	U		NA		NA	2.5	U	11	J	84		3.1	U	2.4	U
Methoxychlor	17	UJ	17	UJ	17	UJ	17	UJ	17	U		NA		NA	25	U	29	U	150	U	31	U	24	U
Toxaphene	170	UJ	170	UJ	170	UJ	170	UJ	170	U		NA		NA	250	U	290	U	1500	U	310	U	240	U
TCLP Pesticide/PCB Analysis (UG/L)																												
Endrin		NA		NA		NA		NA		NA	0.20	U	0.20	U		NA		NA		NA		NA		NA
gamma-BHC		NA		NA		NA		NA		NA	0.10	U	0.10	U		NA		NA		NA		NA		NA
Heptachlor		NA		NA		NA		NA		NA	0.10	U	0.10	U		NA		NA		NA		NA		NA
Heptachlor Epoxide		NA		NA		NA		NA		NA	0.10	U	0.10	U		NA		NA		NA		NA		NA
Methoxychlor		NA		NA		NA		NA		NA	1.0	U	1.0	U		NA		NA		NA		NA		NA
Technical Chlordane		NA		NA		NA		NA		NA	2.0	U	2.0	U		NA		NA		NA		NA		NA
Toxaphene		NA		NA		NA		NA		NA	10	U	10	U		NA		NA		NA		NA		NA
Dioxin Analysis (NG/KG)																												
1,2,3,4,6,7,8-HpCDD	39200	JEB*	2580	JEB*	69400	JEB*	39900	JEB*	7970	JEB*		NA		NA	7760	*	51100	J*	132000	J*	19700	*	90300	*
1,2,3,4,6,7,8-HpCDF	3820	JEB*	1130	JEB	6610	JEB*	2870	JEB*	1590	JEB		NA		NA	1690		2700	EMPC*	5400	J*	1500	*	9800	*
1,2,3,4,7,8,9-HpCDF	159	JEB	53.2	JEB	530	JEB	286	JEB	80.2	JEB		NA		NA	76.8		28.3	J	91.3	J	103		265	J
1,2,3,4,7,8-HxCDD	371	JEB	40.4	JEB	521	JEB	259	JEB	57.8	JEB		NA		NA	24.6		120	J	220	J	78.8		285	
1,2,3,4,7,8-HxCDF	157	JEB	55.2	JEB	421	JEB	217	JEB	70.5	JEB		NA		NA	40.9		177	J	184	J	121		294	

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
1,2,3,6,7,8-HxCDD	2150	JEB*	421	JEB	3200	JEB*	1720	JEB*	662	JEB		NA		NA	392		1400	EMPC*	3000	EMPC	1070		2500	EMPC*
1,2,3,6,7,8-HxCDF	119	J	39.5	J	262	J	129	J	48.6	J		NA		NA	15.0		49.5	J	67.5	J	35.1		227	
1,2,3,7,8,9-HxCDD	1530	JEB	135	JEB	1760	JEB	832	JEB	195	JEB		NA		NA	94.9		451	J	422	J	314		997	
1,2,3,7,8,9-HxCDF	0.10	UJ	0.90	UJ	0.20	UJ	0.20	UJ	0.30	UJ		NA		NA	0.50	U	0.20	UJ	0.40	UJ	0.20	U	0.30	U
1,2,3,7,8-PeCDD	395	JEB	26.5	JEB	470	JEB	253	JEB	40.1	JEB		NA		NA	19.7		135	J	89.2	J	77.9		161	
1,2,3,7,8-PeCDF	89.3	EMPC	0.80	UJ	0.20	UJ	295	EMPC	107	EMPC		NA		NA	1.5	J	4.1	J	13.2	J	3.3	J	0.20	U
2,3,4,6,7,8-HxCDF	205	JEB	48.4	JEB	305	JEB	152	JEB	61.4	JEB		NA		NA	29.8		139	J	220	J	60.6		375	
2,3,4,7,8-PeCDF	24.3	JEB	5.8	JEB	29.9	JEB	14.1	JEB	5.7	JEB		NA		NA	2.0	JEB	9.7	JEB	25.4	JEB	5.2	JEB	22.8	JEB
2,3,7,8-TCDD	94.5	J	7.3	J	129	J	77.8	J	9.0	J		NA		NA	16.9		35.0	J	23.6	J	32.4		46.4	
2,3,7,8-TCDF	13.9	J	4.3	J	18.5	J	7.6	J	3.7	J		NA		NA	1.7	J	4.7	J	10.1	J	3.4	J	10.8	J
OCDD	340000	JEB*	19200	JEB*	541000	JEB*	272000	JEB*	65200	JEB*		NA		NA	52700	*	443000	J*	1370000	J*	157000	*	762000	*
OCDF	3510	JEB*	870	JEB	6460	JEB*	3350	JEB	1580	JEB		NA		NA	3200		1500	EMPC*	8500	J*	2330		16700	*
Total HpCDD	73600	JEB*	4440	JEB*	138000	JEB*	77200	JEB*	14700	JEB*		NA		NA	13600	J*	88400	J*	210000	J*	32800	J*	155000	J*
Total HpCDF	8980	JEB*	2330	JEB	16000	JEB*	6910	JEB*	2010	JEB*		NA		NA	4670	J*	2600	J*	12900	J*	4170	J*	25100	J*
Total HxCDD	15000	JEB*	2110	JEB	19300	JEB*	10200	JEB*	3290	JEB		NA		NA	1760	J	1800	J*	8700	J*	4640	J	6500	J*
Total HxCDF	4120	JEB	651	JEB	5740	JEB*	3550	JEB	1470	JEB		NA		NA	1510	J	8300	J*	4400	J*	3050	J	3400	J*
Total PeCDD	5100	JEB	142	JEB	5320	JEB	2340	JEB	366	JEB		NA		NA	324	JEB	1680	JEB	1050	JEB	887	JEB	2170	JEB
Total PeCDF	839	JEB	153	JEB	1060	JEB	1010	JEB	254	JEB		NA		NA	51.0	J	177	J	464	J	147	J	685	J
Total TCDD	1470	J*	50.7	J	1880	J	1220	J	87.5	J		NA		NA	173	J	630	J	287	J	302	J	638	J
Total TCDF	470	J	63.7	J	554	J	380	J	90.0	J		NA		NA	28.0	J	85.2	J	181	J	78.1	J	327	J
Toxicity Equivalency	1400	J	150	J	2100	J	1100	J	270	J		NA		NA	200	J	990	J	2100	J	510	J	1800	J
TAL Metal Analysis (MG/KG)																										
Aluminum	5380		6510		4010		5060		8770			NA		NA	7950		5970		7030		3590		7730	
Antimony	0.74	UJ	0.74	UJ	7.7	J	0.74	U		R		NA		NA	12.2		2.9		5.3		63.5		10.7	
Arsenic	6.7	J	5.1	J	4.7	J	1.5	J	7.6	J		NA		NA	9.0		10.5		9.4		1.0	U	5.4	
Barium	36.4		26.3		38.0		34.8		45.7			NA		NA	42.4		49.5		20.7		19.7		26.7	
Beryllium	0.080		0.090		0.050		0.12		0.24			NA		NA	0.27		0.29		0.40		0.16		0.41	
Cadmium	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U		NA		NA	0.60	U	0.60	U	0.60	U	0.60	U	0.68	U
Calcium	151000	J	75000	J	208000	J	105000	J	114000	J		NA		NA	6460	J	3150	J	11200	J	40900	J	14000	J
Chromium	20100		18300		16900		19500		25200			NA		NA	1430	J	328	J	626	J	7490	J	1360	J
Cobalt	5.2	J	5.3	J	4.3	J	5.5	J	7.4	J		NA		NA	6.4		3.9		4.8		2.4		5.7	
Copper	23.7		24.6		27.2		29.0		34.7			NA		NA	13.0		6.5		8.8		14.5		10.7	

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-101-0010		MT-SL-102-0012		MT-SL-103 0010		MT-SL-DUP-06		MT-SL-104-0010		MT-SL-A1-SLCOMP		MT-SL-DUP-08		MT-SL-201-0616		MT-SL-202 0717		MT-SL-DUP-01		MT-SL-203-0619		MT-SL-204-0618	
Sample Location	SL-101		SL-102		SL-103		SL-103		SL-104		SL-A1		SL-A1		SL-201		SL-202		SL-202		SL-203		SL-204	
Date Sampled	9/11/2001		9/11/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		9/17/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001		8/29/2001	
Interval	0.0-10.0		0.0-12.0		0.0-10.0		0.0-10.0		0.0-10.0		0.0-0.0		0.0-0.0		6.0-16.0		7.0-17.0		7.0-17.0		6.0-19.0		6.0-18.0	
QC Identifier	None		None		Field Dup. MT-SL-103 0010		Field Dup. MT-SL-103 0010		None		Field Dup. MT-SL-A1-SLCOMP		Field Dup. MT-SL-A1-SLCOMP		None		Field Dup. MT-SL-202 0717		Field Dup. MT-SL-202 0717		None		None	
Iron	5570		10700		5810		8240		8350			NA		NA	10100		7110		9310		4120		11000	
Lead	43.5		45.3		60.0		60.9		60.2			NA		NA	20.6		8.0		8.3		13.6		6.3	
Magnesium	955		787		1010		906		1470			NA		NA	4010		1850		2170		1310		2540	
Manganese	3990		13300		8750		9660		5380			NA		NA	148		90.5		108		137		130	
Mercury	0.020	U	0.020	U		R		R		R		NA		NA	0.040	J	0.46	J	0.31	J	0.080	J	0.080	J
Nickel	5.1		6.2			R	6.8	J	10.1	J		NA		NA	17.9		8.7		9.6		7.1		15.2	
Potassium	458	J	518	J	424	J	478	J	892	J		NA		NA	2410	J	871	J	521	J	510	J	620	J
Selenium	1.0	U	1.0	U	1.0	U	2.1		1.0	U		NA		NA	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.1	UJ
Silver	1.8	J	6.2	J	1.0	U	1.0	U	1.0	U		NA		NA	1.0	U	1.0	U	1.0	U	1.0	U	1.1	U
Sodium	8160		11300		9410		10100		8990			NA		NA	103	J	822		1140		456		154	
Thallium	1.1	U	1.1	U	1.2	UJ	2.8	UJ	1.1	U		NA		NA	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.3	UJ
Vanadium	24.4		25.6		17.5		23.8		34.0			NA		NA	16.4		10.3		11.2		0.64	U	11.7	
Zinc	128		145		121		141		183			NA		NA	34.2		25.8		31.6		34.6		35.9	
TCLP Metal Analysis (UG/L)																								
Arsenic		NA		NA		NA		NA		NA	50.0	U	50.0	U		NA		NA		NA		NA		NA
Barium		NA		NA		NA		NA		NA	1110		814			NA		NA		NA		NA		NA
Cadmium		NA		NA		NA		NA		NA	30.0	U	30.0	U		NA		NA		NA		NA		NA
Chromium		NA		NA		NA		NA		NA	117		113			NA		NA		NA		NA		NA
Lead		NA		NA		NA		NA		NA	30.0	UJ	30.0	UJ		NA		NA		NA		NA		NA
Mercury		NA		NA		NA		NA		NA		R		R		NA		NA		NA		NA		NA
Selenium		NA		NA		NA		NA		NA	50.0	U	50.0	U		NA		NA		NA		NA		NA
Silver		NA		NA		NA		NA		NA	50.0	U	50.0	U		NA		NA		NA		NA		NA
Miscellaneous Analyses																								
Chromium VI	6.1	U	6.6	U	6.3	U	5.5	U	10.9	UJ		NA		NA	2.5	U	2.2	U	2.7	U	3.0	UJ	2.3	UJ
Corrosivity	7.61		7.43		7.48		7.61		7.47		7.7		7.51		8.21		8.56		10.35		8.39		7.97	
Paint Filter		NA		NA		NA		NA	1.0	U		NA		NA		NA		NA		NA		NA		NA
Reactive Cyanide		NA		NA		NA		NA		NA	0.40	U	0.40	U		NA		NA		NA		NA		NA
Reactive Sulfide		NA		NA		NA		NA		NA	694		663			NA		NA		NA		NA		NA
Redox Potential	122.1		58.7		48.2		63.7		77.1			NA		NA	336.5		281.2		324.1		299.5		312	
Sulfide	49.0	J	16.6	UJ	15.8	UJ	230	J	280	J		NA		NA	180	J	230	J	110	J	77.0	J	140	J

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Volatile Organic Analysis (UG/KG)																								
1,1,1-Trichloroethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,1,2,2-Tetrachloroethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,1,2-Trichloro-1,2,2-trifluoroethane	170	U		NA		NA	330	UJ	240	UJ	240	UJ	430	U	850	U	590	U	220	U	230	U	230	U
1,1,2-Trichloroethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,1-Dichloroethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,1-Dichloroethene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,2,4-Trichlorobenzene	170	U		NA		NA	330	U	240	U	240	U	430	U	83	J	590	U	220	U	230	U	230	U
1,2-Dibromo-3-chloropropane		R		NA		NA		R		R		R		R		R		R	220	UJ	230	UJ	230	UJ
1,2-Dibromoethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,2-Dichlorobenzene	67	J		NA		NA	330	U	240	U	130	J	2800		13000		3800		220	U	230	U	230	U
1,2-Dichloroethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,2-Dichloropropane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,3-Dichlorobenzene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
1,4-Dichlorobenzene	15	J		NA		NA	330	U	240	U	240	U	440		2200		670		220	U	230	U	230	U
2-Butanone	170	U		NA		NA	330	U	240	U	240	U	510		850	U	590	U	220	U	230	U	230	U
2-Hexanone	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
4-Methyl-2-Pentanone	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Acetone	170	U		NA		NA	330	U	240	U	240	U	590		620	J	550	J	220	U	230	U	230	U
Benzene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Bromodichloromethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Bromoform	170	U		NA		NA	330	UJ	240	UJ	240	UJ	430	U	850	U	590	U	220	U	230	U	230	U
Bromomethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Carbon Disulfide	300			NA		NA	330	U	240	U	64	J	750		310	J	460		220	U	230	U	230	U
Carbon Tetrachloride	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590		220	U	230	U	230	U
Chlorobenzene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	480	J	220	U	230	U	230	U
Chloroethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Chloroform	19	J		NA		NA	330	U	240	U	240	U	49	J	850	U	79	J	220	U	230	U	230	U
Chloromethane	170	UJ		NA		NA	330	UJ	240	UJ	240	UJ	430	UJ	850	UJ	590	UJ	220	U	230	U	230	U
cis-1,2-Dichloroethene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
cis-1,3-Dichloropropene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Cyclohexane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Dibromochloromethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
~~Dichlorodifluoromethane~~	170	UJ		NA		NA	330	UJ	240	UJ	240	UJ	430	UJ	850	UJ	590	UJ	220	UJ	230	UJ	230	UJ
Ethylbenzene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Isopropylbenzene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Methyl Acetate	56	J		NA		NA	330	U	240	U	240	U	610		1500		1400		220	U	230	U	230	U
Methyl tert-Butyl Ether	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Methylcyclohexane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Methylene Chloride	170	U		NA		NA	330	U	240	U	240	U	430	U	620	U	590	U	220	U	230	U	230	U
Styrene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Tetrachloroethene	170	U		NA		NA	330	U	240	U	240	U	170	J	850	U	590	U	220	U	230	U	230	U
Toluene	170	U		NA		NA	330	U	240	U	220	J	1200		9200		5500	J	220	U	230	U	230	U
Total Xylenes	170	U		NA		NA	330	U	240	U	240	U	430	U	280	J	590	U	220	U	230	U	230	U
trans-1,2-Dichloroethene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
trans-1,3-Dichloropropene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Trichloroethene	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Trichlorofluoromethane	170	U		NA		NA	330	U	240	U	240	U	430	U	850	U	590	U	220	U	230	U	230	U
Vinyl Chloride	170	UJ		NA		NA	330	U	240	U	240	U	430	UJ	850	UJ	590	UJ	220	U	230	U	230	U
Volatile Headspace Analysis (PPBV)																										
1,1,1-Trichloroethane	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
1,1-Dichloroethane	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
1,1-Dichloroethene	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Benzene	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Carbon Tetrachloride	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Chlorobenzene	14			NA		NA		NA		NA		NA		NA		NA	1200			NA		NA		NA
Chloroform	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
cis-1,2-Dichloroethene	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Dichlorodifluoromethane	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Ethylbenzene	5	U		NA		NA		NA		NA		NA		NA		NA	27			NA		NA		NA
Freon 114	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
m&p-Xylene	5	U		NA		NA		NA		NA		NA		NA		NA	71			NA		NA		NA
Methyl tert-Butyl Ether	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Methylene Chloride	15			NA		NA		NA		NA		NA		NA		NA	11			NA		NA		NA
o-Xylene	5	U		NA		NA		NA		NA		NA		NA		NA	27			NA		NA		NA
Tetrachloroethene	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Toluene	5	U		NA		NA		NA		NA		NA		NA		NA	4500			NA		NA		NA
trans-1,2-Dichloroethene	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Trichloroethene	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
Trichlorofluoromethane	9.4			NA		NA		NA		NA		NA		NA		NA	7.4			NA		NA		NA
Vinyl Chloride	5	U		NA		NA		NA		NA		NA		NA		NA	5	U		NA		NA		NA
TCLP Volatile Organic Analysis (UG/L)																								
1,1-Dichloroethene		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethane		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene		NA		NA		NA	10	U	10	U	10	U	6	J	8	J	2	J	10	U	10	U	10	U
2-Butanone		NA		NA		NA	10	U	10	U	21		31		100		10	U	10	U	10	U	10	U
Benzene		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	6	J	10	U	10	U	10	U
Chloroform		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene		NA		NA		NA	10	U	10	U	10	U	1	J	10		10	U	10	U	10	U	10	U
Trichloroethene		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride		NA		NA		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ
Sulfur Compounds Analysis (PPBV)																								
2,5-Dimethylthiophene	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
2-Ethylthiophene	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
3-Methylthiophene	4.0	U		NA		NA		NA		NA		NA		NA		NA	8.9			NA		NA		NA
Butyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Carbon Disulfide	62			NA		NA		NA		NA		NA		NA		NA	460			NA		NA		NA
Carbonyl Sulfide	32			NA		NA		NA		NA		NA		NA		NA	430			NA		NA		NA
Diethyl Disulfide	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Diethyl Sulfide	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Dimethyl Disulfide	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Dimethyl Sulfide	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Ethyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Ethyl Methyl Sulfide	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
~~Hydrogen Sulfide~~	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Isobutyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Isopropyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Methyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
n-Propyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
tert-Butyl Mercaptan	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Tetrahydrothiophene	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Thiophene	4.0	U		NA		NA		NA		NA		NA		NA		NA	4.0	U		NA		NA		NA
Semivolatile Organic Analysis (UG/KG)																								
1,1'-Biphenyl	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2,2'-oxybis(1-Chloropropane)	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	UJ	170	U
2,4,5-Trichlorophenol	2600	UJ		NA		NA	2200	U	470	U	16000	J	37000	U	380	J	27000	U	430	U	870	U	440	U
2,4,6-Trichlorophenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2,4-Dichlorophenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2,4-Dimethylphenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2,4-Dinitrophenol	2600	UJ		NA		NA	2200	U	470	U	46000	U	37000	U	4900	U	27000	U	430	U	870	U	440	U
2,4-Dinitrotoluene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2,6-Dinitrotoluene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2-Chloronaphthalene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2-Chlorophenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2-Methylnaphthalene	1000	UJ		NA		NA	900	U	190	U	18000	U	1800	J	5200		1800	J	170	U	350	U	170	U
2-Methylphenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
2-Nitroaniline	2600	UJ		NA		NA	2200	U	470	U	46000	U	37000	U	4900	U	27000	U	430	U	870	U	440	U
2-Nitrophenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
3,3'-Dichlorobenzidine	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
3-Nitroaniline	2600	UJ		NA		NA	2200	U	470	U	46000	U	37000	U	4900	U	27000	U	430	U	870	U	440	U
4,6-Dinitro-2-methylphenol	2600	UJ		NA		NA	2200	U	470	U	46000	U	37000	U	4900	U	27000	U	430	U	870	U	440	U
4-Bromophenyl-phenylether	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
4-Chloro-3-methylphenol	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
4-Chloroaniline	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
4-Chlorophenyl-phenylether	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
4-Methylphenol		R		NA		NA		R		R		R	83000	J	110000	*J		R		R		R		R
4-Nitroaniline	2600	UJ		NA		NA	2200	U	470	U	46000	U	37000	UJ	4900	U	27000	UJ	430	U	870	U	440	U
4-Nitrophenol	2600	UJ		NA		NA	2200	U	470	U	46000	U	37000	U	4900	UJ	27000	U	430	U	870	U	440	U
Acenaphthene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Acenaphthylene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Acetophenone	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Anthracene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Atrazine	1000	UJ		NA		NA	900	UJ	190	UJ	18000	UJ	15000	U	2000	UJ	11000	U	170	UJ	350	UJ	170	UJ
Benzaldehyde	1000	UJ		NA		NA	900	UJ	190	UJ	18000	UJ	15000	U	2000	UJ	11000	U	170	UJ	350	UJ	170	UJ
Benzo(a)anthracene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Benzo(a)pyrene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Benzo(b)fluoranthene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Benzo(g,h,i)perylene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	UJ	2000	U	11000	UJ	170	U	350	U	170	U
Benzo(k)fluoranthene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Bis(2-Chloroethoxy)methane	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Bis(2-Chloroethyl)ether	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
bis(2-Ethylhexyl)phthalate	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	J	2000	U	11000	UJ	200	U	350	U	170	U
Butylbenzylphthalate	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Caprolactam	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Carbazole	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Chrysene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Di-n-Butylphthalate	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	37	JEB	23	JEB
Di-n-octylphthalate	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	UJ	2000	U	11000	UJ	170	U	350	U	170	U
Dibenzo(a,h)anthracene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Dibenzofuran	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Diethylphthalate	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Dimethylphthalate	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Fluoranthene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Fluorene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Hexachlorobenzene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Hexachlorobutadiene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Hexachlorocyclopentadiene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Hexachloroethane	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Indeno(1,2,3-cd)pyrene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
~~Isophorone~~	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
N-Nitroso-di-n-propylamine	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
N-Nitroso-diphenylamine	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Naphthalene	1000	UJ		NA		NA	900	U	190	U	8600	J	15000	U	760	J	11000	U	170	U	350	U	170	U
Nitrobenzene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Pentachlorophenol	2600	UJ		NA		NA	2200	U	470	U	22000	J	1600	J	4900	U	27000	U	430	U	870	U	440	U
Phenanthrene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
Phenol	1000	UJ		NA		NA	900	U	190	U	18000	U	6500	J	5800		11000	U	170	U	350	U	170	U
Pyrene	1000	UJ		NA		NA	900	U	190	U	18000	U	15000	U	2000	U	11000	U	170	U	350	U	170	U
TCLP Semivolatile Organic Analysis (UG/L)																										
2,4,5-Trichlorophenol		NA	37		53		25	U	25	U	25	U	3	J	25	U	3	J	25	U		NA	25	U
2,4,6-Trichlorophenol		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
2,4-Dinitrotoluene		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
2-Methylphenol		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
4-Methylphenol		NA	19	J	45	J	10	U	10	U	10	U	4900	*	2100	*	2	J	44			NA	33	
Hexachlorobenzene		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
Hexachlorobutadiene		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
Hexachloroethane		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
Nitrobenzene		NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U		NA	10	U
Pentachlorophenol		NA	500	*	770	*	9	J	25	U	25	U	10	J	4	J	25	U	25	U		NA	25	U
Pesticide/PCB Analysis (UG/KG)																										
4,4'-DDD	4.0	U		NA		NA	1.7	U	1.8	UJ	5.0	J	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
4,4'-DDE	4.0	U		NA		NA	1.7	U	1.8	UJ	7.4	J	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
4,4'-DDT	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
Aldrin	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
alpha-BHC	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	4.6		3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
alpha-Chlordane	2.0	U		NA		NA	1.6		0.93	UJ	3.2	J	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
Aroclor-1016	40	U		NA		NA	17	U	18	U	18	UJ	58	U	65	U	42	U	17	U	17	U	17	U
Aroclor-1221	81	U		NA		NA	35	U	37	U	36	UJ	120	U	130	U	86	U	34	U	35	U	35	U
Aroclor-1232	40	U		NA		NA	17	U	18	U	18	UJ	58	U	65	U	42	U	17	U	17	U	17	U
Aroclor-1242	40	U		NA		NA	17	U	18	U	18	UJ	58	U	65	U	42	U	17	U	17	U	17	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Aroclor-1248	40	U		NA		NA	17	U	18	U	18	UJ	58	U	65	U	42	U	17	U	17	U	17	U
Aroclor-1254	40	U		NA		NA	8.6	J	18	U	18	UJ	180		86		42	J	17	U	17	U	17	U
Aroclor-1260	40	U		NA		NA	17	U	18	U	18	UJ	58	U	65	U	42	U	17	U	17	U	17	U
beta-BHC	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
delta-BHC	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
Dieldrin	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
Endosulfan I	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
Endosulfan II	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
Endosulfan Sulfate	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
Endrin	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	UJ	4.2	UJ	1.7	U	1.7	U	1.7	U
Endrin Aldehyde	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
Endrin Ketone	4.0	U		NA		NA	1.7	U	1.8	UJ	1.8	UJ	5.8	U	6.5	U	4.2	UJ	1.7	U	1.7	U	1.7	U
gamma-BHC	2.0	UJ		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	UJ	3.4	UJ	2.2	UJ	0.86	U	0.88	U	0.88	U
gamma-Chlordane	2.0	U		NA		NA	1.7		0.93	UJ	5.0	J	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
Heptachlor	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
Heptachlor Epoxide	2.0	U		NA		NA	0.90	U	0.93	UJ	0.91	UJ	3.0	U	3.4	U	2.2	UJ	0.86	U	0.88	U	0.88	U
Methoxychlor	20	U		NA		NA	9.0	U	9.3	UJ	9.1	UJ	30	U	34	U	22	UJ	8.6	U	8.8	U	8.8	U
Toxaphene	200	U		NA		NA	90	U	93	UJ	91	UJ	300	U	340	U	220	UJ	86	U	88	U	88	U
TCLP Pesticide/PCB Analysis (UG/L)																										
Endrin		NA	0.20	U	0.20	U	0.20	U	0.20	U	0.25	U	0.20	U	0.20	U	0.20	U	0.20	U		NA	0.20	U
gamma-BHC		NA	0.10	U	0.10	U	0.10	U	0.10	U	0.13	U	0.10	U	0.10	U	0.10	U	0.10	U		NA	0.10	U
Heptachlor		NA	0.10	U	0.10	U	0.10	U	0.10	U	0.13	U	0.10	U	0.10	U	0.10	U	0.10	U		NA	0.10	U
Heptachlor Epoxide		NA	0.10	U	0.10	U	0.10	U	0.10	U	0.13	U	0.10	U	0.10	U	0.10	U	0.10	U		NA	0.10	U
Methoxychlor		NA	1.0	U	1.0	U	1.0	U	1.0	U	1.3	U	1.0	U	1.0	U	1.0	U	1.0	U		NA	1.0	U
Technical Chlordane		NA	2.0	U	2.0	U	2.0	U	2.0	U	2.5	U	2.0	U	2.0	U	2.0	U	2.0	U		NA	2.0	U
Toxaphene		NA	10	U	10	U	10	U	10	U	13	U	10	U	10	U	10	U	10	U		NA	10	U
Dioxin Analysis (NG/KG)																										
1,2,3,4,6,7,8-HpCDD	427			NA		NA	22570	*	479		548		1550		12570	*	924		13.7	JEB	7.8	JEB	287	JEB
1,2,3,4,6,7,8-HpCDF	95.5			NA		NA	2250	*	67.4		56.1		132		421		74.8		1.4	JEB	1.1	JEB	39.9	EB
1,2,3,4,7,8,9-HpCDF	3.3	J		NA		NA	84.9	J	3.6	J	3.4	J	7.4		29.1		5.2	U	0.50	U	0.40	U	3.4	J
1,2,3,4,7,8-HxCDD	0.90	J		NA		NA	123		1.8	J	2.2	J	6.2	EMPC	22.8		3.1	U	0.40	U	0.30	U	0.88	J
1,2,3,4,7,8-HxCDF	1.9	J		NA		NA	86.1		2.1	J	2.4	J	6.6		21.6		2.7	U	0.20	U	0.20	U	1.3	J

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
1,2,3,6,7,8-HxCDD	14.4			NA		NA	1390		21.7		22.2		58.0		199		32.1		0.40	U	0.30	U	8.3	
~~1,2,3,6,7,8-HxCDF~~	1.8	J		NA		NA	76.0	EB	1.3	JEB	2.2	JEB	4.7	JEB	15.1	EB	2.7	U	0.20	U	0.20	U	0.60	J
1,2,3,7,8,9-HxCDD	4.0	J		NA		NA	452	EB	5.2	EB	8.3	EB	21.9	EB	74.7	EB	7.8	EMPC	0.40	U	0.30	U	2.2	J
1,2,3,7,8,9-HxCDF	0.80	U		NA		NA	0.50	U	0.30	U	1.0	EMPC	1.1	U	5.7	U	3.5	U	0.30	U	0.20	U	0.76	U
1,2,3,7,8-PeCDD	0.64	EMPC		NA		NA	97.2	JEB	0.91	JEB	1.3	JEB	4.4	JEB	13.5	JEB	3.6	U	0.40	U	0.30	U	0.50	U
1,2,3,7,8-PeCDF	0.090	U		NA		NA	0.30	U	0.20	U	0.30	U	0.70	U	25.3	EMPC	11.7		0.30	U	0.20	U	0.30	U
2,3,4,6,7,8-HxCDF	3.6	J		NA		NA	150	J	2.6	J	3.5	J	7.3		4.7	U	2.9	U	0.30	U	0.20	U	1.3	J
2,3,4,7,8-PeCDF	0.31	EMPC		NA		NA	12.7		0.25	EMPC	0.30	U	0.99	J	2.5	J	2.2	U	0.30	U	0.20	U	0.30	U
2,3,7,8-TCDD	0.68	J		NA		NA	16.0		0.61	J	0.72	J	1.2		3.4		1.8	U	0.30	U	0.20	U	0.64	J
2,3,7,8-TCDF	0.24	EMPC		NA		NA	3.9	EMPC	0.51	J	0.20	U	0.68	EMPC	2.0	U	1.1	U		R		R	0.36	J
OCDD	6260	*		NA		NA	248220	EB*	1960	JEB*	5320	EB*	22680	EB*	94580	EB*	9150	JEB*	129	J	70.8	J	3070	J
OCDF	164			NA		NA	2210	JEB	158	JEB	48.8	JEB	190	JEB	651	JEB	130	EMPC	3.1	J	2.2	J	104	
Total HpCDD	817	J		NA		NA	42930	J*	854	J	1100	J	2770	J	22120	J*	1500	J	24.3	JEB	13.0	JEB	485	JEB
Total HpCDF	291	J		NA		NA	5240	J*	238	J	134	J	339	J	1170	J	237	J	5.0	JEB	3.3	JEB	164	JEB
Total HxCDD	80.7	J		NA		NA	5900	JEB*	103	JEB	134	JEB	325	JEB	1130	JEB	140	JEB	1.7	J	0.61	EMPC	33.1	J
Total HxCDF	108	J		NA		NA	3590	JEB	73.8	JEB	48.5	JEB	129	JEB	409	JEB	95.9	JEB	1.1	UJ	0.40	UJ	35.3	J
Total PeCDD	11.7	JEB		NA		NA	2020	JEB	15.3	JEB	10.3	JEB	45.0	JEB	230	JEB	8.2	JEB	0.40	UJ	1.4	EMPC	2.9	JEB
Total PeCDF	7.2	J		NA		NA	679	J	9.8	J	4.4	J	22.5	J	57.4	J	11.7	J	0.30	UJ	0.20	UJ	2.5	J
Total TCDD	2.3	J		NA		NA	364	J	0.99	J	2.0	J	5.0	J	16.7	J	1.8	UJ	0.30	UJ	0.20	UJ	0.64	JEB
Total TCDF	1.4	UJ		NA		NA	48.9	JEB	2.3	JEB	2.0	JEB	9.6	JEB	13.9	JEB	3.2	EMPC	0.20	UJ	0.20	UJ	1.4	JEB
Toxicity Equivalency	10.0	J		NA		NA	620	J	11.0	J	13.0	J	36.0	J	190	J	15.0	J	0.16	J	0.096	J	5.8	J
TAL Metal Analysis (MG/KG)																								
Aluminum	4760			NA		NA	2890		5330		4160		6770		6130		5770		3800		5280		3700	
Antimony	1.3			NA		NA	35.2	J	0.74	U	3.6		91.1		207	J	35.8	J	0.74	U	0.74	U	0.74	U
Arsenic	8.0			NA		NA	1.9	J	7.8		6.1		2.6	J	1.2	J	2.7	J	6.4		8.8		7.1	
Barium	17.8			NA		NA	13.5		19.1		16.3		35.9		23.0		24.2		21.4		16.9		16.4	J
Beryllium	0.30			NA		NA	0.15		0.28		0.24		0.25		0.23		0.29		0.24	UJ	0.32	J	0.25	UJ
Cadmium	0.52	U		NA		NA	0.60	U	0.60	U	0.60	U	0.60	U	0.59	U	0.60	U	0.60	U	0.60	U	0.60	U
Calcium	1570	J		NA		NA	28100	J	671	J	2570	J	28600	J	50000	J	11900	J	945		719		568	
Chromium	181	J		NA		NA	4230	J	122	J	519	J	10700	J	23700	J	4270	J	16.8	J	105	J	146	J
Cobalt	4.0			NA		NA	2.2		2.9		3.8		5.7		5.3	J	5.0		2.7		3.1		2.5	
Copper	5.6			NA		NA	8.7		5.7		6.6		17.4		25.1		13.0		5.7		5.4		4.4	

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-205-0616		MT-SL-A2-SLCOMP		MT-SL-DUP-02		MT-SL-301-0208		MT-SL-302-0309		MT-SL-303-0618		MT-SL-401-0511		MT-SL-402-0311		MT-SL-403-0510		MT-SL-501 0020		MT-SL-DUP-05		MT-SL-502-0012	
Sample Location	SL-205		SL-A2		SL-A2		SL-301		SL-302		SL-303		SL-401		SL-402		SL-403		SL-501		SL-501		SL-502	
Date Sampled	8/30/2001		8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/4/2001		9/4/2001		9/4/2001	
Interval	6.0-16.0		0.0-0.0		0.0-0.0		2.0-8.0		3.0-9.0		6.0-18.0		5.0-11.0		3.0-11.0		5.0-10.0		0.0-20.0		0.0-20.0		0.0-12.0	
QC Identifier	None		Field Dup. MT-SL-A2-SLCOMP		Field Dup. MT-SL-A2-SLCOMP		None		None		None		None		None		None		Field Dup. MT-SL-501 0020		Field Dup. MT-SL-501 0020		None	
Iron	6220			NA		NA	3370		5360		5560		9080		9980		8550		5040		6120		4740	
Lead	6.2			NA		NA	8.7		4.2		7.2		16.9		27.8		10.8		2.2		3.2		3.8	
Magnesium	1380			NA		NA	839		1500		1440		2990		1320		2280		1290		1500		1140	
Manganese	74.2			NA		NA	143		74.6		134		819		2690		472		93.1		77.6		113	J
Mercury	0.28	J		NA		NA	0.040	J	0.15	J	0.060	J	0.030	J	0.020	UJ	0.020	J	0.020	UJ	0.020	UJ	0.10	J
Nickel	7.6			NA		NA	7.0		7.2		11.2		14.8		12.3		15.5		10.2		10.7		6.8	
Potassium	464	J		NA		NA	413	J	712	J	623	J	1610	J	657	J	1040	J	870	J	729	J	505	J
Selenium	0.87	UJ		NA		NA	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	0.99	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ
Silver	0.87	U		NA		NA	1.0	U	1.0	U	1.0	U	1.0	U	1.7		1.0	U	1.0	U	1.0	U	1.0	U
Sodium	85.3	U		NA		NA	138		98.5	U	98.1	U	693		648		98.2	U	97.8	U	98.4	U	98.6	U
Thallium	0.99	UJ		NA		NA	1.1	UJ	1.1	UJ	1.1	UJ	2.0	J	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ
Vanadium	8.6			NA		NA	5.9		9.1		6.8		0.64	U	4.9		2.6		7.9		9.6		7.4	
Zinc	22.6			NA		NA	23.9		18.3		20.7		53.5		94.2		40.6		19.2		20.4		14.8	U
TCLP Metal Analysis (UG/L)																								
Arsenic		NA	5.0	UJ	5.0	UJ	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U		NA	5.0	U
Barium		NA	46.3	J	159	J	56.9		57.6		46.6		34.4		55.0		50.2		77.8			NA	65.8	
Cadmium		NA	3.0	UJ	3.0	UJ	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U		NA	3.0	U
Chromium		NA	9.4	J	204	J	12.8	J	7.7	J	57.7	J	11.4	J	10.6	J	47.4	J	5.0	U		NA	5.0	U
Lead		NA	3.0	UJ	3.7	J	3.0	U	3.0	U	3.2	J	3.0	U	3.0	U	3.0	U	3.0	U		NA	3.0	U
Mercury		NA	0.20	UJ	0.20	UJ	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U		NA	0.23	J
Selenium		NA	5.0	UJ	5.0	UJ	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U		NA	5.0	U
Silver		NA	5.0	UJ	5.0	UJ	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U		NA	5.0	U
Miscellaneous Analyses																								
Chromium VI	2.5	U		NA		NA	2.2	UJ	2.2	U	2.2	UJ	2.9	UJ	2.0	U	2.5	U	2.1	U	2.1	U	3.0	J
Corrosivity	7.63		8.12		10.4		7.87		6.55		7.56		8.32		7.89		7.68		5.57		5.32		5.37	
Paint Filter	1.0	U		NA		NA		NA		NA		NA		NA	13.0			NA		NA		NA		NA
Reactive Cyanide		NA	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.44			NA	0.72	
Reactive Sulfide		NA	39.6	U	39.6	U	40.1	U	40.0	U	39.6		40.0		40.0	U	40.0	U	39.9	U		NA	40.3	U
Redox Potential	352			NA		NA	383.1		447.6		410.2		330.3		326.3		339.2		515.8		517.8		504.9	
Sulfide	55.0	J		NA		NA	90.0	J	35.0	J	140	J	150	J	300	J	40.0	J	5.1	U	5.1	U	5.2	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Volatile Organic Analysis (UG/KG)																		
1,1,1-Trichloroethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,1,2,2-Tetrachloroethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,1,2-Trichloro-1,2,2-trifluoroethane	290	U	1300	U	530	U	710	U	250	UJ	250	UJ	290	U	1200	U	1400	U
1,1,2-Trichloroethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,1-Dichloroethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,1-Dichloroethene	290	U	1300	U	530	U	710	U	250	U	250	U	290	UJ	1200	U	1400	U
1,2,4-Trichlorobenzene	290	U	570	J	220	J	710	U	250	U	250	U	290	U	1200	U	1400	U
1,2-Dibromo-3-chloropropane	290	UJ		R		R		R		R		R	290	UJ	1200	UJ	1400	UJ
1,2-Dibromoethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,2-Dichlorobenzene	290	U	46000	*	17000	*	280	J	250	U	250	U	32	J	1200	U	1400	U
1,2-Dichloroethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,2-Dichloropropane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,3-Dichlorobenzene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
1,4-Dichlorobenzene	290	U	25000		4300		200	J	250	U	250	U	290	U	1200	U	1400	U
2-Butanone	290	U	1300	U	610		710	U	250	U	250	U	290	U	1200	U	1400	U
2-Hexanone	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
4-Methyl-2-Pentanone	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Acetone	290	U	830	J	280	J	710	U	250	U	250	U	290	U	8000	JEB	1400	UJ
Benzene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Bromodichloromethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Bromoform	290	U	1300	U	530	U	710	U	250	UJ	250	UJ	290	U	1200	U	1400	U
Bromomethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Carbon Disulfide	290	U	160	J	530	U	710	U	54	J	250	U	290	U	1200	U	1400	U
Carbon Tetrachloride	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Chlorobenzene	290	U	77000	*	11000		1300		250	U	250	U	81	J	1200	U	1400	U
Chloroethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Chloroform	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Chloromethane	290	U	1300	UJ	530	UJ	710	UJ	250	UJ	250	UJ	290	U	1200	U	1400	U
cis-1,2-Dichloroethene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
cis-1,3-Dichloropropene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Cyclohexane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Dibromochloromethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
~~Dichlorodifluoromethane~~	290	UJ	1300	UJ	530	UJ	710	UJ	250	UJ	250	UJ	290	UJ	1200	U	1400	U
Ethylbenzene	290	U	380	J	120	J	710	U	250	U	250	U	290	U	1200	U	1400	U
Isopropylbenzene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Methyl Acetate	290	U	1800		410	J	250	J	420		250	U	430		7000		10000	
Methyl tert-Butyl Ether	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Methylcyclohexane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Methylene Chloride	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Styrene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Tetrachloroethene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Toluene	290	U	330	J	160	J	710	U	56	J	250	U	1700		2000		2100	
Total Xylenes	290	U	2300		740		710	U	250	U	250	U	290	U	1200	U	1400	U
trans-1,2-Dichloroethene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
trans-1,3-Dichloropropene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Trichloroethene	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Trichlorofluoromethane	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Vinyl Chloride	290	U	1300	U	530	U	710	U	250	U	250	U	290	U	1200	U	1400	U
Volatile Headspace Analysis (PPBV)																		
1,1,1-Trichloroethane		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
1,1-Dichloroethane		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Benzene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Carbon Tetrachloride		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Chlorobenzene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Chloroform		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
cis-1,2-Dichloroethene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Dichlorodifluoromethane		NA		NA		NA		NA		NA		NA		NA	1200	UJ	1400	UJ
Ethylbenzene		NA		NA		NA		NA		NA		NA		NA	1200	U	1400	U
Freon 114		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA	5	U	5	
Methyl tert-Butyl Ether		NA		NA		NA		NA		NA		NA		NA	5	U	5	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Methylene Chloride		NA		NA		NA		NA		NA		NA		NA	1200	U	1400	U
~~o-Xylene~~		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Tetrachloroethene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Toluene		NA		NA		NA		NA		NA		NA		NA	4000		3800	
trans-1,2-Dichloroethene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Trichloroethene		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
Trichlorofluoromethane		NA		NA		NA		NA		NA		NA		NA	1200	U	1400	U
Vinyl Chloride		NA		NA		NA		NA		NA		NA		NA	5	U	5	U
TCLP Volatile Organic Analysis (UG/L)																		
1,1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	140		9	J	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	10	U	10	U	10	UJ	10	UJ	15		10	U	10	U	10	U	10	U
Benzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	10	U	810	*	4	J	1	J	10	U	10	U	10	U	10	U	10	U
Chloroform	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	10	UJ	10	U	10	U	10	U	10	U	10	UJ	10	U	10	UJ	10	U
Sulfur Compounds Analysis (PPBV)																		
2,5-Dimethylthiophene		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
2-Ethylthiophene		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
3-Methylthiophene		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Butyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Carbon Disulfide		NA		NA		NA		NA		NA		NA		NA	60		60	
Carbonyl Sulfide		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Diethyl Disulfide		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Diethyl Sulfide		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Dimethyl Disulfide		NA		NA		NA		NA		NA		NA		NA	1600	J	2900	J
Dimethyl Sulfide		NA		NA		NA		NA		NA		NA		NA	40	UJ	3000	J
Ethyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	40	U	40	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Ethyl Methyl Sulfide		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
~~Hydrogen Sulfide~~		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Isobutyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Isopropyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	2700	J	40	UJ
Methyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	40		47	
n-Propyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
tert-Butyl Mercaptan		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Tetrahydrothiophene		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Thiophene		NA		NA		NA		NA		NA		NA		NA	40	U	40	U
Semivolatile Organic Analysis (UG/KG)																		
1,1'-Biphenyl	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2,2'-oxybis(1-Chloropropane)	1800	U	130000	UJ	68000	UJ	1900	U	4400	U	4000	U	5500	U	68000	UJ	67000	UJ
2,4,5-Trichlorophenol	4500	U	330000	U	70000	J	4600	U	11000	U	10000	U	820	J	43000	J	33000	J
2,4,6-Trichlorophenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2,4-Dichlorophenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2,4-Dimethylphenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2,4-Dinitrophenol	4500	U	330000	U	170000	U	4600	U	11000	U	10000	U	14000	U	170000	U	170000	U
2,4-Dinitrotoluene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2,6-Dinitrotoluene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2-Chloronaphthalene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2-Chlorophenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2-Methylnaphthalene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2-Methylphenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
2-Nitroaniline	4500	U	330000	U	170000	U	4600	U	11000	U	10000	U	14000	U	170000	U	170000	U
2-Nitrophenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
3,3'-Dichlorobenzidine	1800	U	130000	U	68000	U	1900	UJ	4400	U	4000	U	5500	U	68000	U	67000	U
3-Nitroaniline	4500	U	330000	U	170000	U	4600	U	11000	U	10000	U	14000	U	170000	U	170000	U
4,6-Dinitro-2-methylphenol	4500	U	330000	U	170000	U	4600	U	11000	U	10000	U	14000	U	170000	U	170000	U
4-Bromophenyl-phenylether	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
4-Chloro-3-methylphenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	550	J	68000	U	67000	U
4-Chloroaniline	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
4-Chlorophenyl-phenylether	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
4-Methylphenol		R	130000	U	68000	U	1900	U		R		R	7400	J	43000	J	59000	J
4-Nitroaniline	4500	U	330000	U	170000	U	4600	U	11000	U	10000	U	14000	U	170000	U	170000	U
4-Nitrophenol	4500	U	330000	U	170000	U	4600	U	11000	U	10000	U	14000	U	170000	U	170000	U
Acenaphthene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Acenaphthylene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Acetophenone	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Anthracene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Atrazine	1800	UJ	130000	UJ	68000	UJ	1900	U	4400	UJ	4000	UJ	5500	UJ	68000	UJ	67000	UJ
Benzaldehyde	1800	UJ	130000	UJ	68000	UJ	1900	UJ	4400	UJ	4000	UJ	5500	UJ	68000	UJ	67000	UJ
Benzo(a)anthracene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Benzo(a)pyrene	1800	U	130000	U	68000	U	1900	U	660	J	4000	U	5500	U	68000	U	67000	U
Benzo(b)fluoranthene	1800	U	130000	U	68000	U	1900	U	470	J	4000	U	5500	U	68000	U	67000	U
Benzo(g,h,i)perylene	1800	U	130000	U	68000	U	1900	UJ	4400	U	4000	U	5500	U	68000	U	67000	U
Benzo(k)fluoranthene	1800	U	130000	U	68000	U	1900	U	790	J	4000	U	5500	U	68000	U	67000	U
Bis(2-Chloroethoxy)methane	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Bis(2-Chloroethyl)ether	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
bis(2-Ethylhexyl)phthalate	1800	U	130000	U	68000	U	1900	U	4400	U	8900		5500	U	68000	U	67000	U
Butylbenzylphthalate	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Caprolactam	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Carbazole	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Chrysene	1800	U	130000	U	68000	U	1900	U	590	J	4000	U	5500	U	68000	U	67000	U
Di-n-Butylphthalate	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Di-n-octylphthalate	1800	U	130000	U	68000	U	1900	UJ	4400	U	4000	U	5500	U	68000	U	67000	U
Dibenzo(a,h)anthracene	1800	U	130000	U	68000	U	1900	UJ	4400	U	4000	U	5500	U	68000	U	67000	U
Dibenzofuran	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Diethylphthalate	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Dimethylphthalate	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Fluoranthene	1800	U	130000	U	68000	U	1900	U	1100	J	4000	U	5500	U	68000	U	67000	U
Fluorene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Hexachlorobenzene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Hexachlorobutadiene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Hexachlorocyclopentadiene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Hexachloroethane	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Indeno(1,2,3-cd)pyrene	1800	U	130000	U	68000	U	1900	UJ	4400	U	4000	U	5500	U	68000	U	67000	U
~~Isophorone~~	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
N-Nitroso-di-n-propylamine	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
N-Nitroso-diphenylamine	1800	U	130000	U	7600	J	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Naphthalene	1800	U	59000	J	41000	J	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Nitrobenzene	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	68000	U	67000	U
Pentachlorophenol	4500	U	330000	U	120000	J	4600	U	11000	U	10000	U	750	J	45000	J	43000	J
Phenanthrene	1800	U	130000	U	68000	U	1900	U	620	J	4000	U	5500	U	68000	U	67000	U
Phenol	1800	U	130000	U	68000	U	1900	U	4400	U	4000	U	5500	U	39000	JEB	45000	JEB
Pyrene	1800	U	130000	U	68000	U	1900	U	900	J	4000	U	5500	U	68000	U	67000	U
TCLP Semivolatile Organic Analysis (UG/L)																		
2,4,5-Trichlorophenol	25	U	25	UJ	160	*J	25	UJ	25	U	25	U	18	J	110	J		NA
2,4,6-Trichlorophenol	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	5	J		R		NA
2,4-Dinitrotoluene	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	500	U		NA
2-Methylphenol	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U		R		NA
4-Methylphenol	25		6	J	55	J	10	UJ	10	U	10	U	670	J*	4500	J		NA
Hexachlorobenzene	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	500	U		NA
Hexachlorobutadiene	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	500	U		NA
Hexachloroethane	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	500	U		NA
Nitrobenzene	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	500	U		NA
Pentachlorophenol	25	U	25	UJ	47	J	25	UJ	2	J	25	U	4	J		R		NA
Pesticide/PCB Analysis (UG/KG)																		
4,4'-DDD	1.8	U	34	J	19	J	1.8	UJ	2.1	U	2.0	U	3.4	J	12	J	3.3	UJ
4,4'-DDE	1.8	U	36	J	53	J	1.8	UJ	1.5	J	3.2		5.2	J	8.7	J	5.3	J
4,4'-DDT	1.8	U	3.2	UJ	5.6	J	1.8	J	2.1	U	2.2		2.7	UJ	3.3	UJ	3.3	UJ
Aldrin	0.91	U	11	J	1.7	UJ	0.92	UJ	1.1	U	1.0	U	1.4	UJ	1.7	UJ	1.7	UJ
alpha-BHC	0.91	U	1.7	UJ	1.7	UJ	0.92	UJ	1.1	U	1.0	U	1.4	UJ	1.7	UJ	1.7	UJ
alpha-Chlordane	0.91	U	21	J	14	J	1.7	J	8.4		29	*	4.6	J	4.3	J	2.1	J
Aroclor-1016	18	U	32	UJ	33	UJ	18	UJ	21	UJ	20	U	27	U	33	UJ	33	UJ
Aroclor-1221	36	U	66	UJ	67	UJ	36	UJ	43	UJ	40	U	54	U	67	UJ	67	UJ
Aroclor-1232	18	U	32	UJ	33	UJ	18	UJ	21	UJ	20	U	27	U	33	UJ	33	UJ
Aroclor-1242	18	U	32	UJ	33	UJ	18	UJ	21	UJ	280		27	U	33	UJ	33	UJ

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Aroclor-1248	18	U	32	UJ	33	UJ	18	UJ	21	UJ	20	U	27	U	33	UJ	33	UJ
~~Aroclor-1254~~	4.0	J	32	UJ	33	UJ	18	UJ	16	J	78		27	U	33	UJ	33	UJ
Aroclor-1260	18	U	32	UJ	33	UJ	18	UJ	21	UJ	20	U	27	U	33	UJ	33	UJ
beta-BHC	0.91	U	1.7	UJ	1.7	UJ	0.92	UJ	1.1	U	1.0	U	1.4	UJ	3.5	J	1.7	UJ
delta-BHC	0.91	U	1.7	UJ	1.7	UJ	0.92	UJ	1.1	U	5.2		1.4	UJ	1.7	UJ	1.7	UJ
Dieldrin	1.8	U	5.8	J	3.3	UJ	1.8	UJ	2.1	U	4.4		2.7	UJ	3.3	UJ	3.3	UJ
Endosulfan I	0.91	U	1.7	UJ	1.7	UJ	0.92	UJ	1.1	U	1.0	U	1.4	UJ	1.7	UJ	1.7	UJ
Endosulfan II	1.8	U	3.2	UJ	3.3	UJ	1.8	UJ	2.1	U	2.0	U	2.7	UJ	3.3	UJ	3.3	UJ
Endosulfan Sulfate	1.8	U	3.2	UJ	3.3	UJ	1.8	UJ	2.1	U	2.0	U	2.7	UJ	3.3	UJ	3.3	UJ
Endrin	1.8	U	5.9	J	3.3	UJ	1.8	UJ	2.1	U	5.8		2.7	UJ	3.3	UJ	3.3	UJ
Endrin Aldehyde	1.8	U	3.2	UJ	3.3	UJ	1.8	UJ	2.1	U	2.0	U	2.7	UJ	3.3	UJ	3.3	UJ
Endrin Ketone	1.8	U	26	J	18	J	1.8	UJ	2.1	U	2.0	U	2.7	UJ	3.3	UJ	3.3	UJ
gamma-BHC	0.91	U	1.7	UJ	1.7	UJ	0.92	UJ	1.1	U	1.0	U	1.4	UJ	1.7	UJ	1.7	UJ
gamma-Chlordane	0.91	U	32	*J	57	*J	1.9	J	10		31	*	6.2	J	5.2	J	4.0	J
Heptachlor	0.91	U	1.7	UJ	1.7	UJ	0.92	UJ	1.1	U	1.0	U	1.4	UJ	1.7	UJ	1.7	UJ
Heptachlor Epoxide	0.91	U	2.2	J	4.2	J	0.92	UJ	1.5		12		1.4	UJ	4.0	J	1.7	UJ
Methoxychlor	9.1	U	17	UJ	17	UJ	9.2	UJ	11	U	10	U	14	UJ	17	UJ	17	UJ
Toxaphene	91	U	170	UJ	170	UJ	92	UJ	110	U	100	U	140	UJ	170	UJ	170	UJ
TCLP Pesticide/PCB Analysis (UG/L)																		
Endrin	0.20	U	0.20	UJ	0.20	UJ	0.20	UJ	0.20	U	0.20	U	0.20	U	0.20	U		NA
gamma-BHC	0.10	U	0.10	UJ	0.10	UJ	0.10	UJ	0.10	U	0.10	U	0.10	UJ	0.10	U		NA
Heptachlor	0.10	U	0.10	UJ	0.10	UJ	0.10	UJ	0.10	U	0.10	U	0.10	U	0.10	U		NA
Heptachlor Epoxide	0.10	U	0.10	UJ	0.10	UJ	0.10	UJ	0.10	U	0.10	U	0.10	U	0.10	U		NA
Methoxychlor	1.0	U	1.0	UJ	1.0	UJ	1.0	UJ	1.0	U	1.0	U	1.0	U	1.0	U		NA
Technical Chlordane	2.0	U	2.0	UJ	2.0	UJ	2.0	UJ	2.0	U	2.0	U	2.0	U	2.0	U		NA
Toxaphene	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	10	U		NA
Dioxin Analysis (NG/KG)																		
1,2,3,4,6,7,8-HpCDD	430	JEB	73100	J*	40500	J*	10500	J*	81800	*	93940	*	25640	*	42060	*	27140	*
1,2,3,4,6,7,8-HpCDF	41.2	EB	14400	JEB*	17200	JEB*	1440	JEB	3220	*	3230	*	1890		7070	*	4500	*
1,2,3,4,7,8,9-HpCDF	2.8	J	737	JEB	990	JEB	51.8	JEB	148		109		68.4	J	234	J	139	J
1,2,3,4,7,8-HxCDD	2.1	J	269	JEB	163	JEB	42.5	JEB	54.8		77.1		20.7	J	49.2	J	19.3	J
1,2,3,4,7,8-HxCDF	2.1	J	758	JEB	699	JEB	37.1	JEB	78.3		76.0		46.1	J	170	J	75.7	J

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SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		*Field Dup.* MT-SL-704 0207		*Field Dup.* MT-SL-704 0207	
1,2,3,6,7,8-HxCDD	15.2		3990	JEB*	4690	JEB*	292	JEB	948		1200		350		1310	J	549	J
~~1,2,3,6,7,8-HxCDF~~	1.4	J	189	J	229	J	19.9	J	32.3	EB	32.4	EB	16.3	EB	84.9	EB	37.5	EB
1,2,3,7,8,9-HxCDD	7.1		576	JEB	417	JEB	60.5	JEB	211	EB	315	EB	57.1	EB	153	EB	76.4	EB
1,2,3,7,8,9-HxCDF	0.74	EMPC	3.1	UJ	1.9	UJ	0.80	UJ	1.7	U	1.8	U	0.40	UJ	4.9	U	2.8	U
1,2,3,7,8-PeCDD	1.1	J	34.7	JEB	25.0	JEB	7.3	JEB	13.5	EB	6.6	EB	3.3	JEB	12.1	EB	6.5	EB
1,2,3,7,8-PeCDF	0.27	J	2.4	UJ	1.4	UJ	0.60	UJ	1.2	U	1.1	U	2.9	J	2.6	U	1.3	U
2,3,4,6,7,8-HxCDF	2.7	J	391	JEB	488	JEB	40.4	JEB	90.5		189		35.9	J	149	J	69.0	J
2,3,4,7,8-PeCDF	0.20	U	91.9	JEB	44.9	JEB	3.2	EMPC	4.0	J	6.9		5.3		8.4	J	3.6	J
2,3,7,8-TCDD	0.39	J	18.0	J	1240	J*	13.2	J	21.7		15.5		18.2	J	268	J	83.6	J
2,3,7,8-TCDF	0.57	EMPC	26.9	J	12.0	J	2.1	UJ	2.8	EMPC	9.9		1.6		4.5		2.8	EMPC
OCDD	3370	J*	922000	J*	719000	J*	131000	J*	722660	EB*	719310	EB*	287900	EB*	717200	EB*	485720	EB*
OCDF	64.8		33200	JEB*	28500	JEB*	6250	JEB*	6000	JEB*	6820	JEB*	5200	JEB*	6360	JEB*	5940	JEB*
Total HpCDD	849	JEB	144000	J*	80000	J*	18300	J*	149650	J*	161180	J*	47190	J*	89010	J*	55340	J*
Total HpCDF	115	JEB	36900	JEB*	75200	JEB*	5530	JEB*	13140	J*	13810	J*	8670	J*	22660	J*	17780	J*
Total HxCDD	91.6	J	20400	JEB*	19300	JEB*	1650	JEB	10640	JEB*	8220	JEB*	3090	JEB	5040	JEB	2350	JEB
Total HxCDF	41.7	J	22200	JEB*	27600	JEB*	1600	JEB	2960	JEB*	3300	JEB*	2390	JEB	6530	JEB*	3180	JEB*
Total PeCDD	9.8	JEB	2090	JEB*	1830	JEB*	159	JEB	1040	JEB	1160	JEB	602	JEB	335	JEB	191	JEB
Total PeCDF	7.7	J	1690	JEB*	1400	JEB	111	JEB	237	J	306	J	193	J	270	J	189	J
Total TCDD	1.0	JEB	1090	J*	1490	J*	37.1	J	102	J	88.1	J	97.9	J	279	J	89.0	UJ
Total TCDF	0.97	JEB	210	J*	102	J*	21.6	J	40.8	JEB	56.9	JEB	23.0	JEB	108	JEB	40.0	JEB
Toxicity Equivalency	9.7	J	1700	J	2600	J	200	J	1100	J	1300	J	380	J	1000	J	540	J
TAL Metal Analysis (MG/KG)																		
Aluminum	4470		8090		10600		6660		4290		5800		2790		2420		2620	
Antimony	4.3	J	446	J	547	J	5.7	J	19.5	J	44.4	J	41.7	J	247	J	243	J
Arsenic	7.7		8.1	J	1.7	J	15.7		3.6	J	7.8	J	1.4	J	12.0	J	3.6	J
Barium	18.2	J	104	J	548	J	34.1	J	198	J	657	J	1480	J	252	J	631	J
Beryllium	0.24	UJ	0.26	UJ	0.34	J	0.41	J	0.26	UJ	0.35	J	0.22	UJ	0.17	UJ	0.14	UJ
Cadmium	0.60	U	0.74	J	1.1	J	0.60	U	3.9		16.8		0.60	U	0.60	U	0.60	U
Calcium	2970		21700		17100		1820		4980		22300		1710		2420		1500	
Chromium	578	J	53800	J	67800	J	803	J	2420	J	5280	J	5090	J	29400		29700	
Cobalt	2.8		4.1		5.0		5.3		2.9		5.6	J	2.8		2.1		2.0	
Copper	6.1		157		114		15.8		33.4		108		274		58.0		38.7	

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-503-0012		MT-SL-601-0711		MT-SL-602-0509		MT-SL-603-0007		MT-SL-701-0217		MT-SL-702-0011		MT-SL-703-0215		MT-SL-704 0207		MT-SL-DUP-04	
Sample Location	SL-503		SL-601		SL-602		SL-603		SL-701		SL-702		SL-703		SL-704		SL-704	
Date Sampled	9/4/2001		9/5/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001		8/31/2001	
Interval	0.0-12.0		7.0-11.0		5.0-9.0		0.0-7.0		2.0-17.0		0.0-11.0		2.0-15.0		2.0-7.0		2.0-7.0	
QC Identifier	None		None		None		None		None		None		None		Field Dup. MT-SL-704 0207		Field Dup. MT-SL-704 0207	
Iron	5760		4990		4650		9950		7750		25500		10400		3480		4370	
~~Lead~~	5.7		61.9		88.3		15.4		85.1		427		180		31.0		39.6	
Magnesium	1550		600		820		2290		1140		2000		610		351		155	
Manganese	145	J	68.4	J	121	J	170	J	93.5	J	207	J	45.3	J	34.6	J	15.9	J
Mercury	0.030	J	0.070	J	0.25		0.30		1.2		4.5		0.55		0.20		0.22	
Nickel	16.1		13.7		15.8		19.6		12.8		24.5		12.2		7.5		12.2	
Potassium	549	J	323	J	422	J	814	J	431	J	728	J	226	J	84.1	J	65.4	J
Selenium	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ
Silver	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Sodium	98.3	U	383		213		98.5	U	124	J	150	J	105	J	313		321	
Thallium	1.1	UJ	1.9	J	2.2	J	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.6	J	1.3	J
Vanadium	10.5		52.8		68.6		43.5		4.7		6.7		44.0		9.1		19.6	
Zinc	42.4		207		222		43.1		112		330		172		76.4		121	
TCLP Metal Analysis (UG/L)																		
Arsenic	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U		NA
Barium	58.4		77.2		98.7		59.0		146		90.0		169		124			NA
Cadmium	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U		NA
Chromium	74.4		132		301		9.4	J	37.8		8.7	J	61.5		598			NA
Lead	3.0	U	3.0	U	3.0	U	3.0	U	4.3	J	7.3	J	4.1	J	3.0	U		NA
Mercury	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.35	J	0.20	U	0.20	U		NA
Selenium	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U		NA
Silver	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U		NA
Miscellaneous Analyses																		
Chromium VI	2.4	U	2.4	U	2.3	U	2.2	U	2.3	U	2.4	UJ	2.4	UJ	2.2	UJ	2.1	U
Corrosivity	5.95		7.8		7.19		6.47		8.11		7.43		8.22		7.99		8.09	
Paint Filter		NA		NA		NA		NA		NA		NA		NA		NA		NA
Reactive Cyanide	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U		NA
Reactive Sulfide	39.8	U	271		39.9	U	40.0	U	40.4	U	40.2	U	39.8	U	40.2	U		NA
Redox Potential	489.3		360.4		373		430.8		341.6		376.3		344.6		347.1		353.5	
Sulfide	5.9	U	20.0		46.0		8.8		5.8	U	6.0	U	48.0		310		290	

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

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SOIL ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SO-A2-OVCOMP		MT-SO-A2-UNCOMP		MT-SO-A3-OVCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-OVCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-OVCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-OVCOMP		MT-SO-A7-UNCOMP	
Sample Location	SO-A2		SO-A2		SO-A3		SO-A3		SO-A4		SO-A4		SO-A6		SO-A6		SO-A7		SO-A7	
Date Sampled	8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	None		None		None		None		None		None		None		None		None		None	
Volatile Organic Analysis (UG/KG)																				
1,1,1-Trichloroethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,1,2,2-Tetrachloroethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,1,2-Trichloro-1,2,2-trifluoroethane	190	U	250	U	200	UJ	210	UJ	240	U	170	U	180	U	210	U	260	U	240	UJ
1,1,2-Trichloroethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,1-Dichloroethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,1-Dichloroethene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,2,4-Trichlorobenzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,2-Dibromo-3-chloropropane		R		R		R		R		R		R		R		R	260	UJ	240	UJ
1,2-Dibromoethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,2-Dichlorobenzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,2-Dichloroethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,2-Dichloropropane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,3-Dichlorobenzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
1,4-Dichlorobenzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
2-Butanone	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
2-Hexanone	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
4-Methyl-2-Pentanone	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Acetone	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Benzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Bromodichloromethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Bromoform	190	U	250	U	200	UJ	210	UJ	240	U	170	U	180	U	210	U	260	U	240	UJ
Bromomethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Carbon Disulfide	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Carbon Tetrachloride	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Chlorobenzene	190	U	250	U	200	U	210	U	240	U	170	U	25	J	210	U	260	U	240	UJ
Chloroethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Chloroform	25	J	33	J	200	U	210	U	32	J	170	U	180	U	210	U	260	U	240	UJ
Chloromethane	190	UJ	250	UJ	200	UJ	210	UJ	240	UJ	170	UJ	180	UJ	210	UJ	260	U	240	UJ
cis-1,2-Dichloroethene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
cis-1,3-Dichloropropene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Cyclohexane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Dibromochloromethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Dichlorodifluoromethane	190	UJ	250	UJ	200	UJ	210	UJ	240	UJ	170	UJ	180	UJ	210	UJ	260	UJ	240	UJ
Ethylbenzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SOIL ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SO-A2-OVCOMP		MT-SO-A2-UNCOMP		MT-SO-A3-OVCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-OVCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-OVCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-OVCOMP		MT-SO-A7-UNCOMP	
Sample Location	SO-A2		SO-A2		SO-A3		SO-A3		SO-A4		SO-A4		SO-A6		SO-A6		SO-A7		SO-A7	
Date Sampled	8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	None		None		None		None		None		None		None		None		None		None	
Isopropylbenzene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Methyl Acetate	44	J	250	U	200	U	210	U	130	J	170	U	180	U	210	U	260	U	560	J
Methyl tert-Butyl Ether	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Methylcyclohexane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Methylene Chloride	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Styrene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Tetrachloroethene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Toluene	19	J	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	650	J
Total Xylenes	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
trans-1,2-Dichloroethene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
trans-1,3-Dichloropropene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Trichloroethene	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Trichlorofluoromethane	190	U	250	U	200	U	210	U	240	U	170	U	180	U	210	U	260	U	240	UJ
Vinyl Chloride	190	UJ	250	UJ	200	U	210	U	240	UJ	170	UJ	180	U	210	U	260	U	240	UJ
Semivolatile Organic Analysis (UG/KG)																				
1,1'-Biphenyl	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2,2'-oxybis(1-Chloropropane)	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2,4,5-Trichlorophenol	2400	U	460	U	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
2,4,6-Trichlorophenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2,4-Dichlorophenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2,4-Dimethylphenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2,4-Dinitrophenol	2400	U	460	U	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
2,4-Dinitrotoluene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2,6-Dinitrotoluene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2-Chloronaphthalene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2-Chlorophenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2-Methylnaphthalene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2-Methylphenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
2-Nitroaniline	2400	U	460	U	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
2-Nitrophenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
3,3'-Dichlorobenzidine	940	U	180	U	880	U	200	U	1800	U	180	U	180	UJ	180	UJ	900	U	940	U
3-Nitroaniline	2400	U	460	U	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
4,6-Dinitro-2-methylphenol	2400	U	460	U	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
4-Bromophenyl-phenylether	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
4-Chloro-3-methylphenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SOIL ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SO-A2-OVCOMP		MT-SO-A2-UNCOMP		MT-SO-A3-OVCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-OVCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-OVCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-OVCOMP		MT-SO-A7-UNCOMP	
Sample Location	SO-A2		SO-A2		SO-A3		SO-A3		SO-A4		SO-A4		SO-A6		SO-A6		SO-A7		SO-A7	
Date Sampled	8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	None		None		None		None		None		None		None		None		None		None	
4-Chloroaniline	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
4-Chlorophenyl-phenylether	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
4-Methylphenol		R		R		R		R		R	860	J	180	U	180	U		R	1200	J
4-Nitroaniline	2400	U	460	UJ	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
4-Nitrophenol	2400	U	460	U	2200	U	510	U	4500	U	450	U	440	U	450	U	2300	U	2300	U
Acenaphthene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Acenaphthylene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Acetophenone	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Anthracene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Atrazine	940	UJ	180	U	880	UJ	200	UJ	1800	UJ	180	UJ	180	U	180	U	900	UJ	940	UJ
Benzaldehyde	940	UJ	180	U	880	UJ	200	UJ	1800	UJ	180	UJ	180	UJ	180	UJ	900	UJ	940	UJ
Benzo(a)anthracene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Benzo(a)pyrene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Benzo(b)fluoranthene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Benzo(g,h,i)perylene	940	U	180	UJ	880	U	200	U	1800	U	180	U	180	UJ	180	UJ	900	U	940	U
Benzo(k)fluoranthene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Bis(2-Chloroethoxy)methane	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Bis(2-Chloroethyl)ether	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
bis(2-Ethylhexyl)phthalate	940	U	180	UJ	880	U	290	U	1800	U	180	U	610	U	180	U	900	U	940	U
Butylbenzylphthalate	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Caprolactam	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Carbazole	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Chrysene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Di-n-Butylphthalate	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Di-n-octylphthalate	940	U	180	UJ	880	U	200	U	1800	U	180	U	180	UJ	180	UJ	900	U	940	U
Dibenzo(a,h)anthracene	940	U	180	U	880	U	200	U	1800	U	180	U	180	UJ	180	UJ	900	U	940	U
Dibenzofuran	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Diethylphthalate	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Dimethylphthalate	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Fluoranthene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Fluorene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Hexachlorobenzene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Hexachlorobutadiene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Hexachlorocyclopentadiene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Hexachloroethane	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SOIL ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SO-A2-OVCOMP		MT-SO-A2-UNCOMP		MT-SO-A3-OVCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-OVCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-OVCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-OVCOMP		MT-SO-A7-UNCOMP	
Sample Location	SO-A2		SO-A2		SO-A3		SO-A3		SO-A4		SO-A4		SO-A6		SO-A6		SO-A7		SO-A7	
Date Sampled	8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	None		None		None		None		None		None		None		None		None		None	
Indeno(1,2,3-cd)pyrene	940	U	180	U	880	U	200	U	1800	U	180	U	180	UJ	180	UJ	900	U	940	U
Isophorone	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
N-Nitroso-di-n-propylamine	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
N-Nitroso-diphenylamine	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Naphthalene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Nitrobenzene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Pentachlorophenol	2400	U	980		2200	U	120	J	4500	U	450	U	440	U	450	U	2300	U	2300	U
Phenanthrene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Phenol	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	390	JEB
Pyrene	940	U	180	U	880	U	200	U	1800	U	180	U	180	U	180	U	900	U	940	U
Pesticide/PCB Analysis (UG/KG)																				
4,4'-DDD	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
4,4'-DDE	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
4,4'-DDT	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
Aldrin	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
alpha-BHC	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
alpha-Chlordane	2.7	EB	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	2.1		0.93	U
Aroclor-1016	37	U	36	U	17	U	20	U	35	U	35	U	17	UJ	17	UJ	18	U	18	U
Aroclor-1221	74	U	73	U	35	U	40	U	71	U	71	U	35	UJ	35	UJ	36	U	37	U
Aroclor-1232	37	U	36	U	17	U	20	U	35	U	35	U	17	UJ	17	UJ	18	U	18	U
Aroclor-1242	37	U	36	U	17	U	20	U	35	U	35	U	17	UJ	17	UJ	18	U	18	U
Aroclor-1248	37	U	36	U	17	U	20	U	35	U	35	U	17	UJ	17	UJ	18	U	18	U
Aroclor-1254	37	U	36	U	17	U	20	U	39		35	U	17	UJ	17	UJ	5.7	J	18	U
Aroclor-1260	37	U	36	U	17	U	20	U	35	U	35	U	17	UJ	17	UJ	18	U	18	U
beta-BHC	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
delta-BHC	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
Dieldrin	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
Endosulfan I	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
Endosulfan II	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
Endosulfan Sulfate	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
Endrin	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
Endrin Aldehyde	3.7	U	3.6	U	1.7	U	2.0	UJ	3.5	U	3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
Endrin Ketone	3.7	U	3.6	U	1.7	U	2.0	UJ	6.3		3.5	U	1.7	UJ	1.7	UJ	1.8	U	1.8	U
gamma-BHC	1.9	UJ	1.8	UJ	0.89	U	1.0	UJ	1.8	UJ	1.8	UJ	0.88	UJ	0.90	UJ	0.91	U	0.93	U
gamma-Chlordane	2.5		1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	2.7		0.93	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SOIL ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SO-A2-OVCOMP		MT-SO-A2-UNCOMP		MT-SO-A3-OVCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-OVCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-OVCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-OVCOMP		MT-SO-A7-UNCOMP	
Sample Location	SO-A2		SO-A2		SO-A3		SO-A3		SO-A4		SO-A4		SO-A6		SO-A6		SO-A7		SO-A7	
Date Sampled	8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	None		None		None		None		None		None		None		None		None		None	
Heptachlor	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
Heptachlor Epoxide	1.9	U	1.8	U	0.89	U	1.0	UJ	1.8	U	1.8	U	0.88	UJ	0.90	UJ	0.91	U	0.93	U
Methoxychlor	19	U	18	U	8.9	U	10	UJ	18	U	18	U	8.8	UJ	9.0	UJ	9.1	U	9.3	U
Toxaphene	190	U	180	U	89	U	100	UJ	180	U	180	U	88	UJ	90	UJ	91	U	93	U
Dioxin Analysis (NG/KG)																				
1,2,3,4,6,7,8-HpCDD	3340	*	41.0		2100	*	42.2		765		8.6		4350	J*	513	J	9910	*	714	
1,2,3,4,6,7,8-HpCDF	894		3.4	U	343		5.0		108		2.5	J	633	JEB	79.5	JEB	609		131	
1,2,3,4,7,8,9-HpCDF	31.0		0.40	U	13.8		0.60	U	6.5		1.7	J	18.5	EMPC	4.9	EMPC	20.2		4.8	J
1,2,3,4,7,8-HxCDD	8.8		0.30	U	18.3		0.40	U	3.2	J	0.96	J	9.4	JEB	0.80	UJ	11.9		0.71	J
1,2,3,4,7,8-HxCDF	13.9		0.27	U	9.8		0.30	U	4.1	J	1.2	J	22.1	JEB	1.4	JEB	12.1		1.6	J
1,2,3,6,7,8-HxCDD	123		1.8	U	160		3.1	J	30.2		1.4	J	160	JEB	10.3	JEB	156		16.0	
1,2,3,6,7,8-HxCDF	10.6		0.11	EMPC	8.9	EB	0.30	U	2.5	JEB	1.2	JEB	13.0	EMPC	0.50	UJ	7.1	EB	1.1	JEB
1,2,3,7,8,9-HxCDD	26.6		0.68	J	67.6	EB	1.6	JEB	7.8	EB	2.3	JEB	26.5	JEB	2.8	JEB	37.9	EB	3.5	JEB
1,2,3,7,8,9-HxCDF	0.50	U	0.20	U	4.3	EMPC	0.40	U	3.5	JEB	3.0	JEB	10.8	EMPC	0.60	UJ	0.20	U	0.20	U
1,2,3,7,8-PeCDD	3.2	J	0.23	EMPC	15.9	EB	0.54	EMPC	2.2	JEB	1.7	JEB	2.6	EMPC	0.60	UJ	2.6	JEB	0.20	U
1,2,3,7,8-PeCDF	0.69	J	0.20	U	1.0	J	0.30	U	1.1	J	1.6	J	0.40	UJ	0.50	UJ	0.20	U	0.20	U
2,3,4,6,7,8-HxCDF	28.0		0.20	U	16.2		0.30	U	5.1		1.2	J	22.2	JEB	4.0	JEB	23.1		2.6	J
2,3,4,7,8-PeCDF	1.4	JEB	0.20	U	1.9	J	0.30	U	1.1	J	1.1	J	1.7	JEB	0.40	UJ	1.6	J	0.10	U
2,3,7,8-TCDD	4.4		0.20	U	3.7		0.30	U	2.3		0.66	EMPC	25.2	J	0.48	EMPC	2.4		0.41	J
2,3,7,8-TCDF	0.99	J		R	0.69	J	0.20	U	1.4		0.73	J	0.87	UJ	0.30	UJ	1.5		0.29	J
OCDD	51900	*	371		22290	EB*	425	JEB	4550	EB*	67.4	JEB	56600	J*	7090	J*	114850	JEB*	5240	EB*
OCDF	1230		3.5	U	431	JEB	6.3	EMPC	174	JEB	6.6	JEB	616	JEB	817	JEB	958	JEB	545	JEB
Total HpCDD	6240	J*	74.1	UJ	4090	J*	80.8	J	1380	J	14.1	J	7870	J*	1020	J	18220	J*	1280	J
Total HpCDF	2800	J	20.0	J	831	J	12.8	J	361		6.0	J	1990	JEB	404	JEB	1730	J	528	J
Total HxCDD	746	J	8.3	EMPC	943	JEB	17.3	JEB	138	JEB	4.6	JEB	1260	JEB	92.8	JEB	987	J	81.6	JEB
Total HxCDF	928	J	6.0	EMPC	318	JEB	5.6	JEB	140	JEB	7.1	JEB	920	JEB	74.6	JEB	573	JEB	106	JEB
Total PeCDD	102	JEB	1.0	EMPC	250	JEB	2.9	JEB	24.0	JEB	1.7	JEB	176	JEB	5.5	JEB	105	JEB	7.0	JEB
Total PeCDF	42.4	J	3.8	J	52.4	J	0.30	UJ	9.7	J	2.7	J	61.5	JEB	3.9	JEB	42.7	J	8.6	J
Total TCDD	19.8	J	0.20	UJ	44.4	J	0.56	EMPC	2.3	J	0.66	EMPC	51.4	J	0.48	EMPC	5.7	J	0.66	J
Total TCDF	12.3	J	0.63	EMPC	17.9	JEB	0.51	JEB	6.4	JEB	0.73	JEB	9.7	J	0.97	UJ	15.5	JEB	3.0	JEB
Toxicity Equivalency	77.0	J	0.76	J	76.0	J	1.5	J	20.0	J	4.3	J	110	J	9.1	J	150	J	12.0	J
TAL Metal Analysis (MG/KG)																				
Aluminum	4050		4120		3120		2000		5010		6050		6120		4100		4190		8400	
Antimony	9.2		0.74	U	2.3		0.74	U	22.3	J	0.74	U	3.4	J	0.74	U	4.4	J	1.2	J
Arsenic	4.5		13.9		5.5		6.3		1.6	J	5.8		9.9		7.2		7.2		8.2	

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SOIL ANALYTICAL RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SO-A2-OVCOMP		MT-SO-A2-UNCOMP		MT-SO-A3-OVCOMP		MT-SO-A3-UNCOMP		MT-SO-A4-OVCOMP		MT-SO-A4-UNCOMP		MT-SO-A6-OVCOMP		MT-SO-A6-UNCOMP		MT-SO-A7-OVCOMP		MT-SO-A7-UNCOMP	
Sample Location	SO-A2		SO-A2		SO-A3		SO-A3		SO-A4		SO-A4		SO-A6		SO-A6		SO-A7		SO-A7	
Date Sampled	8/29/2001		8/29/2001		8/30/2001		8/30/2001		8/30/2001		8/30/2001		9/5/2001		9/5/2001		8/31/2001		8/31/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	None		None		None		None		None		None		None		None		None		None	
Barium	45.9		27.8		14.9		12.9		20.7		26.6		24.2		15.2		48.5		24.2	
Beryllium	0.21		0.22		0.20		0.13		0.26		0.17		0.34	J	0.25	UJ	0.27	UJ	0.41	J
Cadmium	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U
Calcium	4040		1520		2320		560		1450		1130		565		667		988		735	
Chromium	1080		17.4		316		12.8		2670		26.8		480		81.2		563		174	
Cobalt	2.5		5.5		2.8		1.8		3.5		5.4		4.9		2.5		2.6		3.4	
Copper	10.8		11.2		5.8		5.4		9.0		9.8		8.9		5.8		13.1		15.9	
Iron	4780		6300		3680		3580		5570		9060		8020		6120		4460		6710	
Lead	18.5		5.8		4.0		2.5		10.2		4.2		6.3		3.3		24.7		7.3	
Magnesium	1100		2350		961		828		1460		3530		2540		1380		1090		1440	
Manganese	72.5		141		83.8		33.4		185		106		101		59.2		72.4		58.7	
Mercury	0.93	J	0.020	UJ	0.030	J	0.020	UJ	0.090	J	0.040	J	0.17		0.060	J	0.57		0.050	J
Nickel	6.5		20.0		7.7		6.5		9.9		17.6		17.0		8.9		15.4		11.0	
Potassium	406	J	1360	J	514	J	438	J	649	J	2180	J	1040	J	695	J	373	J	397	J
Selenium	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ
Silver	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Sodium	98.0	U	522		98.0	U	98.5	U	98.4	U	98.5	U	97.9	U	98.6	U	98.5	U	97.9	U
Thallium	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ
Vanadium	4.8		10.3		5.7		4.7		3.6		14.5		14.4		10.2		10.6		11.8	
Zinc	40.0		19.2		14.5		12.0		23.3		24.4		25.7		16.1	U	45.1		38.6	
Wet Chemistry Analysis																				
Chromium VI	2.2	U	2.2	U	2.1	U	2.1	U	2.2	U	2.1	U	28.0		2.1	U	2.2	UJ	2.2	UJ
Corrosivity	8.01		8.82		7.75		7.78		6.4		8.29		5.55		5.39		6.43		8.06	
Redox Potential	353.2		395.3		387.8		391.5		442.1		356.7		476.7		285		408.9		346.3	
Sulfide	39.0		5.5	U	5.2	U	5.2	U	5.5	U	85.0		5.2	U	5.4	U	5.4	U	5.6	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

BLANK ANALYTICAL RESULTS - AQUEOUS UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-TB-082901		MT-SL-RB01		MT-SL-RB02		MT-SL-RB-03		MT-SL-TB-091101		MT-SL-RB04		MT-SL-TB091701	
Sample Location	Blank		Blank		Blank		Blank		Blank		Blank		Blank	
Date Sampled	8/29/2001		8/30/2001		8/30/2001		9/4/2001		9/11/2001		9/17/2001		9/17/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Rinsate Blank		Rinsate Blank		Rinsate Blank		Trip Blank		Rinsate Blank		Trip Blank	
Volatile Organic Analysis (UG/L)														
1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-Trichloro-1,2,2-trifluoroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane		R		R		R		R		R		R		R
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloropropane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	UJ	10	UJ	10	UJ	7	J	10	U	5	J	10	U
Benzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Bromodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Bromomethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Carbon Disulfide	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	10	U	10	U	10	U	10	U	2	J	10	U	2	J
Chloromethane	10	UJ	10	UJ	10	UJ	10	UJ	250	UJ	10	UJ	250	UJ
cis-1,2-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Dibromochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Dichlorodifluoromethane	10	UJ	10	UJ	10	UJ	10	UJ	250	UJ	10	UJ	250	UJ

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

BLANK ANALYTICAL RESULTS - AQUEOUS UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-TB-082901		MT-SL-RB01		MT-SL-RB02		MT-SL-RB-03		MT-SL-TB-091101		MT-SL-RB04		MT-SL-TB091701	
Sample Location	Blank		Blank		Blank		Blank		Blank		Blank		Blank	
Date Sampled	8/29/2001		8/30/2001		8/30/2001		9/4/2001		9/11/2001		9/17/2001		9/17/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Rinsate Blank		Rinsate Blank		Rinsate Blank		Trip Blank		Rinsate Blank		Trip Blank	
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Acetate	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl tert-Butyl Ether	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methylcyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methylene Chloride	1	J	1	J	1	J	10	U	2	J	2	J	3	J
Styrene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Toluene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Total Xylenes	10	U	10	U	10	U	10	U		R	10	U		R
trans-1,2-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Trichlorofluoromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Semivolatile Organic Analysis (UG/L)														
1,1'-Biphenyl		NA	10	U	10	UJ	10	U		NA	10	U		NA
2,2'-oxybis(1-Chloropropane)		NA	10	U	10	UJ	10	U		NA	10	UJ		NA
2,4,5-Trichlorophenol		NA	25	U	25	UJ	25	U		NA	25	U		NA
2,4,6-Trichlorophenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
2,4-Dichlorophenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
2,4-Dimethylphenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
2,4-Dinitrophenol		NA	25	U	25	UJ	25	UJ		NA	25	U		NA
2,4-Dinitrotoluene		NA	10	U	10	UJ	10	U		NA	10	U		NA
2,6-Dinitrotoluene		NA	10	U	10	UJ	10	U		NA	10	U		NA
2-Chloronaphthalene		NA	10	U	10	UJ	10	U		NA	10	U		NA
2-Chlorophenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
2-Methylnaphthalene		NA	10	U	10	UJ	10	U		NA	10	U		NA
2-Methylphenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
2-Nitroaniline		NA	25	U	25	UJ	25	U		NA	25	U		NA
2-Nitrophenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
3,3'-Dichlorobenzidine		NA	10	U	10	UJ	10	U		NA	10	U		NA
3-Nitroaniline		NA	25	U	25	UJ	25	U		NA	25	U		NA
4,6-Dinitro-2-methylphenol		NA	25	U	25	UJ	25	UJ		NA	25	U		NA

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BLANK ANALYTICAL RESULTS - AQUEOUS UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-TB-082901		MT-SL-RB01		MT-SL-RB02		MT-SL-RB-03		MT-SL-TB-091101		MT-SL-RB04		MT-SL-TB091701	
Sample Location	Blank		Blank		Blank		Blank		Blank		Blank		Blank	
Date Sampled	8/29/2001		8/30/2001		8/30/2001		9/4/2001		9/11/2001		9/17/2001		9/17/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Rinsate Blank		Rinsate Blank		Rinsate Blank		Trip Blank		Rinsate Blank		Trip Blank	
4-Bromophenyl-phenylether		NA	10	U	10	UJ	10	U		NA	10	U		NA
4-Chloro-3-methylphenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
4-Chloroaniline		NA	10	U	10	UJ	10	U		NA	10	U		NA
4-Chlorophenyl-phenylether		NA	10	U	10	UJ	10	U		NA	10	U		NA
4-Methylphenol		NA	10	U	10	UJ	10	U		NA	10	U		NA
4-Nitroaniline		NA	25	U	25	UJ	25	U		NA	25	U		NA
4-Nitrophenol		NA	25	U	25	UJ	25	U		NA	25	U		NA
Acenaphthene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Acenaphthylene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Acetophenone		NA	10	U	10	UJ	10	U		NA	10	U		NA
Anthracene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Atrazine		NA	10	U	10	UJ	10	UJ		NA	10	UJ		NA
Benzaldehyde		NA	3	J	2	J	10	UJ		NA	2	J		NA
Benzo(a)anthracene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Benzo(a)pyrene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Benzo(b)fluoranthene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Benzo(g,h,i)perylene		NA	10	U	10	UJ	10	UJ		NA	10	U		NA
Benzo(k)fluoranthene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Bis(2-Chloroethoxy)methane		NA	10	U	10	UJ	10	U		NA	10	U		NA
Bis(2-Chloroethyl)ether		NA	10	U	10	UJ	10	U		NA	10	U		NA
bis(2-Ethylhexyl)phthalate		NA	10	U	10	UJ	10	U		NA	10	U		NA
Butylbenzylphthalate		NA	10	U	10	UJ	10	U		NA	10	U		NA
Caprolactam		NA	10	U	10	UJ	10	U		NA	10	U		NA
Carbazole		NA	10	U	10	UJ	10	U		NA	10	U		NA
Chrysene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Di-n-Butylphthalate		NA	2	J	1	J	2	J		NA	1	J		NA
Di-n-octylphthalate		NA	10	U	10	UJ	10	U		NA	10	U		NA
Dibenzo(a,h)anthracene		NA	10	U	10	UJ	10	UJ		NA	10	U		NA
Dibenzofuran		NA	10	U	10	UJ	10	U		NA	10	U		NA
Diethylphthalate		NA	10	U	10	UJ	10	U		NA	10	U		NA
Dimethylphthalate		NA	10	U	10	UJ	10	U		NA	10	U		NA
Fluoranthene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Fluorene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Hexachlorobenzene		NA	10	U	10	UJ	10	U		NA	10	U		NA

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R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

BLANK ANALYTICAL RESULTS - AQUEOUS UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-TB-082901		MT-SL-RB01		MT-SL-RB02		MT-SL-RB-03		MT-SL-TB-091101		MT-SL-RB04		MT-SL-TB091701	
Sample Location	Blank		Blank		Blank		Blank		Blank		Blank		Blank	
Date Sampled	8/29/2001		8/30/2001		8/30/2001		9/4/2001		9/11/2001		9/17/2001		9/17/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Rinsate Blank		Rinsate Blank		Rinsate Blank		Trip Blank		Rinsate Blank		Trip Blank	
Hexachlorobutadiene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Hexachlorocyclopentadiene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Hexachloroethane		NA	10	U	10	UJ	10	U		NA	10	U		NA
Indeno(1,2,3-cd)pyrene		NA	10	U	10	UJ	10	UJ		NA	10	U		NA
Isophorone		NA	10	U	10	UJ	10	U		NA	10	U		NA
N-Nitroso-di-n-propylamine		NA	10	U	10	UJ	10	U		NA	10	U		NA
N-Nitroso-diphenylamine		NA	10	U	10	UJ	10	U		NA	10	U		NA
Naphthalene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Nitrobenzene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Pentachlorophenol		NA	25	U	25	UJ	25	U		NA	25	U		NA
Phenanthrene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Phenol		NA	10	U	2	J	10	U		NA	10	U		NA
Pyrene		NA	10	U	10	UJ	10	U		NA	10	U		NA
Pesticide/PCB Analysis (UG/L)														
4,4'-DDD		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
4,4'-DDE		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
4,4'-DDT		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
Aldrin		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
alpha-BHC		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
alpha-Chlordane		NA	0.60		0.050	UJ	0.050	UJ		NA	0.050	U		NA
Aroclor-1016		NA	1.0	U	1.0	UJ	1.0	UJ		NA	1.0	U		NA
Aroclor-1221		NA	2.0	U	2.0	UJ	2.0	UJ		NA	2.0	U		NA
Aroclor-1232		NA	1.0	U	1.0	UJ	1.0	UJ		NA	1.0	U		NA
Aroclor-1242		NA	1.0	U	1.0	UJ	1.0	UJ		NA	1.0	U		NA
Aroclor-1248		NA	1.0	U	1.0	UJ	1.0	UJ		NA	1.0	U		NA
Aroclor-1254		NA	1.0	U	1.0	UJ	1.0	UJ		NA	1.0	U		NA
Aroclor-1260		NA	1.0	U	1.0	UJ	1.0	UJ		NA	1.0	U		NA
beta-BHC		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
delta-BHC		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
Dieldrin		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
Endosulfan I		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
Endosulfan II		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
Endosulfan Sulfate		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
Endrin		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

BLANK ANALYTICAL RESULTS - AQUEOUS UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-TB-082901		MT-SL-RB01		MT-SL-RB02		MT-SL-RB-03		MT-SL-TB-091101		MT-SL-RB04		MT-SL-TB091701	
Sample Location	Blank		Blank		Blank		Blank		Blank		Blank		Blank	
Date Sampled	8/29/2001		8/30/2001		8/30/2001		9/4/2001		9/11/2001		9/17/2001		9/17/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Rinsate Blank		Rinsate Blank		Rinsate Blank		Trip Blank		Rinsate Blank		Trip Blank	
Endrin Aldehyde		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
Endrin Ketone		NA	0.10	U	0.10	UJ	0.10	UJ		NA	0.10	U		NA
gamma-BHC		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
gamma-Chlordane		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
Heptachlor		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
Heptachlor Epoxide		NA	0.050	U	0.050	UJ	0.050	UJ		NA	0.050	U		NA
Methoxychlor		NA	0.50	U	0.50	UJ	0.50	UJ		NA	0.50	U		NA
Toxaphene		NA	5.0	U	5.0	UJ	5.0	UJ		NA	5.0	U		NA
Dioxin Analysis (PG/L)														
1,2,3,4,6,7,8-HpCDD		NA	5.1	U	6.8	U	5.4	J		NA	13.0	J		NA
1,2,3,4,6,7,8-HpCDF		NA	3.3	U	4.2	U	1.5	EMPC		NA	8.8	EMPC		NA
1,2,3,4,7,8,9-HpCDF		NA	4.2	U	5.2	U	1.4	U		NA	9.9	EMPC		NA
1,2,3,4,7,8-HxCDD		NA	3.2	U	4.5	U	1.3	U		NA	6.9	J		NA
1,2,3,4,7,8-HxCDF		NA	2.2	U	2.9	UJ	1.4	EMPC		NA	6.3	EMPC		NA
1,2,3,6,7,8-HxCDD		NA	3.3	U	4.6	U	1.3	U		NA	6.3	J		NA
1,2,3,6,7,8-HxCDF		NA	2.2	J	2.9	U	0.90	U		NA	2.3	U		NA
1,2,3,7,8,9-HxCDD		NA	3.2	EMPC	4.5	U	1.3	U		NA	10.4	J		NA
1,2,3,7,8,9-HxCDF		NA	4.3	J	3.5	U	1.0	U		NA	12.2	J		NA
1,2,3,7,8-PeCDD		NA	2.4	EMPC	3.5	U	1.7	U		NA	5.2	J		NA
1,2,3,7,8-PeCDF		NA	2.5	U	2.5	U	1.3	U		NA	4.6	EMPC		NA
2,3,4,6,7,8-HxCDF		NA	2.4	U	2.8	U	2.4	U		NA	6.7	EMPC		NA
2,3,4,7,8-PeCDF		NA	2.4	U	2.5	U	2.2	EMPC		NA	6.9	EMPC		NA
2,3,7,8-TCDD		NA	2.2	U	2.7	U	1.2	U		NA	2.3	U		NA
2,3,7,8-TCDF		NA	1.5	U	2.4	U	0.80	U		NA	1.7	U		NA
OCDD		NA	20.2	J	10.4	U	24.4	J		NA	39.0	J		NA
OCDF		NA	3.6	EMPC	6.0	EMPC	3.1	U		NA	21.4	J		NA
Total HpCDD		NA	5.1	UJ	6.8	UJ	8.8	J		NA	13.0	J		NA
Total HpCDF		NA	3.7	UJ	4.6	UJ	1.5	EMPC		NA	18.7	EMPC		NA
Total HxCDD		NA	3.2	EMPC	6.7	EMPC	1.3	UJ		NA	23.6	J		NA
Total HxCDF		NA	6.5	J	3.0	UJ	3.7	EMPC		NA	19.3	J		NA
Total PeCDD		NA	2.4	EMPC	3.5	UJ	4.0	J		NA	5.2	J		NA
Total PeCDF		NA	2.4	UJ	2.5	UJ	2.2	EMPC		NA	11.5	EMPC		NA
Total TCDD		NA	5.5	EMPC	2.7	UJ	2.4	EMPC		NA	2.3	UJ		NA
Total TCDF		NA	11.8	EMPC	4.7	EMPC	2.0	EMPC		NA	1.7	UJ		NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

BLANK ANALYTICAL RESULTS - AQUEOUS UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-TB-082901		MT-SL-RB01		MT-SL-RB02		MT-SL-RB-03		MT-SL-TB-091101		MT-SL-RB04		MT-SL-TB091701	
Sample Location	Blank		Blank		Blank		Blank		Blank		Blank		Blank	
Date Sampled	8/29/2001		8/30/2001		8/30/2001		9/4/2001		9/11/2001		9/17/2001		9/17/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Rinsate Blank		Rinsate Blank		Rinsate Blank		Trip Blank		Rinsate Blank		Trip Blank	
Toxicity Equivalency		NA	3.4	J	0.00060	J	1.2	J		NA	14.0	J		NA
TAL Metal Analysis (UG/L)														
Aluminum		NA	45.7	U	45.7	U	45.7	U		NA	45.7	U		NA
Antimony		NA	3.7	U	3.7	U	3.7	U		NA	3.7	U		NA
Arsenic		NA	5.0	U	5.0	U	5.0	U		NA	5.0	U		NA
Barium		NA	2.0	U	2.0	U	2.0	U		NA	2.0	U		NA
Beryllium		NA	0.10	U	0.10	U	0.10	U		NA	0.10	U		NA
Cadmium		NA	3.0	U	3.0	U	3.0	U		NA	3.0	U		NA
Calcium		NA	25.3	B	40.1	U	43.5	U		NA	10.7	U		NA
Chromium		NA	5.0	U	5.0	U	5.0	U		NA	5.0	U		NA
Cobalt		NA	1.8	U	1.8	U	1.8	U		NA	1.8	U		NA
Copper		NA	2.2	U	2.2	U	2.2	U		NA	2.2	U		NA
Iron		NA	19.7	B	28.7	J	26.9	J		NA	17.1	U		NA
Lead		NA	3.0	U	3.0	UJ	3.0	UJ		NA	3.0	UJ		NA
Magnesium		NA	75.9	U	75.9	U	75.9	U		NA	75.9	U		NA
Manganese		NA	1.2	U	1.2	U	1.2	U		NA	4.5			NA
Mercury		NA	0.20	U	0.20	UJ	0.20	UJ		NA	0.20	UJ		NA
Nickel		NA	4.0	U	4.0	U	4.0	U		NA	4.0	U		NA
Potassium		NA	21.9	U	21.9	UJ	24.2	J		NA	21.9	UJ		NA
Selenium		NA	5.0	U	5.0	UJ	5.0	UJ		NA	5.0	U		NA
Silver		NA	5.0	U	5.0	U	5.0	U		NA	5.0	U		NA
Sodium		NA	490	U	490	U	490	U		NA	490	U		NA
Thallium		NA	5.7	U	5.7	UJ	5.7	UJ		NA	7.5	UJ		NA
Vanadium		NA	3.2	U	3.2	U	3.2	U		NA	3.2	U		NA
Zinc		NA	21.0		17.1		18.8			NA	8.5	U		NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - *Analyte detected in equipment blank*

BLANK ANALYTICAL RESULTS - SOLID UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-TB02		MT-SL-TB-090401		MT-SL-TB-090501	
Sample Location	Blank		Blank	·	Blank	
Date Sampled	8/30/2001		9/4/2001		9/5/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Trip Blank		Trip Blank	
Volatile Organic Analysis (UG/KG)						
1,1,1-Trichloroethane	250	U	250	U	250	U
1,1,2,2-Tetrachloroethane	250	U	250	U	250	U
1,1,2-Trichloro-1,2,2-trifluoroethane	250	U	250	U	250	U
1,1,2-Trichloroethane	250	U	250	U	250	U
1,1-Dichloroethane	250	U	250	U	250	U
1,1-Dichloroethene	250	U	250	U	250	U
1,2,4-Trichlorobenzene	250	U	250	U	250	U
1,2-Dibromo-3-chloropropane	250	UJ	250	UJ		R
1,2-Dibromoethane	250	U	250	U	250	U
1,2-Dichlorobenzene	250	U	250	U	250	U
1,2-Dichloroethane	250	U	250	U	250	U
1,2-Dichloropropane	250	U	250	U	250	U
1,3-Dichlorobenzene	250	U	250	U	250	U
1,4-Dichlorobenzene	250	U	250	U	250	U
2-Butanone	250	U	250	U	250	U
2-Hexanone	250	U	250	U	250	U
4-Methyl-2-Pentanone	250	U	250	U	250	U
Acetone	250	U	250	U	250	U
Benzene	250	U	250	U	250	U
Bromodichloromethane	250	U	250	U	250	U
Bromoform	250	U	250	U	250	U
Bromomethane	250	U	250	U	250	U
Carbon Disulfide	250	U	250	U	250	U
Carbon Tetrachloride	250	U	250	U	250	U
Chlorobenzene	250	U	250	U	250	U
Chloroethane	250	U	250	U	250	U
Chloroform	71	J	74	J	33	J
Chloromethane	250	U	250	U	250	UJ
cis-1,2-Dichloroethene	250	U	250	U	250	U
cis-1,3-Dichloropropene	250	U	250	U	250	U
Cyclohexane	250	U	250	U	250	U
Dibromochloromethane	250	U	250	U	250	U
Dichlorodifluoromethane	250	UJ	250	UJ	250	UJ
Ethylbenzene	250	U	250	U	250	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

BLANK ANALYTICAL RESULTS - SOLID UNITS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	MT-SL-TB02		MT-SL-TB-090401		MT-SL-TB-090501	
Sample Location	Blank		Blank		Blank	
Date Sampled	8/30/2001		9/4/2001		9/5/2001	
Interval	0.0-0.0		0.0-0.0		0.0-0.0	
QC Identifier	Trip Blank		Trip Blank		Trip Blank	
Isopropylbenzene	250	U	250	U	250	U
Methyl Acetate	250	U	250	U	250	U
Methyl tert-Butyl Ether	250	U	250	U	250	U
Methylcyclohexane	250	U	250	U	250	U
Methylene Chloride	250	U	250	U	250	U
Styrene	250	U	250	U	250	U
Tetrachloroethene	250	U	250	U	250	U
Toluene	250	U	250	U	250	U
Total Xylenes	250	U	250	U	250	U
trans-1,2-Dichloroethene	250	U	250	U	250	U
trans-1,3-Dichloropropene	250	U	250	U	250	U
Trichloroethene	250	U	250	U	250	U
Trichlorofluoromethane	250	U	250	U	250	U
Vinyl Chloride	250	U	250	U	250	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate; * - From dilution analysis;
R - Rejected; NA - Not Analyzed; EMPC - Est. Max. Possible Conc.; EB - Analyte detected in equipment blank

SLUDGE AND SOIL SAMPLE PERCENT SOLIDS RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	VOCs	SVOCs	Pesticides/ PCBs	Dioxins	Metals	Chromium VI	Corrosivity	Paint Filter	Reactive Cyanide	Reactive Sulfide	Redox Potential	Sulfide
MT-SL-101-0010	21	21	21	24.8	29.4	32.8	32.8				32.8	32.8
MT-SL-102-0012	23	24	24	18.7	21.8	30.1	30.1				30.1	30.1
MT-SL-103-0010	21	35	35	29	31	31.6	31.6				31.6	31.6
MT-SL-104-0010	24	21	21	17.9	21.1	13.1	13.1	13.1			13.1	13.1
MT-SL-201-0616	87	68	68	86.6	81.4	80.6	80.6				80.6	80.6
MT-SL-202-0717	78	58	58	85.4	82.6	55.7	55.7				55.7	55.7
MT-SL-203-0619	83	54	54	72.4	84.5	67.9	67.9				67.9	67.9
MT-SL-204-0618	87	72	72	63	72.4	55.1	55.1				55.1	55.1
MT-SL-205-0616	82	83	83	80	83.3	79.6	79.6	79.6			79.6	79.6
MT-SL-301-0208	87	94	94	93.7	92.3	89.2	89.2		89.2	89.2	89.2	89.2
MT-SL-302-0309	89	91	91	90.6	92.2	90.8	90.8		90.8	90.8	90.8	90.8
MT-SL-303-0618	83	92	92	91.9	90	92.1	92.1		92.1	92.1	92.1	92.1
MT-SL-401-0511	59	57	57	68.1	71.5	69	69		69	69	69	69
MT-SL-402-0311	39	43	43	36.4	40.5	50	50	50	50	50	50	50
MT-SL-403-0510	51	78	78	69.2	79.9	79.9	79.9		79.9	79.9	79.9	79.9
MT-SL-501-0020	100	99	99	97.6	97.3	97.2	97.2		97.2	97.2	97.2	97.2
MT-SL-502-0012	94	96	96	96.3	95.6	95.9	95.9		95.9	95.9	95.9	95.9
MT-SL-503-0012	88	93	93	90	93.2	84.6	84.6		84.6	84.6	84.6	84.6
MT-SL-601-0711	30	39	39	39.1	32.3	41.1	41.1		41.1	41.1	41.1	41.1
MT-SL-602-0509	57	32	32	39.9	27.3	43.9	43.9		43.9	43.9	43.9	43.9
MT-SL-603-0007	45	91	91	91.3	91.3	91	91		91	91	91	91
MT-SL-701-0217	85	77	77	85	89.4	86	86		86	86	86	86
MT-SL-702-0011	87	83	83	82	82.9	83.7	83.7		83.7	83.7	83.7	83.7
MT-SL-703-0215	78	61	61	82.7	81.8	82.9	82.9		82.9	82.9	82.9	82.9
MT-SL-704-0207	32	33	33	52	37.5	45.7	45.7		45.7	45.7	45.7	45.7
MT-SL-A1-SLCOMP							21.7		21.7	21.7		
MT-SL-A2-SLCOMP							94.2		94.2	94.2		
MT-SL-DUP-01	82	56	56	75.8	82.7	75.1	75.1				75.1	75.1
MT-SL-DUP-02							76.2		76.2	76.2		
MT-SL-DUP-04	31	30	30	60.5	41.9	48.4	48.4				48.4	48.4
MT-SL-DUP-05	98	97	97	97.1	97.7	97.9	97.9				97.9	97.9
MT-SL-DUP-06	28	34	34	31.9	29.5	25.9	25.9				25.9	25.9
MT-SL-DUP-08							17		17	17		

SLUDGE AND SOIL SAMPLE PERCENT SOLIDS RESULTS
EE/CA FIELD INVESTIGATION
MOHAWK TANNERY SITE, NASHUA, NEW HAMPSHIRE

Sample Number	VOCs	SVOCs	Pesticides/ PCBs	Dioxins	Metals	Chromium VI	Corrosivity	Paint Filter	Reactive Cyanide	Reactive Sulfide	Redox Potential	Sulfide
MT-SO-A2-OVCOMP	87	90	90	90.4	91.8	92.2	92.2				92.2	92.2
MT-SO-A2-UNCOMP	85	92	92	90.4	90.4	91.6	91.6				91.6	91.6
MT-SO-A3-OVCOMP	97	95	95	95.4	96.2	95.5	95.5				95.5	95.5
MT-SO-A3-UNCOMP	94	83	83	94.6	93.9	95.7	95.7				95.7	95.7
MT-SO-A4-OVCOMP	92	95	95	85	92.3	91.1	91.1				91.1	91.1
MT-SO-A4-UNCOMP	92	94	94	92.1	94.8	94.5	94.5				94.5	94.5
MT-SO-A6-OVCOMP	96	96	96	95.5	95.4	95.8	95.8				95.8	95.8
MT-SO-A6-UNCOMP	97	94	94	94.4	95.6	93.3	93.3				93.3	93.3
MT-SO-A7-OVCOMP	94	93	93	92	94.8	92.7	92.7				92.7	92.7
MT-SO-A7-UNCOMP	85	90	90	84.3	87.8	88.9	88.9				88.9	88.9

APPENDIX H

HISTORICAL AERIAL PHOTOGRAPH OF MOHAWK TANNERY SITE

AERIAL PHOTOGRAPH OF MOHAWK TANNERY (DATE UNKOWN)				APPENDIX H
MOHAWK TANNERY SITE				TETRA TECH NUS, INC.
NASHUA, NEW HAMPSHIRE				
DRAWN BY:	D.W. MACDOUGALL	REV.:	0	55 Jonspin Road Wilmington, MA 01887
CHECKED BY:	S. VETERE	DATE:	APRIL 2002	(978)658-7899
SCALE:	AS SHOWN	ACAD NAME:	DWG\4111\1010\APP_H.DWG	

Originals in color.

APPENDIX I

WETLAND DELINEATION SUPPORTING INFORMATION

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** A3 **PLOT:** A3 wet

DELINEATORS(S): K.O'Neill/M. Croot **DATE:** 7/10/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Tree				
Acer rubrum	20/25	80	*	FAC
Platanus occidentalis	5/25	20	*	FACW-
Shrub				
Cornus amomum	7/7	100	*	FACW
Herb				
Carex lurida	22/46	48	*	OBL
Onoclea sensibilis	17/46	37	*	FACW
C. crinita	5/46	11		OBL
Osmunda cinnamomea	2/46	4		FACW
Wet = wetland plot				

HYDROPHYTES

OBL	FACW	FAC	*OTHER
1	3	1	

NON-HYDROPHYTES

FAC	FACU	UPL

Hydrophytes Subtotal (A): 5

Non-hydrophytes Subtotal (B): 0

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ____

Aerial photography Identification: ____

Other Identification: ____

☐ **NO RECORDED DATA**

☐ **OBSERVATIONS:**

Depth to Free Water: 5"

Depth to Saturation (including capillary fringe): 0"

Altered Hydrology (explain): None, slightly concave area of floodplain

☒ Inundated ☒ Saturated in upper 12" ☒ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other H_2S odor

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-6"	0	5 yr 2.5/2	-	Organic muck with sand water marks indicate that it is often ponded w/1-8" water.
6-18"	A	5 yr. 2.5/1		Organic muck

HYDRIC SOIL INDICATOR(S):

I

REFERENCES(S)

NEIWPCC, July 1998

OPTIONAL SOIL DATA

Taxonomic subgroup: typic fluvaquent
Soil drainage class: very poorly drained
Depth to active water table: 5"
NTCHS hydric soil criterion:

REFERENCE(S)

Soil Survey Hillsborough County Eastern Part 1981
USACOE 1991. Soil Drainage Classes Guidelines

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☒	☐
Hydric soils criterion met?	☒	☐
Wetland hydrology criterion met?	☒	☐
IS THIS DATAPOINT IN A WETLAND?	☒	☐

REMARKS:

PROJECT TITLE: Mohawk Tannery **TRANSECT:** A3 **PLOT:** A3 wet

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** A3 **PLOT:** A3 up

DELINEATORS(S): K.O'Neill/M. Croot **DATE:** 7/10/01

VEGETATION Stratum and Species		DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Tree	Populus grandidentata	10/15	67	*	FACU-
	Prunus serotina	5/15	34	*	FACU
Shrub	Acer rubrum	30/62	48	*	FAC
	Ulmus rubra	22/62	350	*	FACW-
	Prunus rubra	10/62	16		FACU
Herbs	Polygonum cuspidatum	35/35	100	*	FACU-

Up = upland plot

HYDROPHYTES

OBL	FACW	FAC	*OTHER
		1	

NON-HYDROPHYTES

FAC	FACU	UPL
1	3	

Hydrophytes Subtotal (A): 1 **Non-hydrophytes Subtotal (B):** 5

PERCENT HYDROPHYTES (100A/A+B): 20%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ____

Aerial photography Identification: ____

Other Identification: ____

☐ **NO RECORDED DATA**

☒ **OBSERVATIONS:**

Depth to Free Water: >24"

Depth to Saturation (including capillary fringe): >20"

Altered Hydrology (explain): Some fill in wetland area from sewer line construct

☐ Inundated ☐ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other None observed

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Needs sketch

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-6"	A	7.5 yr 3/2	None	Loamy sand
6-18"	B	7.5 yr 3/3	None	Fine/medium sand

HYDRIC SOIL INDICATOR(S):

None

REFERENCES(S)

NEIWPCC, July 1998

OPTIONAL SOIL DATA

Taxonomic subgroup: Typic Udipsamments
Soil drainage class: Drained somewhat excessively
Depth to active water table: >20"
NTCHS hydric soil criterion:

REFERENCE(S)

Soil Survey Hillsborough County Eastern Part 1981
USACOE 1991. Soil Drainage Classes Guidelines

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☐	☒
Hydric soils criterion met?	☐	☒
Wetland hydrology criterion met?	☐	☒
IS THIS DATAPOINT IN A WETLAND?	☐	☒

REMARKS:

PROJECT TITLE: Mohawk Tannery **TRANSECT:** A3 **PLOT:** A3 up

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** A3 **PLOT:** A12 up

DELINEATORS(S): K.O'Neill/M. Croot **DATE:** 7/10/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Tree				
Acer rubrum	80/80	100	X	FAC
Shrub				
Clethra alnifolia	15/21	71	X	FAC+
Viburnum recognitum	1/21	5		FACW-
Ulnus ruba	5/21	24	X	FAC
Herb				
Osmunda cinnamomea	55/55	100	X	FACW
Up = upland plot				

HYDROPHYTES **NON-HYDROPHYTES**

OBL	FACW	FAC	*OTHER	FAC	FACU	UPL
	1	3				

Hydrophytes Subtotal (A): 4 **Non-hydrophytes Subtotal (B):** 0

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ____

Aerial photography Identification: ____

Other Identification: ____

☐ **NO RECORDED DATA**

☐ **OBSERVATIONS:**

Depth to Free Water: >18"

Depth to Saturation (including capillary fringe): 13"

Altered Hydrology (explain): Area may have been isolated from river high water by fill

☐ Inundated ☐ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Needs sketch

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-6"		10 yr 2/2	None noted-	Loamy sand
6-18"		10 yr. 6/8		Sand

HYDRIC SOIL INDICATOR(S):

None

REFERENCES(S)

OPTIONAL SOIL DATA

Taxonomic subgroup: Fluventic Dystrochrepts
Soil drainage class: well drained
Depth to active water table: >18"
NTCHS hydric soil criterion:

REFERENCE(S)

Soil Survey, Eastern Part of Hillsborough County 1981
1991 USACOE 1991. Soil Drainage Classes Guidelines

CONCLUSIONS

	Yes	No	REMARKS:
Hydrophytic vegetation criterion met?	☒	☐	
Hydric soils criterion met?	☐	☒	
Wetland hydrology criterion met?	☐	☒	
IS THIS DATAPOINT IN A WETLAND?	☒	☐	

PROJECT TITLE: Mohawk Tannery **TRANSECT:** A12 **PLOT:** A12 up

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** A12 **PLOT:** A12 wet

DELINEATORS(S): K.O'Neill/M. Croot **DATE:** 7/10/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Tree Acer rubrum	65/65	100	X	FAC
Shrubs				
Viburnum recognitum	15/29	52	X	FAC-
Rhododendron viscosum	8/29	28	X	OBL
Cornus amomum	6/29	21	X	FACW
Herb				
Osmunda cinnamomea	55/55	100	X	OBL
Impatiens capensis	5/30	17	X	FACW
Peltandra virginica	10/30	33	X	OBL
Wet = wetland plot				

HYDROPHYTES

OBL	FACW	FAC	*OTHER
3	2	1	

NON-HYDROPHYTES

FAC	FACU	UPL

Hydrophytes Subtotal (A): 6 **Non-hydrophytes Subtotal (B):** 0

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ______

Aerial photography Identification: ______

Other Identification: ______

☐ **NO RECORDED DATA**

☒ **OBSERVATIONS:**

Depth to Free Water: 10"

Depth to Saturation (including capillary fringe): 6"

Altered Hydrology (explain): ______

☒ Inundated ☒ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-8"		10 yr 2/1	-	Organic muck w/sand
8-20"		10 yr 3/2	-	Organic muck w/sand

HYDRIC SOIL INDICATOR(S):

I

REFERENCES(S)

OPTIONAL SOIL DATA

Taxonomic subgroup: Typic Fluventic
Soil drainage class: Very pporly drained
Depth to active water table: Surface, 0"
NTCHS hydric soil criterion:

REFERENCE(S)

Hillsborough County Soil Survey 1981
USACOE 1991. Soil Drainage Classes Guidelines

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☒	☐
Hydric soils criterion met?	☒	☐
Wetland hydrology criterion met?	☒	☐
IS THIS DATAPOINT IN A WETLAND?	☒	☐

REMARKS:

PROJECT TITLE: Mohawk Tannery **TRANSECT:** A12 **PLOT:** A12 wet

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** B3 **PLOT:** B3 wet

DELINEATORS(S): K. O'Neill/M. Croot **DATE:** 7/11/01

VEGETATION Stratum and Species		DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Tree	Acer rubrum	72/72	100	*	FAC
Shrub	Clethra alrifolia	5/5	100	X	FACT
Herb					
	Onoclea sensibilis	30/52	58	X	FAXW
	Unidentified WL grass	18/52	35	X	*
	Sagitarria latifolia	3/52	6		OBL
	Peltandra virginica	1/52	2		OBL
wet = wetland plot					

HYDROPHYTES **NON-HYDROPHYTES**

OBL	FACW	FAC	*OTHER	FAC	FACU	UPL
	1	2				

Hydrophytes Subtotal (A): 3 **Non-hydrophytes Subtotal (B):** 0

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ________

Aerial photography Identification: ________

Other Identification: ________

☐ **NO RECORDED DATA**

☒ **OBSERVATIONS:**

Depth to Free Water: 12"

Depth to Saturation (including capillary fringe): 5"

Altered Hydrology (explain): None observed

☐ Inundated ☒ Saturated in upper 12" ☒ Water Marks ☒ Drift Lines ☒ Sediment Deposits ☒ Drainage Patterns within Wetland

☒ Other H_sS Odor

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root *distribution, soil water, etc.*
0-1"	0			Leaf litter
1-18"		10 yr. 3/1	None	Organic muck w/sand

HYDRIC SOIL INDICATOR(S):

II H28 odor w/in 12"

REFERENCES(S)

NEIWPCC, July 1988

OPTIONAL SOIL DATA

Taxonomic subgroup: Typic Fluvaquent
Soil drainage class: very poorly drained
Depth to active water table: 12"
NTCHS hydric soil criterion: I

REFERENCE(S)

Hillsborough County Soil Survey Eastern Part
USACOE, 1991 Soil Drainage Classes Guidance

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☒	☐
Hydric soils criterion met?	☒	☐
Wetland hydrology criterion met?	☒	☐
IS THIS DATAPOINT IN A WETLAND?	☒	☐

REMARKS:

Swale is open/connected to the Nashua River

PROJECT TITLE: Mohawk Tannery **TRANSECT:** B3 **PLOT:** B3 wet

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** B3 **PLOT:** B3 up

DELINEATORS(S): K.O'Neill/M. Croot **DATE:** 7/10/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Trees Ulnus ruba	65/65	100	*	FAC
Shrubs				
Viburnum recognitum	12/12	100	*	FACW-
Unidentified upland grass*	80/83	96	*	FACU
Onoclea sensibilis	3/83	4	*	FACW
*only observed in upland areas				

HYDROPHYTES

OBL	FACW	FAC	*OTHER
	1	1	

NON-HYDROPHYTES

FAC	FACU	UPL
	1	

Hydrophytes Subtotal (A): 2

Non-hydrophytes Subtotal (B): 1

PERCENT HYDROPHYTES (100A/A+B): 50%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ____

Aerial photography Identification: ____

Other Identification: ____

☐ **NO RECORDED DATA**

☐ **OBSERVATIONS:**

Depth to Free Water: >18"

Depth to Saturation (including capillary fringe): >18"

Altered Hydrology (explain): None

☐ Inundated ☐ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other H_2S odor

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-68"		10 yr 3/2	None	Silty sand
6-18"		10 yr 3/2	None	Sand

HYDRIC SOIL INDICATOR(S):

None

REFERENCES(S)

NEIWPCC, July 1998

OPTIONAL SOIL DATA

Taxonomic subgroup: Fluventic Dystrochrepts
Soil drainage class: Well drained
Depth to active water table: >18"
NTCHS hydric soil criterion:

REFERENCE(S)

Hillsborough County Soil Survey, Eastern Part, 1981
USACOE 1991. Soil Drainage Classes Guidelines

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☒	☐
Hydric soils criterion met?	☐	☐
Wetland hydrology criterion met?	☐	☐
IS THIS DATAPOINT IN A WETLAND?	☐	☒

REMARKS:

PROJECT TITLE: Mohawk Tannery **TRANSECT:** B3 **PLOT:** B3 up

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** C5 **PLOT:** C5x (Test Plot Lagoon 1)

DELINEATORS(S): K. O'Neill/M. Croot **DATE:** 7/11/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Herb				
* Carex sp.	65/77	84	*	FACW
Phragmites australis	5/77	6		FACW
Impatiens capensis	5/77	6		FACW
Scriptus atrovirens	2/77			OBL
X = visually apparent wetland * only found in saturated soils/minimally FACW				

HYDROPHYTES

OBL	FACW	FAC	*OTHER
1	3		

NON-HYDROPHYTES

FAC	FACU	UPL

Hydrophytes Subtotal (A): 1 **Non-hydrophytes Subtotal (B):** 0

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ______

Aerial photography Identification: ______

Other Identification: ______

☐ **NO RECORDED DATA**

☒ **OBSERVATIONS:**

Depth to Free Water: 0"

Depth to Saturation (including capillary fringe): 0"

Altered Hydrology (explain): Settling pond constructed 1960s, abandoned in 1984. Pond is 60ft from river

☒ Inundated ☒ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☒ Drainage Patterns within Wetland

☐ Other

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-24"		10 yr 2/1	none	Tannery waste/sludge - ponded water

HYDRIC SOIL INDICATOR(S): IIIA

REFERENCES(S)

OPTIONAL SOIL DATA

REFERENCE(S)

Taxonomic subgroup:
Soil drainage class: very poorly drained
Depth to active water table: 0
NTCHS hydric soil criterion:

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☒	☐
Hydric soils criterion met?	☐	☐
Wetland hydrology criterion met?	☒	☐
IS THIS DATAPOINT IN A WETLAND?	☐	☒

REMARKS: N/A. Although Lagoon 1 substrate resembles an histosol, it is actually tannery sludge waste. The ACOE and NHDES have determined (during an on site inspection) that the lagoon would not be considered a jurisdictional wetland.

PROJECT TITLE: Mohawk Tannery **TRANSECT:** C5 **PLOT:** C5x

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** C5 **PLOT:** C5 up

DELINEATORS(S): K. O'Neill/M. Croot **DATE:** 7/11/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Herb				
Phragmites australis	100/100	100	*	FACW
Up = upland plot				

HYDROPHYTES **NON-HYDROPHYTES**

OBL	FACW	FAC	*OTHER	FAC	FACU	UPL
	1					

Hydrophytes Subtotal (A): 1 **Non-hydrophytes Subtotal (B):** 0

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ____

Aerial photography Identification: ____

Other Identification: ____

☐ **NO RECORDED DATA**

☐ **OBSERVATIONS:**

Depth to Free Water: >24"

Depth to Saturation (including capillary fringe): 24"

Altered Hydrology (explain): Constructed Soil Berm

☐ Inundated ☐ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other

SOIL Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-24"	A	10 yr 7/8	None	Med. Sand-fill

HYDRIC SOIL INDICATOR(S):

None

REFERENCES(S)

OPTIONAL SOIL DATA

Taxonomic subgroup:
Soil drainage class: very well drained
Depth to active water table: >24"
NTCHS hydric soil criterion:

REFERENCE(S)

USACOE, 1991 Soil Drainage Classes Guidance

CONCLUSIONS

	Yes	No	REMARKS:
Hydrophytic vegetation criterion met?	☒	☐	Settling pond excavated for waste water treatment
Hydric soils criterion met?	☐	☒	Site work ended in 1984
Wetland hydrology criterion met?	☐	☒	Lagoon is 60'
IS THIS DATAPOINT IN A WETLAND?	☐	☒	

PROJECT TITLE: **TRANSECT:** C5 **PLOT:** C5 up

PROJECT TITLE: Mohawk Tannery Site **TRANSECT:** N/A **PLOT:** AREA 2 x (1-3) Test Plots

DELINEATORS(S): K. O'Neill/M. Croot **DATE:** 7/11/01

VEGETATION Stratum and Species	DOMINANCE RATIO	PERCENT DOMINANCE	DOM	NWI STATUS
Herb				
Phragmites australis*	100/100	100	*	FACW
up = upland plot				
* disturbed area				

HYDROPHYTES **NON-HYDROPHYTES**

OBL	FACW	FAC	*OTHER	FAC	FACU	UPL
	1					

Hydrophytes Subtotal (A): 1 **Non-hydrophytes Subtotal (B):**

PERCENT HYDROPHYTES (100A/A+B): 100%

HYDROLOGY

☐ **RECORDED DATA**

Stream, lake, or tidal gage Identification: ________

Aerial photography Identification: ________

Other Identification: ________

☐ **NO RECORDED DATA**

☒ **OBSERVATIONS:**

Depth to Free Water: >24"

Depth to Saturation (including capillary fringe): >24"

Altered Hydrology (explain): More than 24" fill placed on old lagoon

☐ Inundated ☐ Saturated in upper 12" ☐ Water Marks ☐ Drift Lines ☐ Sediment Deposits ☐ Drainage Patterns within Wetland

☐ Other

SOIL **Sketch landscape position of this plot. Indicate relative position of other plot(s) and the wetland flag if not on plan.**

Submission of photo of plot is encouraged

DEPTH	HORIZON	MATRIX COLOR	REDOXIMORPHIC FEATURES (color, abundance, size, contrast)	COMMENTS (USDA texture, nodules, concretions, masses, pore linings, retrictive layers, root distribution, soil water, etc.
0-1"		Leaf/plant debris	None	Loamy sand
1-24"		2.5 y 5/6	None	Sand, moist at 18"
				Note: 3 plots conducted across Area 2. Similar results for each plot (Non-wetland)

HYDRIC SOIL INDICATOR(S): **REFERENCES(S)**

OPTIONAL SOIL DATA **REFERENCE(S)**

Taxonomic subgroup:
Soil drainage class:
Depth to active water table:
NTCHS hydric soil criterion:

CONCLUSIONS

	Yes	No
Hydrophytic vegetation criterion met?	☒	☐
Hydric soils criterion met?	☐	☒
Wetland hydrology criterion met?	☐	☒
IS THIS DATAPOINT IN A WETLAND?	☐	☒

REMARKS:

PROJECT TITLE: **TRANSECT:** N/A **PLOT:** AREA 2 X (1-3)

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF

June 14, 2002

Regulatory Division
Corps File No. 200201485

Mr. Neil Handler
Remedial Project Manager
United States Environmental Protection Agency
Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Dear Mr. Handler,

Based on the site inspection performed by the Corps on June 10, 2002 at the Mohawk Tannery Site in Nashua, New Hampshire and information you have provided, we have determined that a Department of the Army permit is not required for the work in the two treatment lagoons as shown on "Site Plan and Sampling Locations, Mohawk Tannery Site, Nashua, New Hampshire", dated October 17, 2001. Our regulatory jurisdiction encompasses all work in or affecting navigable waters of the United States under Section 10 of the Rivers and Harbors Act of 1899 and the discharge of dredged or fill material into all waters of the United States, including adjacent wetlands, under Section 404 of the Clean Water Act. Since no work in or affecting navigable water will occur; and/or no fill will be placed in waters or wetlands, a Department of the Army permit is not required.

If you have any questions, please contact us at, 1-800-343-4789 or, if you are in Massachusetts, call 1-800-362-4367.

Sincerely,

David H. Killoy, P.E., C.P. G.
Chief, Permits & Enforcement Branch
Regulatory Division

cc:

Mr. Collis Adams
Administrator
Wetlands Bureau
6 Hazen Drive
Concord, NH 03302

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

NEIL HANDLER NH

Date: 6/13/02

Made Call ☑ Received Call ☐ Return Call ☐

CONTACT:

Name: COLLIS ADAMS

Address: NH DES WETLANDS DIVISION

Project Name: MOHAWK TANNERY

Project No.:

Phone: (603) 271-2147

SUMMARY OF CONVERSATION:

I SPOKE TO COLLIS TO LET HIM KNOW THAT I HAD HEARD BACK FROM THE CORPS OF ENGINEERS (MIKE HICKS) TODAY AND THAT THE CORPS WAS PREPARING A LETTER TO BE SENT TO EPA WHICH WOULD STATE THAT THE AREA 1 LAGOON @ THE TANNERY WOULD NOT BE CONSIDERED A FEDERAL JURISDICTIONAL WETLAND. COLLIS SAID THAT HE HAD ALSO TALKED BRIEFLY WITH MIKE HICKS AND THAT THE STATE OF NH ALSO CONCURRED THAT THIS AREA WOULD NOT BE CONSIDERED A WETLANDS UNDER THE STATE REGULATIONS. I ALSO ASKED COLLIS TO CLARIFY WHETHER THE PROXIMITY OF THE AREA 1 TO THE RIVER WOULD MAKE IT A WETLANDS. COLLIS INDICATED THAT THE STATE OF NH DID NOT HAVE A BUFFER ZONE RELATED TO A SPECIFIC DISTANCE AROUND THEIR RIVERS (FOR EXAMPLE WITHIN 100' OF THE RIVER) WHICH WERE WETLANDS. THE STATE DOES CLASSIFY THE BANKS OF SURFACE WATERS AS WETLANDS BUT SINCE OUR WORK WOULD NOT BE OCCURRING ALONG THE BANKS OF THE NASHUA RIVER COLLIS INDICATED WE DID NOT HAVE A WETLANDS ISSUE FROM THAT STANDPOINT EITHER.

RESPONSE:

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Superfund Document Management System

Doc ID # 2 [illegible]
Page # [illegible]

Imagery Cover Sheet
Unscannable Item

Contact the Superfund Records Center to View this Document

Site Name Mohawk Tannery
Operable Unit [illegible]
Break Number 2.2

Report or Document Title EE/CA

Date of Item 7/15/2002
Description of Item Wells/Test Plot+Trench Locations
Number and Type of Item(s) 1 [illegible] Map

APPENDIX J

HUMAN HEALTH RISK EVALUATION SUPPORTING INFORMATION

TABLE J.1
SAMPLE LIST
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY
NASHUA, NEW HAMPSHIRE

receptor	NSAMPLE	SAMP_DATE	MATRIX	BORING	TOP	BOTTOM	AOC
Surface Only Areas 2 to 7	MT-SL-502-0012	4-Sep-01	Sludge	SL-502	0	12	Lagoon 5
Surface Only Areas 2 to 7	MT-SL-503-0012	4-Sep-01	Sludge	SL-503	0	12	Lagoon 5
Surface Only Areas 2 to 7	MT-SL-501-0020-AVG	4-Sep-01	Sludge	SL-501	0	20	Lagoon 5
Surface Only Areas 2 to 7	MT-SL-603-0007	5-Sep-01	Sludge	SL-603	0	7	Lagoon 6
Surface Only Areas 2 to 7	MT-SL-702-0011	31-Aug-01	Sludge	SL-702	0	11	Lagoon 7
Surface Only Areas 2 to 7	MT-SO-A2-OVCOMP	29-Aug-01	Soil	SO-A2	0	0	Lagoon 2
Surface Only Areas 2 to 7	MT-SO-A3-OVCOMP	30-Aug-01	Soil	SO-A3	0	0	Lagoon 3
Surface Only Areas 2 to 7	MT-SO-A4-OVCOMP	30-Aug-01	Soil	SO-A4	0	0	Lagoon 4
Surface Only Areas 2 to 7	MT-SO-A6-OVCOMP	5-Sep-01	Soil	SO-A6	0	0	Lagoon 6
Surface Only Areas 2 to 7	MT-SO-A7-OVCOMP	31-Aug-01	Soil	SO-A7	0	0	Lagoon 7
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-101-0010	11-Sep-01	Sludge	SL-101	0	10	Lagoon 1
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-103-0010-AVG	17-Sep-01	Sludge	SL-103	0	10	Lagoon 1
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-104-0010	17-Sep-01	Sludge	SL-104	0	10	Lagoon 1
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-102-0012	11-Sep-01	Sludge	SL-102	0	12	Lagoon 1
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-201-0616	29-Aug-01	Sludge	SL-201	6	16	Lagoon 2
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-205-0616	30-Aug-01	Sludge	SL-205	6	16	Lagoon 2
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-204-0618	29-Aug-01	Sludge	SL-204	6	18	Lagoon 2
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-203-0619	29-Aug-01	Sludge	SL-203	6	19	Lagoon 2
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-202-0717-AVG	29-Aug-01	Sludge	SL-202	7	17	Lagoon 2
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-301-0208	30-Aug-01	Sludge	SL-301	2	8	Lagoon 3
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-302-0309	30-Aug-01	Sludge	SL-302	3	9	Lagoon 3
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-303-0618	30-Aug-01	Sludge	SL-303	6	18	Lagoon 3
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-402-0311	30-Aug-01	Sludge	SL-402	3	11	Lagoon 4
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-403-0510	30-Aug-01	Sludge	SL-403	5	10	Lagoon 4
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-401-0511	30-Aug-01	Sludge	SL-401	5	11	Lagoon 4
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-502-0012	4-Sep-01	Sludge	SL-502	0	12	Lagoon 5
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-503-0012	4-Sep-01	Sludge	SL-503	0	12	Lagoon 5
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-501-0020-AVG	4-Sep-01	Sludge	SL-501	0	20	Lagoon 5
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-603-0007	5-Sep-01	Sludge	SL-603	0	7	Lagoon 6
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-602-0509	5-Sep-01	Sludge	SL-602	5	9	Lagoon 6
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-601-0711	5-Sep-01	Sludge	SL-601	7	11	Lagoon 6
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-702-0011	31-Aug-01	Sludge	SL-702	0	11	Lagoon 7
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-704-0207-AVG	31-Aug-01	Sludge	SL-704	2	7	Lagoon 7
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-703-0215	31-Aug-01	Sludge	SL-703	2	15	Lagoon 7
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SL-701-0217	31-Aug-01	Sludge	SL-701	2	17	Lagoon 7
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A2-OVCOMP	29-Aug-01	Soil	SO-A2	0	0	Lagoon 2
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A3-OVCOMP	30-Aug-01	Soil	SO-A3	0	0	Lagoon 3
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A3-UNCOMP	30-Aug-01	Soil	SO-A3	0	0	Lagoon 3
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A4-OVCOMP	30-Aug-01	Soil	SO-A4	0	0	Lagoon 4
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A6-OVCOMP	5-Sep-01	Soil	SO-A6	0	0	Lagoon 6
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A6-UNCOMP	5-Sep-01	Soil	SO-A6	0	0	Lagoon 6
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A7-OVCOMP	31-Aug-01	Soil	SO-A7	0	0	Lagoon 7
All Soil and Sludge Areas 1 to 7 With Top < 10 ft	MT-SO-A7-UNCOMP	31-Aug-01	Soil	SO-A7	0	0	Lagoon 7
Sludge Area 1 With Top Is 0 ft	MT-SL-101-0010	11-Sep-01	Sludge	SL-101	0	10	Lagoon 1
Sludge Area 1 With Top Is 0 ft	MT-SL-103-0010-AVG	17-Sep-01	Sludge	SL-103	0	10	Lagoon 1
Sludge Area 1 With Top Is 0 ft	MT-SL-104-0010	17-Sep-01	Sludge	SL-104	0	10	Lagoon 1
Sludge Area 1 With Top Is 0 ft	MT-SL-102-0012	11-Sep-01	Sludge	SL-102	0	12	Lagoon 1

TABLE J.2
DIOXIN AND FURAN TOXICITY EQUIVALENT FACTORS[a]
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Compound	TEF
Dioxins	
Mono-, Di-, and Trichlorodibenzo-p-dioxins	0
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1
Other TCDDs	0
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDDs)	1
Other PeCDDs	0
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxins (HxCDDs)	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxins (HxCDDs)	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxins (HxCDDs)	0.1
Other HxCDDs	0
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01
Other HpCDDs	0
Octachlorodibenzo-p-dioxin (OCDD)	0.0001
Furans	
Mono-, Di-, and Trichlorodibenzo-p-furans	0
2,3,7,8-Tetrachlorodibenzo-p-furan (TCDF)	0.1
Other TCDFs	0
1,2,3,7,8-Pentachlorodibenzo-p-furan (PeCDF)	0.05
2,3,4,7,8-Pentachlorodibenzo-p-furans (PeCDF)	0.5
Other PeCDFs	0
1,2,3,4,7,8-Hexachlorodibenzo-p-furans (HxCDFs)	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-furans (HxCDFs)	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-furans (HxCDFs)	0.1
2,3,4,6,7,8-Hexachlorodibenzo-p-furans (HxCDFs)	0.1
Other HxCDFs	0
1,2,3,4,6,7,8-Heptachlorodibenzo-p-furans (HpCDFs)	0.01
1,2,3,4,7,8,9-Heptachlorodibenzo-p-furans (HpCDFs)	0.01
Other HpCDFs	0
Octachlorodibenzo-p-furan (OCDF)	0.0001

[a]Van de Berg et al., "Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife, " Environmental Health Perspectives 106: pp, 775-792, December, 1998.

APPENDIX K

CANCER RISK ESTIMATES USING PROPOSED DIOXIN CSF

TABLE K.1
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE** SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
4-Methylphenol	1300	Max		*		0.1	2.04E-08	2.19E-05		1.00E+00				
2-Methylnaphthalene	21	Max		*		0.13	2.04E-08	2.84E-05		1.00E+00				
Pentachlorophenol	32	Max		*		0.25	2.04E-08	5.47E-05	1.20E-01	1.00E+00	1.20E-01	7.82E-08	2.10E-04	2.10E-04
Dioxin TEQ	0.0016	Max		0.5	6	0.03	1.02E-08	6.56E-06	1.00E+06	1.00E+00	1.00E+06	1.63E-05	1.05E-02	1.05E-02
Antimony	4	Max		*			2.04E-08			1.50E-01				
Arsenic	7.6	Max		1	7	0.03	2.04E-08	6.56E-06	1.50E+00	1.00E+00	1.50E+00	2.32E-07	7.48E-05	7.50E-05
Chromium	25200	Max		*			2.04E-08			1.30E-02				
Manganese	13300	Max		*			2.04E-08			4.00E-02				
														1.08E-02

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time

= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS_{oral} * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time

= (4650 cm2 * 231 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS_{dermal} * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.

2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.

3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.

4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.

6 Personal communication with A. Burke.

7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

TABLE K.2a
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD**
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	CSFinhal mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	2.04E-08	5.30E-08	7.40E-19	2.00E+00	1.00E+00	2.00E+00	2.00E+00	1.14E-08	2.97E-08	4.14E-19	4.11E-08
Dioxin TEQ	0.0013	Max		0.5	6	0.03	1.02E-08	1.14E-08	7.40E-19	1.00E+06	1.00E+00	1.00E+06	1.00E+06	1.32E-05	1.48E-05	9.62E-16	2.80E-05
Antimony	44.4	Max		*			2.04E-08		7.40E-19		1.50E-01						
Arsenic	15.7	Max		1	7	0.03	2.04E-08	1.14E-08	7.40E-19	1.50E+00	1.00E+00	1.50E+00	1.50E+01	4.79E-07	2.67E-07	1.74E-16	7.47E-07
Barium	657	Max		*			2.04E-08		7.40E-19		7.00E-02						
Cadmium	16.8	Max		*		0.001	2.04E-08	3.79E-10	7.40E-19		2.50E-02		6.30E+00			7.83E-17	7.83E-17
Lead	427	Max		*			2.04E-08		7.40E-19								
Manganese	207	Max		*			2.04E-08		7.40E-19		4.00E-02						
Mercury	4.5	Max		*			2.04E-08		7.40E-19		1.00E+00						
																	2.88E-05

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time

= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time

= (4650 cm2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)

= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.
** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE K.2b
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-07	1.66E-07	5.40E-07
Dioxin TEQ	0.0013	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.00E+06	1.00E+00	1.00E+06	4.35E-04	8.24E-05	5.17E-04
Antimony	44.4	Max		*			6.69E-07			1.50E-01				
Arsenic	15.7	Max		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	1.58E-05	1.49E-06	1.73E-05
Barium	657	Max		*			6.69E-07			7.00E-02				
Cadmium	16.8	Max		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Lead	427	Max		*			6.69E-07							
Manganese	207	Max		*			6.69E-07			4.00E-02				
Mercury	4.5	Max		*			6.69E-07			1.00E+00				
														5.35E-04

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d
Age-Adjusted Dermal Contact Rate = ((2800 cm2 * 0.2 mg/cm2-ev * 6 y)/15 kg) + ((5700 cm2 * 0.07 mg/cm2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABSoral*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)
Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABSdermal*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)
CSFabs = CSFadm / GI ABS used in toxicity study
Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

TABLE K.3
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL SOIL/SLUDGE AREAS 1-7**
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
1,4-Dichlorobenzene	1	95%UCL		*		0.1	6.69E-07	2.11E-07	2.40E-02	1.00E+00	2.40E-02	1.61E-08	5.07E-09	2.11E-08
Chlorobenzene	1.7	95%UCL		*		0.1	6.69E-07	2.11E-07		1.00E+00				
4-Methylphenol	1300	Max		*		0.1	6.69E-07	2.11E-07		1.00E+00				
Benzo(a)Pyrene	0.66	Max		*		0.13	6.69E-07	2.75E-07	7.30E+00	1.00E+00	7.30E+00	3.22E-06	1.32E-06	4.55E-06
2-Methylnaphthalene	21	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Naphthalene	61	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Pentachlorophenol	120	95%UCL		*		0.25	6.69E-07	5.28E-07	1.20E-01	1.00E+00	1.20E-01	9.64E-06	7.61E-06	1.72E-05
Aroclor 1242	0.028	95%UCL		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-08	1.66E-08	5.40E-08
Dioxin TEQ	0.0026	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.00E+06	1.00E+00	1.00E+06	8.70E-04	1.65E-04	1.03E-03
Antimony	506	95%UCL		*			6.69E-07			1.50E-01				
Arsenic	8.6	95%UCL		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	8.63E-06	8.18E-07	9.45E-06
Barium	154	95%UCL		*			6.69E-07			7.00E-02				
Cadmium	0.78	95%UCL		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Chromium	67800	Max		*			6.69E-07			1.30E-02				
Lead	67.6	95%UCL		*			6.69E-07							
Manganese	1810	95%UCL		*			6.69E-07			4.00E-02				
Mercury	0.76	95%UCL		*			6.69E-07			1.00E+00				
Thallium	0.81	95%UCL		*			6.69E-07			1.00E+00				
Vanadium	32.1	95%UCL		*			6.69E-07			2.60E-02				
														1.07E-03

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS $_{oral}$ * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS $_{dermal}$ * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

APPENDIX L

COSTING OF REMOVAL ACTION ALTERNATIVES

Mohawk Tannery EE/CA
Alternative 1 – Excavation and Off-Site Disposal

ASSUMPTIONS:

1. Alternative 1 cost items include:
   - Personnel and equipment mobilization
   - Site preparation
   - Excavation and stockpiling of overlying soil at a designated, onsite soil staging area
   - Excavation and stockpiling of sludge/waste at a separate, onsite staging area
   - Loading, transportation, and disposal of sludge/waste at an off-site landfill facility
   - Initial backfill of excavation with overlying soil
   - Backfill and compaction to original grade with imported, clean, common fill
   - Site restoration
   - Post-removal site control

2. Unit costs were derived from values published in:

   [1] *Means Environmental Remediation Cost Data*, 6th Annual Edition, R.S. Means Company, Inc., 2000;

   [2] *Means Heavy Construction Cost Data*, 12th Annual Edition, R.S. Means Company, Inc., 1998; and

   [3] *Means Environmental Remediation Cost Data—Assemblies*, 4th Annual Edition, R.S. Means Company, Inc., 1998.

   Means reference codes (i.e. [18 01 0102]) are provided in the comments/references column on the capital costs spreadsheets.

3. Hourly labor costs for construction activities were derived from *The Davis-Bacon Wage Determinations* for Hillsborough County, New Hampshire; published by the U.S. Department of Labor (http://www.access.gpo.gov/davisbacon/)

4. The *Engineering News-Record* Construction Cost Index (CCI) was used to adjust construction costs from 1998/2000 levels to present day levels as follows:

   - CCI_{1998} = 5920; CCI_{2000} = 6221; $CCI_{March, 2002}$ = 6502
   - Unit costs from 1998 were adjusted by [(6502 – 5920) / 5920] * 100% = 9.8% to reflect present day costs
   - Unit costs from 2000 were adjusted by [(6502 – 6221) / 6221] * 100% = 4.5% to reflect present day costs

5. Abbreviations: LF = linear feet; SF = square feet; SY = square yard; CF = cubic feet; CY = cubic yard; AC = acre; WK = week; MO = month; LS = lump sum; KGAL = 1,000 gallons; PDI = pre-design investigation; TCLP = toxicity characteristic leaching procedure; VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds

6. Discount rate for net present worth analysis at 7% per OSWER Directive No. 9355.3-20, June 25, 1993.

ESTIMATED TIME TO COMPLETE ALTERNATIVE 1 (see Figure 5-1):

Once authorized to proceed:

Engineering & Design Specifications (including PDI):	16 weeks
Subcontracting/Procurement:	8 weeks
Mobilization:	1 week
Site Preparation:	3 weeks
Excavation and Disposal: (overlying soil 4 weeks; waste/sludge 30 weeks)	34 weeks
Site restoration:	3 weeks
Demobilization:	1 week

Total site time (from mob to demob): 42 weeks @ 4 wk/mo = approximately 11 months

Total project duration: ~17 months

Note: Duration assumes 5 day work week and 8 hour day. Total project duration does not include potential delays attributed to reduced excavation rates from excessive sludge/waste moisture content.

CAPITAL COST ITEMS:

Mob/Demob and Monthly Costs include delivery/pickup and monthly costs for equipment and supplies necessary to implement the removal action.

1) Equipment Mobilization/Demobilization Costs ($23,150) include one-time costs for the delivery and pickup of the following items. The costs for mob/demob were obtained from TtNUS historical costs and vendor quotes.
   - Office trailer - $500
   - Storage trailer - $250
   - Construction equipment – $5,000
   - Level C respirator cartridges w/ breakthrough indicator for H_2S – $7,200
   - Sampling equipment/supplies - $5,000

- Frac tanks (2) – $500 each
- Water storage tanks (2) – $250 each
- Odor control units (2) - $1,000 each
- Site utilities (installation) - $1,500
- Sanitary facilities - $100
- Dumpster - $100

2) Monthly costs for equipment/supplies: Monthly costs are provided on the capital costs spreadsheet (items 2-9) for equipment, supplies, facilities, and services necessary to implement the removal action. The duration of costs is assumed to equal the total site time from mob thru demob. Monthly costs were obtained from TtNUS historical costs and vendor quotes.

Decontamination Facilities include:

1) Truck Decontamination Pad – assumed 20' x 40' in size with 6" gravel base, 40 mil high density polyethylene (HDPE) liner, and 4" crushed stone, graded to divert decontamination fluids into water collection sump, with wood-framed splash guards equipped with plastic sheeting installed on either side of the pad.
2) Decontamination Services – assume:
   - Purchase of two 3,000 PSI pressure washers
   - Operation of pressure washer (including water, soap, electricity, and labor) for duration of T&D, but at a rate of 25% of total T&D hours (T&C duration assumed equal to duration of sludge/waste excavation): 30 wks x 5 days/wk x 8 hrs/day x 25% = 300 hours)
3) Personnel Decontamination Pad – assumed 10' x 10' in size with 6" gravel base, 40 mil HDPE liner, and 4" crushed stone.
4) Clean and Collected Water Storage Tanks – 2,450 gallons each (2 @ 11 months = 24 months), price quoted by Rain for Rent.

Site Preparation

1) Site Access Road Construction. The site access road would originate at the Broad Street entrance to the Fimbel Door Company property, proceed around the Fimbel building, and follow the existing dirt road that runs to the west of the Fimbel Landfill and onto the Mohawk Tannery Site between the gravel pit and Area 5. The proposed route is currently paved between Broad Street and the back of the Fimbel Building. The unpaved portion of the route would be improved with one foot of graded and compacted gravel and crushed stone. Cost estimates for road construction assume:
   - Clearing light brush: 1,500 FT x 30 FT corridor = 45,000 SF = approximately 1 acre
   - Delivery of gravel: 1,500 FT length, 20 FT width, 1 FT thick road = 30,000 CF ≅ 1,100 CY
   - Spreading and compaction of gravel road – 30,000 SF ≅ 3,300 SY
2) Building/Foundation Demolition. Building foundations and concrete structures existing in the vicinity of Area 6 would be demolished to provide room for the construction of a sludge/waste stockpile area. The wood-framed clarifier building adjacent to Area 1 would also be demolished to provide greater access to Area 1 for earth-moving equipment. For costing purposes, it is assumed that the structures do not contain asbestos or lead-based paint. Cost estimation for these items use the following assumptions:
   - Excavation and demolition of 6-8 foundations: assume 10,000 SF at 2 FT thick ≅ 750 CY
   - Transportation and Disposal of foundation debris: assume 750 CY ≅ 1,200 TON
   - Removal and disposal of clarifier tank (assuming water suitable for discharge to sewer)
   - Demolition of wood-framed building: 30 FT x 90 FT x 10 FT = 27,000 CF

- Disposal of wood debris: 1,000 CY estimated

3) Clear Medium Brush. Clearing of medium brush would be necessary throughout the site to facilitate access to disposal areas and traffic patterns during excavation and hauling. Cost estimation for this item assumes 10 acres of clearing.
4) Installation of Erosion and Sedimentation Controls. Erosion and sedimentation controls would be installed along the Nashua River to prevent impacts to the river due to runoff from the site. The cost estimation for this item assumes:
   - Silt fence along Nashua River - 2,500 feet assumed
   - 20 tons hay bales assumed
5) Haul Road Construction. Existing onsite roads would be improved to facilitate onsite traffic during excavation activities. Cost estimates assume that roads would be repaired/bulldozed, expanded, and graded so that they are easily passable for heavy trucks. Road dimensions assumed to be 15 feet in width and 1 foot in thickness of gravel/crushed stone:
   - Approximately 4,000 LF x 15 FT x 1 FT = 60,000 CF – volume of stone needed
   - Deliver and dump 60,000 CF ≅ 2,222 CY gravel/crushed stone
   - Spread, Grade, and Compact 60,000 SF ≅ 6,667 SY
6) Prepare Stockpile/Staging Areas. Stockpile/staging areas would be constructed in Area 5 and in Area 6 to stockpile overlying soil and sludge/waste, respectively. Construction of each of the stockpile areas would be similar, consisting of six inches of sand/gravel, overlain by a 40-mil polyethylene liner and one foot of sand/gravel. The overlying soil stockpile would be approximately 80' x 80' in size and the sludge/waste stockpile would be approximately 100' x 100' in size. Each would be graded to promote the collection of liquids (from dewatering or precipitation) in a sump. Cost estimation for this item assumed:
   - 16,400 SF (1,850 SY) graded to prepare stockpile areas (both areas)
   - 16,400 SF 40-mil polyethylene liner
   - 16,400 SF * 1.5 FT sand/gravel (base and cover material included) = 24,600 CF = 910 CY sand/gravel
   - perimeter erosion and sedimentation controls (silt fence and hay bales at perimeter of stockpile area)
7) Dust Suppression would be performed during site preparation through the use of spray from a water truck.

Dewatering would be required prior to excavation in Area 1 and during excavation in Areas 1, 2, and possibly 3. For cost estimation purposes, it is assumed that the dewatering system would be operated and maintained for 20 weeks. 160 foot diameter, one foot depth of water assumed for rough estimation of surface water volume in Area 1. It is assumed, pending results of the PDI, that standing water in the lagoon and water from excavations would be pumped into the Nashua sewer system via the onsite sewer line. A fractionation tank would be set up on site as temporary storage for dewatering fluids as they become more turbid during the dewatering process. A second water storage tank would be set up on site into which water would be pumped after the settling process has been completed. Water samples would be collected from this tank to verify that it is acceptable for discharge to the sewer. For the purposes of costing, it is assumed that water will be ultimately discharged to the sewer without pretreatment.

1) Pump rental (3 pumps/1 standby) for 20 weeks = 60 weeks total rental
2) Discharge Hose – 3" PVC hose (2 at 500 feet each = 1000 LF)
3) Fractionation Tanks – two 20,000 gallon tanks for 11 months each @ $900/month
4) Analytical requirements for discharge to sewer estimated at 10 samples each for BOD, COD, cyanide, suspended solids, VOCs, SVOCs, metals, and pH

5) Disposal Fees – assumes 250,000 gallons total: 150,000 gallons surface water and 1,000 gallons groundwater per day of excavation (1,000 gallons/day x 100 days = 100,000 gallons)

Sludge/Waste/Soil Excavation assumes excavation and stockpiling of overlying soil, excavation and stockpiling of sludge/waste. Excavation rate of overlying soil assumed to be 60 CY/hour; excavation rate of sludge/waste assumed to be 50 CY/hour.

1) Excavate and Load Overlying Soil. For costing purposes, assumed excavation of overlying soil with crawler-mounted, hydraulic excavator, 2.0 CY bucket @ 60 CY/hour. (Estimated volume in place = 9,500 cy)
2) Excavate and Load Sludge/Waste. For costing purposes, assumed reduced production rate for excavation of sludge/waste (50 CY/HR) due to increased moisture content and excavation below the water table. Unit costs increased by 150% to account for dewatering and odor control considerations during excavation. (Estimated volume in place = 60,000 cy)
3) Transport Sludge/Waste to Stockpile. Two 12 CY dump trucks assumed at 1,360 hours for excavation.
4) Dust suppression assumed to occur twice daily over excavation area, haul roads, and/or stockpile. Approximately 1 acre (43,560 SF) per pass assumed. Two per day for 30 weeks = 300 acres.
5) Odor Control during excavation assumed to involve:
   - Rental of 535-gallon water tank, mixing tank, and diesel-powered generator system in which odor control solution would be mixed and delivered to nozzle lines surrounding the excavation area – 8 months @ 2,910/month
   - Pump rental with which to fill water tank 30 weeks @ 300/week
   - For costing purposes, water:product dilution ratio of 100:1 assumed, which results in usage cost of approximately $86.16/hour. Actual usage rate will be determined as part of the PDI. Assume $86.16/hour for 1,200 hours of sludge/waste excavation
   - Assumed $3,500 for technician to travel to site, supervise start up of system, and train operating personnel
   - Subcontractor costs such as taxes and freight are not included in this line item, but incorporated into the cost estimate as an "indirect cost adjustment factor" at the bottom of the sheet
   - Cost estimation based on information from and discussions with vendor
6) Air Monitoring includes the collection of air samples at two locations daily (during excavation) near perimeter of site to monitor impacts to ambient air on neighboring properties. Air samples analyzed for sulfides and dioxin. 2 samples/day*30 weeks*5 day/week = 300 samples. $Cost_{sulfide} \cong$ \$300/sample, $cost_{dioxin} \cong$ \$700/sample.

Sludge/Waste Stockpiling and Handling

1) Odor/Moisture Control. Assume odor/moisture control measures in stockpile area will require lime up to 10% of weight of sludge/waste or 9,000 tons (Sludge/waste density assumed to be 1.5 ton/cy; 60,000cy sludge/waste in place = 90,000 tons)
2) Sludge Dewatering/Moisture Control. Assume odor/moisture control at 1 laborer (and rental of front-end loader ($75/hour) to mix lime into sludge/waste. Assumed duration of stockpile = duration of sludge/waste excavation: 30 wks x 5 days/wk x 8 hrs/day = 1200 hrs.
3) Stockpile Maintenance includes rental of dozer for life of stockpile, assumes use of same laborer/equipment operator costed for dewatering/moisture control above. (1 operator, 2 pieces of equipement)

Confirmatory Sampling/Analysis would be performed to determine the vertical and lateral extent of excavation during removal activities, and to characterize stockpiled sludge/waste in compliance with the acceptance requirements provided by the disposal facility. Confirmatory soil samples would be collected only when all visually contaminated sludge has been removed from the current excavation area. Confirmatory samples would be collected for dioxins, SVOCs, and metals; and would be shipped to an off-site laboratory for analysis with a 24-hour turn around time. (sample shipping and analytical costs obtained from TtNUS historical costs)

1) Shipping Cost. Assume 5 coolers, shipped for overnight delivery, per week for 30 weeks of sludge/waste excavation.
2) Analytical Cost. Assume one confirmatory sample for every 500 SF of open excavation. Confirmatory samples would be collected for dioxins ($780/sample), SVOCs ($225/sample), and metals ($125/sample).
3) Stockpile Characterization Samples. Assume one stockpile characterization sample per 500 tons of sludge/waste delivered to the disposal facility. Samples analyzed for TCLP VOCs ($250/sample), TCLP SVOCs ($225/sample), TCLP metals ($140/sample), ignitability ($35/sample), corrosivity ($10/sample), reactivity ($80/sample), and paint filter ($10/sample).

Offsite Disposal of Sludge/Waste

1) Load Dump Trucks assumes use of crawler-mounted, hydraulic excavator with 2.0 CY bucket at 75 CY/HR; volume increased by 10% from excavated volume (60,000 cy to 66,000 cy) to account for bulking and addition of lime. Loading rates and T&D duration assume that availability of trucks (approx. 20/day) is sufficient to keep up with excavation production rate.
2) Transportation and Disposal
   - Alternative 1A – Assumes sludge/waste suitable for disposal in RCRA Subtitle D landfill, $80/ton based on quote from RCRA D landfill facility in New Hampshire.
   - Alternative 1B – Assumes sludge from Area 1 requires disposal in RCRA Subtitle C landfill, $181/ton based on quote from RCRA C landfill facility in NY; sludge/waste from other disposal areas suitable for disposal at RCRA D facility in NH ($80/ton).
   - Alternative 1C – Assumes sludge from Area 1 would be subject to U.S. land disposal ban and would require disposal at Canadian landfill, $225/ton based on discussion with vendors and past experience with disposal of dioxin-containing waste; sludge/waste from other disposal areas suitable for disposal at RCRA D facility ($80/ton).

Site Restoration

1) Backfill and Compaction. Excavations will be backfilled initially with overlying soil hauled from the overlying soil stockpile area, and backfilled to final grade with unclassified fill delivered and dumped onsite. For costing purposes, it was assumed that excavations would be backfilled to original grade. Backfill will be spread and compacted in 6-inch lifts. Assume 69,000 CY of fill would be required from an off-site source to backfill excavation to original grade (bulking factor to account for compaction during backfill = 1.15).
2) Place Topsoil assumes 4-inch layer of topsoil over the area of excavation. Approximately 136,500 SF x 0.33 FT = 45,455 CF or 1,685 CY.
3) Revegetate assumes 136,500 SF (3.13 acres) by hydroseeding. Assumes that timing of site work is seasonally appropriate to allow site restoration to occur immediately following site work. Additional costs are not included for temporary erosion control measures or additional mobilization costs.

Site Staffing includes site personnel required to coordinate and direct removal actions for the duration of the NTCRA.

1) Site Supervisor/Field Operations Leader responsible for field oversight of excavation subcontractor, coordination of field activities, documentation of field decisions, preparation of daily construction reports, communication between field crew/subcontractor and home office.
2) Site Engineer responsible for coordinating verification sampling and stockpile sampling efforts, interpretation of laboratory analytical results, and maintenance of soil sample database and daily excavation limits.
3) Sampler/Site Safety Officer responsible for collecting excavation cleanup verification samples, stockpile samples, and preparation of chain-of-custody paperwork/sample log sheets. Would also serve as site safety officer during excavation, coordinate pre-construction health and safety meeting and daily morning health and safety meetings.
4) Sampler/Technician responsible for operation of odor control system, daily setup and break-down of air sampling stations, preparation of chain-of-custody paperwork for air samples, daily packing and shipping of air samples, assist first sampler with soil sample collection/location survey.
5) Travel costs assume $123 per person, per day for lodging, meals, and incidental expenses.

Note: Travel costs are included only for the general contractor staff. It is assumed that local subcontractors would be hired, requiring no travel reimbursement.

OPERATIONS AND MAINTENANCE COSTS:

Post Removal Site Control (PRSC) would include the inspection and maintenance of new vegetation and erosion controls on a quarterly basis for the first 2 years after the completion of the removal action. Assume inspection and maintenance costs as follows:

- Vegetation - $500/quarter for 8 quarters (Year 1 = $2,000, Year 2 = $2,000)
- Erosion controls - $500/quarter for 8 quarters (Year 1 = $2,000, Year 2 = $2,000)

TABLE L-1PW
PRESENT WORTH ANALYSIS - ALTERNATIVES 1A, 1B, AND 1C
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Alternative 1A - Disposal of 100% of Sludge/Waste at U.S. RCRA D Landfill

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	14,939,248		14,939,248
1	0.935		4,000	3,738
2	0.873		4,000	3,494

TOTAL PRESENT WORTH **$14,946,480**

Alternative 1B - Area 1 Sludge to U.S. RCRA C Landfill

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	20,427,699		20,427,699
1	0.935		4,000	3,738
2	0.873		4,000	3,494

TOTAL PRESENT WORTH **$20,434,931**

Alternative 1C - Area 1 Sludge to Canadian Landfill

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	22,818,707		22,818,707
1	0.935		4,000	3,738
2	0.873		4,000	3,494

TOTAL PRESENT WORTH **$22,825,939**

[1] Discount rate of 7% per OSWER Directive

TABLE L-1A
CAPITAL COSTS FOR ALTERNATIVE 1A - EXCAVATION AND OFF-SITE DISPOSAL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Item	Qty	Unit	Unit Cost ($) Sub.	Mat.	Labor	Equip.	Total Cost ($) Sub.	Mat.	Labor	Equip.	Total Direct Cost ($)	Comments/ References
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150.00	0.00	0.00	0.00	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	11	MO	0.00	0.00	0.00	385.00	0	0	0	4,235	4,235	historical costs
3) Storage Trailer (1 ea)	11	MO	0.00	0.00	0.00	75.00	0	0	0	825	825	historical costs
4) Portable Communication Equipment	11	MO	0.00	0.00	0.00	300.00	0	0	0	3,300	3,300	historical costs
5) Site Utilities	11	MO	200.00	0.00	0.00	0.00	2,200	0	0	0	2,200	historical costs
6) Sanitary Facilities	11	MO	105.00	0.00	0.00	0.00	1,155	0	0	0	1,155	historical costs
7) Security	11	MO	6,000.00	0.00	0.00	0.00	66,000	0	0	0	66,000	historical costs
8) Sampling Equipment	11	MO	0.00	0.00	0.00	2,000.00	0	0	0	22,000	22,000	historical costs
9) Dumpster Rental/Service	11	MO	230.00	0.00	0.00	0.00	2,530	0	0	0	2,530	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) Decontamination Services												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	300	HR	0.00	7.84	29.58	0.00	0	2,352	8,874	0	11,226	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	9,900	0	0	9,900	see assumptions
SITE PREPARATION												
1) Site Access Road Construction												
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]

TABLE L-1A (cont.)
CAPITAL COSTS FOR ALTERNATIVE 1A - EXCAVATION AND OFF-SITE DISPOSAL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE PREPARATION (cont.)												
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to Stockpile Areas	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	300	AC	0.00	2.56	20.87	26.43	0	768	6,261	7,929	14,958	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE STOCKPILING AND HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Stockpile Maintenance	1200	HR	0.00	0.00	0.00	75.00	0	0	0	90,000	90,000	see assumptions
CONFIRMATORY SAMPLING/ANALYSES	1											
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Stockpile Characterization Samples	200	EA	750.00	0.00	0.00	0.00	150,000	0	0	0	150,000	see assumptions
OFFSITE DISPOSAL OF SLUDGE/WASTE												
1) Load Dump Trucks	66000	CY	0.00	0.00	0.73	1.78	0	0	48,180	117,480	165,660	[17 03 0277]
2) Transportation and Disposal Costs	99000	TON	80.00	0.00	0.00	0.00	7,920,000	0	0	0	7,920,000	see assumptions

TABLE L-1A (cont.)
CAPITAL COSTS FOR ALTERNATIVE 1A - EXCAVATION AND OFF-SITE DISPOSAL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Item	Qty	Unit	Unit Cost ($) Sub.	Unit Cost ($) Mat.	Unit Cost ($) Labor	Unit Cost ($) Equip.	Total Cost ($) Sub.	Total Cost ($) Mat.	Total Cost ($) Labor	Total Cost ($) Equip.	Total Direct Cost ($)	Comments/ References
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	30,549	6,133	6,386	43,069	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	11	MO	0.00	0.00	3200.00	0.00	0	0	35,200	0	35,200	
2) Site Engineer	11	MO	0.00	0.00	3200.00	0.00	0	0	35,200	0	35,200	
4) Sampler/Site Safety Officer	11	MO	0.00	0.00	2400.00	0.00	0	0	26,400	0	26,400	
5) Sampler/Technician	11	MO	0.00	0.00	2400.00	0.00	0	0	26,400	0	26,400	
6) Travel Expenses	210	DAY	0.00	0.00	492.00	0.00	0	0	103,320	0	103,320	see assumptions
SUBTOTAL DIRECT COST							8,987,715	559,383	529,441	858,710	10,935,249	

	Total Cost ($) Sub.	Total Cost ($) Mat.	Total Cost ($) Labor	Total Cost ($) Equip.	Total Cost ($)	Comments
Subtotal Direct Cost	8,987,715	559,383	529,441	858,710	10,935,249	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	26,472	42,936	69,408	
Subtotal	8,987,715	559,383	555,913	901,646	11,004,657	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	39,157	0	0	39,157	
G&A @ 10% of Equipment, Material, and Labor	0	55,938	55,591	90,165	201,694	
SubContract @ 4% of Sub. Cost	359,509	0	0	0	359,509	
Labor Overhead @ 60%	0	0	73,920	0	73,920	
Subtotal Direct and Indirect	9,347,224	654,478	685,424	991,811	11,678,936	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					1,167,894	
Engineering @ 6% of Construction Cost and 2% of Transportation and Disposal Cost					383,936	
Home Office Mgmt. And Support @ 3% Direct and Indirect					350,368	
Total Project Cost					13,581,134	
Contingency @ 10% of Total Project Cost					1,358,113	
TOTAL COST					14,939,248	

TABLE L-1B
CAPITAL COSTS FOR ALTERNATIVE 1B - EXCAVATION AND OFF-SITE DISPOSAL (AREA 1 SLUDGE TRANSPORTED TO RCRA C DISPOSAL FACILITY)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150.00	0.00	0.00	0.00	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	11	MO	0.00	0.00	0.00	385.00	0	0	0	4,235	4,235	historical costs
3) Storage Trailer (1 ea)	11	MO	0.00	0.00	0.00	75.00	0	0	0	825	825	historical costs
4) Portable Communication Equipment	11	MO	0.00	0.00	0.00	300.00	0	0	0	3,300	3,300	historical costs
5) Site Utilities	11	MO	200.00	0.00	0.00	0.00	2,200	0	0	0	2,200	historical costs
6) Sanitary Facilities	11	MO	105.00	0.00	0.00	0.00	1,155	0	0	0	1,155	historical costs
7) Security	11	MO	6,000.00	0.00	0.00	0.00	66,000	0	0	0	66,000	historical costs
8) Sampling Equipment	11	MO	0.00	0.00	0.00	2,000.00	0	0	0	22,000	22,000	historical costs
9) Dumpster Rental/Service	11	MO	230.00	0.00	0.00	0.00	2,530	0	0	0	2,530	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) Decontamination Services												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	300	HR	0.00	7.84	29.58	0.00	0	2,352	8,874	0	11,226	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	9,900	0	0	9,900	see assumptions
SITE PREPARATION												
1) Site Access Road Construction												
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]

TABLE L-1B (cont.)
CAPITAL COSTS FOR ALTERNATIVE 1B - EXCAVATION AND OFF-SITE DISPOSAL (AREA 1 SLUDGE TRANSPORTED TO RCRA C DISPOSAL FACILITY
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE PREPARATION (cont.)												
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to Stockpile Areas	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	300	AC	0.00	2.56	20.87	26.43	0	768	6,261	7,929	14,958	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE STOCKPILING AND HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Stockpile Maintenance	1200	HR	0.00	0.00	0.00	75.00	0	0	0	90,000	90,000	see assumptions
CONFIRMATORY SAMPLING/ANALYSES												
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Stockpile Characterization Samples	200	EA	750.00	0.00	0.00	0.00	150,000	0	0	0	150,000	see assumptions
OFFSITE DISPOSAL OF SLUDGE/WASTE												
1) Load Dump Trucks	66000	CY	0.00	0.00	0.73	1.78	0	0	48,180	117,480	165,660	[17 03 0277]
2) Transportation and Disposal Costs (Subtitle D)	57750	TON	80.00	0.00	0.00	0.00	4,620,000	0	0	0	4,620,000	see assumptions
2) Transportation and Disposal Costs (Subtitle C)	41250	TON	181.00	0.00	0.00	0.00	7,466,250	0	0	0	7,466,250	see assumptions

TABLE L-1B (cont.)
CAPITAL COSTS FOR ALTERNATIVE 1B - EXCAVATION AND OFF-SITE DISPOSAL (AREA 1 SLUDGE TRANSPORTED TO RCRA C DISPOSAL FACILITY)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	30,549	6,133	6,386	43,069	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	11	MO	0.00	0.00	3200.00	0.00	0	0	35,200	0	35,200	
2) Site Engineer	11	MO	0.00	0.00	3200.00	0.00	0	0	35,200	0	35,200	
4) Sampler/Site Safety Officer	11	MO	0.00	0.00	2400.00	0.00	0	0	26,400	0	26,400	
5) Sampler	11	MO	0.00	0.00	2400.00	0.00	0	0	26,400	0	26,400	
6) Travel Expenses	210	DAY	0.00	0.00	492.00	0.00	0	0	103,320	0	103,320	see assumptions
SUBTOTAL DIRECT COST							13,153,965	559,383	529,441	858,710	15,101,499	

	Total Cost ($)				Total Cost ($)	Comments
	Sub.	Mat.	Labor	Equip.		
Subtotal Direct Cost	13,153,965	559,383	529,441	858,710	15,101,499	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	26,472	42,936	69,408	
Subtotal	13,153,965	559,383	555,913	901,646	15,170,907	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	39,157	0	0	39,157	
G&A @ 10% of Equipment, Material, and Labor	0	55,938	55,591	90,165	201,694	
SubContract @ 4% of Sub. Cost	526,159	0	0	0	526,159	
Labor Overhead @ 60%	0	0	73,920	0	73,920	
Subtotal Direct and Indirect	13,680,124	654,478	685,424	991,811	16,011,836	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					1,601,184	
Engineering @ 6% of Construction Cost and 2% of Transportation and Disposal Cost					477,260	
Home Office Mgmt. And Support @ 3% Direct and Indirect					480,355	
Total Project Cost					18,570,635	
Contingency @ 10% of Total Project Cost					1,857,064	
TOTAL COST					20,427,699	

TABLE L-1C
CAPITAL COSTS FOR ALTERNATIVE 1C - EXCAVATION AND OFF-SITE DISPOSAL (AREA 1 SLUDGE TRANSPORTED TO CANADIAN LANDFILL)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Item	Qty	Unit	Unit Cost ($) Sub.	Unit Cost ($) Mat.	Unit Cost ($) Labor	Unit Cost ($) Equip.	Total Cost ($) Sub.	Total Cost ($) Mat.	Total Cost ($) Labor	Total Cost ($) Equip.	Total Direct Cost ($)	Comments/ References
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150.00	0.00	0.00	0.00	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	11	MO	0.00	0.00	0.00	385.00	0	0	0	4,235	4,235	historical costs
3) Storage Trailer (1 ea)	11	MO	0.00	0.00	0.00	75.00	0	0	0	825	825	historical costs
4) Portable Communication Equipment	11	MO	0.00	0.00	0.00	300.00	0	0	0	3,300	3,300	historical costs
5) Site Utilities	11	MO	200.00	0.00	0.00	0.00	2,200	0	0	0	2,200	historical costs
6) Sanitary Facilities	11	MO	105.00	0.00	0.00	0.00	1,155	0	0	0	1,155	historical costs
7) Security	11	MO	6,000.00	0.00	0.00	0.00	66,000	0	0	0	66,000	historical costs
8) Sampling Equipment	11	MO	0.00	0.00	0.00	2,000.00	0	0	0	22,000	22,000	historical costs
9) Dumpster Rental/Service	11	MO	230.00	0.00	0.00	0.00	2,530	0	0	0	2,530	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) Decontamination Services												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	300	HR	0.00	7.84	29.58	0.00	0	2,352	8,874	0	11,226	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	9,900	0	0	9,900	see assumptions
SITE PREPARATION												
1) Site Access Road Construction												
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]

TABLE L-1C (cont.)
CAPITAL COSTS FOR ALTERNATIVE 1C - EXCAVATION AND OFF-SITE DISPOSAL (AREA 1 SLUDGE TRANSPORTED TO CANADIAN LANDFILL)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE PREPARATION (cont.)												
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to Stockpile Areas	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	300	AC	0.00	2.56	20.87	26.43	0	768	6,261	7,929	14,958	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE STOCKPILING AND HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Stockpile Maintenance	1200	HR	0.00	0.00	0.00	75.00	0	0	0	90,000	90,000	see assumptions
CONFIRMATORY SAMPLING/ANALYSES												
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Stockpile Characterization Samples	200	EA	750.00	0.00	0.00	0.00	150,000	0	0	0	150,000	see assumptions
OFFSITE DISPOSAL OF SLUDGE/WASTE												
1) Load Dump Trucks	66000	CY	0.00	0.00	0.73	1.78	0	0	48,180	117,480	165,660	[17 03 0277]
2) Transportation and Disposal Costs (US Subtitle D)	57750	TON	80.00	0.00	0.00	0.00	4,620,000	0	0	0	4,620,000	see assumptions
2) Transportation and Disposal Costs (Canada)	41250	TON	225.00	0.00	0.00	0.00	9,281,250	0	0	0	9,281,250	see assumptions

TABLE L-1C (cont.)
CAPITAL COSTS FOR ALTERNATIVE 1C - EXCAVATION AND OFF-SITE DISPOSAL (AREA 1 SLUDGE TRANSPORTED TO CANADIAN LANDFILL)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	30,549	6,133	6,386	43,069	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	11	MO	0.00	0.00	3200.00	0.00	0	0	35,200	0	35,200	
2) Site Engineer	11	MO	0.00	0.00	3200.00	0.00	0	0	35,200	0	35,200	
4) Sampler/Site Safety Officer	11	MO	0.00	0.00	2400.00	0.00	0	0	26,400	0	26,400	
5) Sampler/Technician	11	MO	0.00	0.00	2400.00	0.00	0	0	26,400	0	26,400	
6) Travel Expenses	210	DAY	0.00	0.00	492.00	0.00	0	0	103,320	0	103,320	see assumptions
SUBTOTAL DIRECT COST							14,968,965	559,383	529,441	858,710	16,916,499	

	Total Cost ($)				Total Cost ($)	Comments
	Sub.	Mat.	Labor	Equip.		
Subtotal Direct Cost	14,968,965	559,383	529,441	858,710	16,916,499	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	26,472	42,936	69,408	
Subtotal	14,968,965	559,383	555,913	901,646	16,985,907	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	39,157	0	0	39,157	
G&A @ 10% of Equipment, Material, and Labor	0	55,938	55,591	90,165	201,694	
SubContract @ 4% of Sub. Cost	598,759	0	0	0	598,759	
Labor Overhead @ 60%	0	0	73,920	0	73,920	
Subtotal Direct and Indirect	15,567,724	654,478	685,424	991,811	17,899,436	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					1,789,944	
Engineering @ 6% of Construction Cost and 2% of Transportation and Disposal Cost					517,916	
Home Office Mgmt. And Support @ 3% Direct and Indirect					536,983	
Total Project Cost					20,744,279	
Contingency @ 10% of Total Project Cost					2,074,428	
TOTAL COST					22,818,707	

TETRA TECH NUS, INC.		COST ESTIMATE ASSUMPTIONS	
CLIENT: EPA	FILE NO.: N4111-3.5	BY: SAV	PAGE: 1 of 5
SUBJECT: Assumptions and basis of costs for Alternative 2		REVIEWED BY: DMB/GB	DATE: July 2002

Mohawk Tannery EE/CA
Alternative 2 – Excavation and Consolidation Into On-Site Landfill

ASSUMPTIONS:

1. Alternative 2 includes:
   - Personnel and equipment mobilization
   - Site preparation
   - Construction of landfill liner system (to be completed prior to excavation)
   - Excavation and stockpiling of overlying soil at a designated, onsite soil staging area
   - Excavation of sludge/waste and consolidation into on-site landfill
   - Initial backfill of excavation with overlying soil
   - Backfill and compaction to original grade with imported, clean, common fill
   - Construction of landfill cover and closure of landfill
   - Site restoration including wetlands re-creation
   - PRSC including operation and maintenance of landfill

2. Unit costs were derived from same sources as identified for Alternative 1.

3. Hourly labor costs for construction activities were derived from the same source as identified for Alternative 1.

4. The *Engineering News-Record* Construction Cost Index (CCI) was used to adjust construction costs by the same method used for Alternative 1.

5. Abbreviations: LF = linear feet; SF = square feet; SY = square yard; CF = cubic feet; CY = cubic yard; AC = acre; WK = week; MO = month; LS = lump sum; KGAL = 1,000 gallons; PDI = pre-design investigation; TCLP = toxicity characteristic leaching procedure; VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds

6. Discount rate for net present worth analysis at 7% per OSWER Directive No. 9355.3-20, June 25, 1993 (same as Alternative 1).

ESTIMATED TIME TO COMPLETE ALTERNATIVE 2 (see Figure 5-1):

<u>Once authorized to proceed</u>

Engineering & Design Specifications (including PDI):	25 weeks
Coordination with NHDES re: on-site landfill approvals	8 weeks
Subcontracting/Procurement:	8 weeks
Mobilization:	2 week
Site Preparation (including landfill liner construction):	16 weeks

Excavation and Consolidation into Landfill: 34 weeks
(overlying soil 4 weeks; waste/sludge 30 weeks)

Site Restoration (including landfill closure): 10 weeks

Demobilization: 2 week

Total site time (from mob to demob): 64 weeks @ 4 wk/mo = approximately 16 months

Total project duration: ~26 months

Note: Duration assumes 5 day work week and 8 hour day.Total project duration does not include potential delays attributed to reduced excavation rates from excessive sludge/waste moisture content.

CAPITAL COST ITEMS:

Mob/Demob and Monthly Costs for Alternative 2 would be as detailed for Alternative 1.

Decontamination Facilities for Alternative 2 would be as detailed for Alternative 1, except that pressure washer operation would be assumed at 10% of excavation time instead of 25% to account for fewer off-site truck trips.

Site Preparation activities for Alternative 2 would be as detailed for Alternative 1.

Construction of the Landfill Liner System would be part of the Site Preparation requirements for Alternative 2. The landfill footprint size was estimated using the following assumptions:

- 60,000 CY sludge/waste would be placed into landfill
- 10% volume addition would result due to addition of bulking agent for moisture/odor control, ∴66,000 CY (1,782,000 CF) landfill capacity used for costing purposes.
- Assuming 30 to 40 foot thickness of sludge/waste, approximately 50,000 SF required for landfill footprint – conceptual design of landfill assumes circle with 250 FT diameter.

The system would be double-lined, and the following components were used as the basis for construction cost estimates (see Figure 4-3 for a graphic depiction of the conceptual design of the landfill liner system):

1) Clearing and Grading of landfill area: 50,000 SF ≅ 5,555 SY
2) Placement of 24" Clay Layer: 50,000 SF * 2 FT = 100,000 CF ≅ 3,700 CY
3) Lower Geomembrane Layer – 60 mil thickness over the entire landfill area
4) A Secondary Leachate Collection System would be installed above the Lower Geomembrane and would function as the Leak Detection System—designed to intercept any leachate that passes through the Primary Leachate Collection System. The system would be 12" in thickness, consisting of coarse-grained sand and gravel material to facilitate leachate drainage to the perimeter of the landfill. The perimeter of the landfill would be outfitted with

perforated pipe to collect leachate and funnel it to a drainage sump, from which it would be pumped, pretreated (if necessary), and discharged to the sewer system.

5) Structural Fill Layer would consist of 12" of structural material over the landfill area
6) Middle Clay Layer would be 6" of clay – 25,000 CF ≅ 950 CY
7) Primary Leachate Collection System would be constructed as described above, except with a 24" thickness

Sludge/Waste Excavation, **Dewatering**, and **Confirmatory Sampling/Analysis** assumptions and basis of cost would be the same as detailed for Alternative 1.

Sludge/Waste Handling would occur within the sludge/waste stockpiling area as described for Alternative 1; and would involve odor control and dewatering. Landfill maintenance would also be necessary for the duration of site work as sludge/waste is transported from the stockpiling area to the on-site landfill.

1) Odor Control. Assume odor/moisture control measures within landfill will require lime up to 10% of weight of sludge/waste or 9,000 tons. (Sludge/waste density assumed to be 1.5 ton/cy; 60,000cy sludge/waste in place = 90,000 tons)
2) Sludge Dewatering/Moisture Control. Assume labor for odor/moisture control at 2 laborers for 1200 hrs (8 HR/day x 30 weeks x 5 days/wk) (anticipated duration of excavation/sludge placement); assume rental of bulldozer and front-end loader to manipulate/mix lime into sludge/waste
3) Landfill Maintenance includes labor required to secure landfill at end of day and maintain the integrity of erosion and sedimentation controls – 2 man hours/day assumed during course of sludge/waste placement (2 hrs/day x 30 wks x 5 days/wk = 300 hrs)

Landfill Closure would be implemented subsequent to the completion of excavation and placement of all contaminated sludge/waste. The following components were used as the basis for construction cost estimates (see Figure 4-3 for a graphic depiction of the conceptual design of the landfill cover system):

1) Gas Venting Layer would consist of 12" of sand/gravel with gas vent piping system consisting of network of perforated pipe (5,000 LF), five vertical pipes for off-gas release (250 LF), and five gas treatment units
2) Upper Clay Layer – 18" clay layer (1.5 FT)* 50,000 SF = 75,000 CF ≅ 2,800 CY delivered and spread
3) Upper Filter Layer – 60 mil non-woven geotextile, 50,000 SF ≅ 5,555 SY
4) Soil Cover – 24" unclassified fill (2 FT)* 50,000 SF = 100,000 CF ≅ 3,700 CY delivered and spread
5) Topsoil Cover – 6" topsoil (0.5 FT)* 50,000 SF = 25,000 CF ≅ 950 CY furnished and placed
6) Vegetative Cover – assume 1.5 acres seeded, mulched, and watered
7) Perimeter Fencing – assume 800 LF of 7 foot high chain-link fence, one 12' wide swinging gate, and 3 strands galvanized barbed wire
8) Installation of Monitoring Wells includes the drilling and construction of six groundwater monitoring wells (three upgradient from the landfill and three downgradient from the landfill). Assumed 5 days drilling required.

Site Restoration and **Site Staffing** assumptions would be the same as detailed for Alternative 1.

OPERATIONS AND MAINTENANCE COSTS:

Post Removal Site Control would involve post-closure care requirements as detailed in 40 CFR 258. For costing purposes, assume that post-closure care would be performed for the required 30-year period. It is assumed that post-closure care activities would be performed on a monthly basis for 2 years, a quarterly basis for years 3-5, and on a semi-annual basis thereafter. Cost items included in the estimate of operations and maintenance costs for Alternative 2 include:

- Inspect and maintain the integrity and effectiveness of the final cover
    - Fertilize/reseed landfill cover (assume 1/3 of landfill area per year) @ $500/YR
    - Erosion inspection and repair @ $1,000/YR
    - Mowing, 1.15 acres, 3 times/year = 3.45 acres * $80/acre ≅ $275/YR
- Operate and maintain the leachate collection and stormwater collection systems
    - Assume 40 inches annual precipitation (http://lwf.ncdc.noaa.gov) over 50,000 SF landfill area – 50,000 SF * 3.33 FT ≅ 167,000 CF ≅ 1.25 million GAL/YR
    - Discharge to sewer at 1.25 million GAL/YR * $2/KGAL ≅ $2,500/YR
    - Analysis of 2 samples/event @ $200/sample = $400/event
- Monitor groundwater in the vicinity of the landfill
    - Sampling and analysis of 6 monitoring wells assumed @ $500/well = $3,000/event
    - Rental of sample equipment @ $1,000/event
- Monitor air emissions from the landfill @ $1,000/event
- Labor required for field investigations – 2 people @ 40 HR = 80 HR * $75/HR = $6,000/event
- Yearly reporting – 120 HR @ $85/HR = $10,200/YR

PRSC would also include those measures described in the basis of cost for Alternative 1 – specifically, quarterly inspection of new vegetation and erosion controls for the first two years.

Alternative 2C – Excavation and Consolidation into On-Site Landfill; Off-Site Landfill Disposal of Area 1 Sludge

Alternative 2C includes the excavation, stockpiling, transportation, and disposal of sludge from Area 1 at a Canadian landfill. Sludge/waste from Areas 2, 3, 4, 6, and 7 would be consolidated into an on-site landfill, as described above. Capital cost estimates for Alternative 2C are the same as those described above, with the following exceptions (see Table K-2C):

- Required landfill capacity would be reduced by approximately 25,000 CY since Area 1 sludge would be disposed of at an off-site location. Anticipated capital costs were reduced accordingly.
- <u>Transportation and Disposal Costs</u> for Area 1 sludge to Canadian landfill are based on unit costs published in R.S. Means and discussion with vendors.
  - 25,000 CY + 10% volume addition = 27,500 CY = 41,250 tons
  - 27,500 CY @ 20 CY/trip = 1375 trips * 1,000-mile/trip assumed = 1,375,000 miles total transport from site to landfill.
  - On-site landfill O&M costs assumed to be the same for Alternative 2C as for Alternatives 2A and 2B.

TABLE L-2PW
PRESENT WORTH ANALYSIS - ALTERNATIVE 2
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Alternatives 2A and 2B - Consolidation into On-Site Landfill

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	5,571,917		5,571,917
1	0.935		155,275	145,117
2	0.873		155,275	135,623
3	0.816		60,075	49,039
4	0.763		60,075	45,831
5	0.713		60,075	42,833
6	0.666		37,275	24,838
7	0.623		37,275	23,213
8	0.582		37,275	21,694
9	0.544		37,275	20,275
10	0.508		37,275	18,949
11	0.475		37,275	17,709
12	0.444		37,275	16,551
13	0.415		37,275	15,468
14	0.388		37,275	14,456
15	0.362		37,275	13,510
16	0.339		37,275	12,626
17	0.317		37,275	11,800
18	0.296		37,275	11,028
19	0.277		37,275	10,307
20	0.258		37,275	9,633
21	0.242		37,275	9,002
22	0.226		37,275	8,413
23	0.211		37,275	7,863
24	0.197		37,275	7,349
25	0.184		37,275	6,868
26	0.172		37,275	6,419
27	0.161		37,275	5,999
28	0.150		37,275	5,606
29	0.141		37,275	5,239
30	0.131		37,275	4,897

TOTAL PRESENT WORTH **$6,300,072**

TABLE L-2PW (cont.)
PRESENT WORTH ANALYSIS - ALTERNATIVE 2C
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Alternative 2C - Consolidation into On-Site Landfill; Off-Site Disposal of Area 1 Sludge

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	18,428,170		18,428,170
1	0.935		155,275	145,117
2	0.873		155,275	135,623
3	0.816		60,075	49,039
4	0.763		60,075	45,831
5	0.713		60,075	42,833
6	0.666		37,275	24,838
7	0.623		37,275	23,213
8	0.582		37,275	21,694
9	0.544		37,275	20,275
10	0.508		37,275	18,949
11	0.475		37,275	17,709
12	0.444		37,275	16,551
13	0.415		37,275	15,468
14	0.388		37,275	14,456
15	0.362		37,275	13,510
16	0.339		37,275	12,626
17	0.317		37,275	11,800
18	0.296		37,275	11,028
19	0.277		37,275	10,307
20	0.258		37,275	9,633
21	0.242		37,275	9,002
22	0.226		37,275	8,413
23	0.211		37,275	7,863
24	0.197		37,275	7,349
25	0.184		37,275	6,868
26	0.172		37,275	6,419
27	0.161		37,275	5,999
28	0.150		37,275	5,606
29	0.141		37,275	5,239
30	0.131		37,275	4,897

TOTAL PRESENT WORTH **$19,156,325**

TABLE L-2A,B
CAPITAL COSTS FOR ALTERNATIVES 2A and 2B - EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150	0	0	0	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	16	MO	0	0	0	385	0	0	0	6,160	6,160	historical costs
3) Storage Trailer (1 ea)	16	MO	0.00	0.00	0.00	75.00	0	0	0	1,200	1,200	historical costs
4) Portable Communication Equipment	16	MO	0.00	0.00	0.00	300.00	0	0	0	4,800	4,800	historical costs
5) Site Utilities	16	MO	200.00	0.00	0.00	0.00	3,200	0	0	0	3,200	historical costs
6) Sanitary Facilities	16	MO	105.00	0.00	0.00	0.00	1,680	0	0	0	1,680	historical costs
7) Security	16	MO	6,000.00	0.00	0.00	0.00	96,000	0	0	0	96,000	historical costs
8) Sampling Equipment	16	MO	0.00	0.00	0.00	2,000.00	0	0	0	32,000	32,000	historical costs
9) Dumpster Rental/Service	16	MO	230.00	0.00	0.00	0.00	3,680	0	0	0	3,680	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) *Decontamination Services*												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	120	HR	0.00	7.84	29.58	0.00	0	941	3,550	0	4,490	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	9,900	0	0	9,900	see assumptions
SITE PREPARATION												
1) Site Access Road Construction							0	0	0	0	0	
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]

TABLE L-2A,B (cont.)
CAPITAL COSTS FOR ALTERNATIVE 2A and 2B - EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
CONSTRUCT LANDFILL LINER SYSTEM												
1) Clear and Grade Landfill Area	5555	SY	0.00	0.00	0.85	2.50	0	0	4,722	13,888	18,609	[17 03 0101]
2) Place Lower Clay Layer (24")	3700	CY	0.00	6.26	2.68	4.86	0	23,162	9,916	17,982	51,060	[17 03 0428]
3) Lower Geomembrane (60 mil)	50000	SF	0.00	2.00	0.00	0.00	0	100,000	0	0	100,000	[33 08 0572]
4) Secondary Leachate Collection System												
4a) Sand/Gravel	1850	CY	0.00	5.72	2.56	1.91	0	10,582	4,736	3,534	18,852	[17 03 0430]
4b) Perforated PVC Pipe (6" diameter)	800	LF	0.00	2.13	3.85	0.78	0	1,704	3,080	624	5,408	[027 109 2110]
4c) Geotextile Filter	5555	SY	0.00	1.65	0.15	0.00	0	9,166	833	0	9,999	[022 400 1510]
5) Structural Fill	1850	CY	0.00	5.72	2.56	1.91	0	10,582	4,736	3,534	18,852	[17 03 0430]
6) Middle Clay Layer	950	CY	0.00	6.26	2.68	4.86	0	5,947	2,546	4,617	13,110	[17 03 0428]
CONSTRUCT LANDFILL LINER SYSTEM (cont)												
7) Primary Leachate Collection System												
7a) Sand/Gravel	3700	CY	0.00	5.72	2.56	1.91	0	21,164	9,472	7,067	37,703	[17 03 0430]
7b) Perforated PVC Pipe (6" diameter)	800	LF	0.00	2.13	3.85	0.78	0	1,704	3,080	624	5,408	[027 109 2110]
7c) Geotextile Filter	5555	SY	0.00	1.65	0.15	0.00	0	9,166	833	0	9,999	[022 400 1510]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to On-Site Landfill	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	340	AC	0.00	2.56	20.87	26.43	0	870	7,096	8,986	16,952	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Sludge/Waste Handling During Landfill Construction	1200	HR	0.00	0.00	14.00	75.00	0	0	16,800	90,000	106,800	see assumptions
4) Landfill Maintenance	300	HR	0.00	0.00	10.09	0.00	0	0	3,027	0	3,027	see assumptions
CONFIRMATORY SAMPLING/ANALYSES												
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Landfill Characterization Samples	50	EA	750.00	0.00	0.00	0.00	37,500	0	0	0	37,500	see assumptions
LANDFILL CLOSURE												
1) Gas Venting Layer												
1a) Sand/Gravel Layer	1850	CY	0.00	5.72	2.56	1.91	0	10,582	4,736	3,534	18,852	[17 03 0430]
1b) Slotted Pipe Network	5000	LF	0.00	2.25	7.50	1.20	0	11,250	37,500	6,000	54,750	[33 26 0803]
1c) Gas Vent Piping System	250	LF	0.00	6.10	9.00	2.40	0	1,525	2,250	600	4,375	[33 07 0201]
1d) Off-Gas Treatment Unit	5	EA	0.00	44,000.00	0.00	0.00	0	220,000	0	0	220,000	[33 13 9101]
2) Upper Clay Layer	2800	CY	0.00	6.26	2.68	4.86	0	17,528	7,504	13,608	38,640	[17 03 0428]
3) Upper Filter Layer	5555	SY	0.00	2.00	0.00	0.00	0	11,110	0	0	11,110	[33 08 0572]
4) Soil Cover	3700	CY	0.00	5.29	0.90	2.07	0	19,573	3,330	7,659	30,562	[17 03 0423]
5) Topsoil Cover	950	CY	0.00	18.13	3.64	3.79	0	17,224	3,458	3,601	24,282	[18 05 0301]
6) Vegetative Cover	1.15	AC	0.00	14,654.04	60.94	55.03	0	16,852	70	63	16,986	[18 05 0402]
7) Perimeter Fencing												
7a) 7' Galvanized Chain Link Fence	800	LF	0.00	27.35	1.37	0.00	0	21,880	1,096	0	22,976	[18 04 0108]

CAPITAL COSTS FOR ALTERNATIVE 2A and 2B - EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
7b) 12' Wide Swing Gate	1	EA	0.00	362.48	69.48	85.13	0	362	69	85	517	[18 04 0118]
7c) Three-Strand Barbed Wire	800	LF	0.00	0.23	0.57	0.36	0	184	456	288	928	[18 04 0111]
8) Installation of Monitoring Wells												
8a) Mobilize Drill Rig and Crew	1	LS	0.00	0.00	629.09	1,272.81	0	0	629	1,273	1,902	[33 01 0101]
8b) Vehicle/Equipment Rental	5	DAY	0.00	500.00	0.00	0.00	0	2,500	0	0	2,500	
8c) Drilling	150	LF	0.00	20.00	0.00	0.00	0	3,000	0	0	3,000	
8d) Well Construction	150	LF	0.00	15.00	0.00	0.00	0	2,250	0	0	2,250	
8e) Drilling Crew Labor	80	HR	0.00	0.00	13.00	0.00	0	0	1,040	0	1,040	
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	45,325	9,100	9,475	63,900	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	16	MO	0.00	0.00	3200.00	0.00	0	0	38,400	0	38,400	
2) Site Engineer	16	MO	0.00	0.00	3200.00	0.00	0	0	38,400	0	38,400	
4) Sampler/Site Safety Officer	16	MO	0.00	0.00	2400.00	0.00	0	0	28,800	0	28,800	
5) Sampler/Technician	16	MO	0.00	0.00	2400.00	0.00	0	0	28,800	0	28,800	
6) Travel Expenses	320	DAY	0.00	0.00	492.00	0.00	0	0	104,550	0	104,550	see assumptions
SUBTOTAL DIRECT COST							987,890	1,121,847	618,088	847,755	3,575,579	

	Total Cost ($)				Total Cost ($)	Comments
	Sub.	Mat.	Labor	Equip.		
Subtotal Direct Cost	987,890	1,121,847	618,088	847,755	3,575,579	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	30,904	42,388	73,292	
Subtotal	987,890	1,121,847	648,992	890,143	3,648,872	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	78,529	0	0	78,529	
G&A @ 10% of Equipment, Material, and Labor	0	112,185	64,899	89,014	266,098	
SubContract @ 5% of Sub. Cost	49,395	0	0	0	49,395	
Field Construction Labor Overhead @ 60%	0	0	143,370	0	143,370	
Subtotal Direct and Indirect	1,037,285	1,312,561	857,261	979,157	4,186,264	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					418,626	
Engineering @ 6% of Subtotal Direct and Indirect					251,176	
Home Office Mgmt. And Support @ 5% Direct and Indirect					209,313	
Total Field Cost					5,065,379	
Contingency @ 10% of Total Field Cost					506,538	
TOTAL COST					5,571,917	

TABLE L-2C
CAPITAL COSTS FOR ALTERNATIVE 2C - EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL (AREA 1 SLUDGE TO OFF-SITE LANDFILL)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Item	Qty	Unit	Unit Cost ($) Sub.	Unit Cost ($) Mat.	Unit Cost ($) Labor	Unit Cost ($) Equip.	Total Cost ($) Sub.	Total Cost ($) Mat.	Total Cost ($) Labor	Total Cost ($) Equip.	Total Direct Cost ($)	Comments/ References
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150	0	0	0	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	16	MO	0	0	0	385	0	0	0	6,160	6,160	historical costs
3) Storage Trailer (1 ea)	16	MO	0.00	0.00	0.00	75.00	0	0	0	1,200	1,200	historical costs
4) Portable Communication Equipment	16	MO	0.00	0.00	0.00	300.00	0	0	0	4,800	4,800	historical costs
5) Site Utilities	16	MO	200.00	0.00	0.00	0.00	3,200	0	0	0	3,200	historical costs
6) Sanitary Facilities	16	MO	105.00	0.00	0.00	0.00	1,680	0	0	0	1,680	historical costs
7) Security	16	MO	6,000.00	0.00	0.00	0.00	96,000	0	0	0	96,000	historical costs
8) Sampling Equipment	16	MO	0.00	0.00	0.00	2,000.00	0	0	0	32,000	32,000	historical costs
9) Dumpster Rental/Service	16	MO	230.00	0.00	0.00	0.00	3,680	0	0	0	3,680	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) Decontamination Services												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	300	HR	0.00	7.84	29.58	0.00	0	6,899	26,030	0	32,930	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	10,800	0	0	10,800	see assumptions
SITE PREPARATION												
1) Site Access Road Construction												
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]

TABLE L-2C (cont.)
CAPITAL COSTS FOR ALTERNATIVE 2C - EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL (AREA 1 SLUDGE TO OFF-SITE LANDFILL)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
CONSTRUCT LANDFILL LINER SYSTEM												
1) Clear and Grade Landfill Area	3850	SY	0.00	0.00	0.85	2.50	0	0	3,273	9,625	12,898	[17 03 0101]
2) Place Lower Clay Layer (24")	2600	CY	0.00	6.26	2.68	4.86	0	16,276	6,968	12,636	35,880	[17 03 0428]
3) Lower Geomembrane (60 mil)	35000	SF	0.00	2.00	0.00	0.00	0	70,000	0	0	70,000	[33 08 0572]
4) Secondary Leachate Collection System												
4a) Sand/Gravel	1300	CY	0.00	5.72	2.56	1.91	0	7,436	3,328	2,483	13,247	[17 03 0430]
4b) Perforated PVC Pipe (6" diameter)	800	LF	0.00	2.13	3.85	0.78	0	1,704	3,080	624	5,408	[027 109 2110]
4c) Geotextile Filter	3850	SY	0.00	1.65	0.15	0.00	0	6,353	578	0	6,930	[022 400 1510]
5) Structural Fill	1300	CY	0.00	5.72	2.56	1.91	0	7,436	3,328	2,483	13,247	[17 03 0430]
6) Middle Clay Layer	650	CY	0.00	6.26	2.68	4.86	0	4,069	1,742	3,159	8,970	[17 03 0428]
7) Primary Leachate Collection System												
7a) Sand/Gravel	2600	CY	0.00	5.72	2.56	1.91	0	14,872	6,656	4,966	26,494	[17 03 0430]
7b) Perforated PVC Pipe (6" diameter)	800	LF	0.00	2.13	3.85	0.78	0	1,704	3,080	624	5,408	[027 109 2110]
7c) Geotextile Filter	3850	SY	0.00	1.65	0.15	0.00	0	6,353	578	0	6,930	[022 400 1510]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to On-Site Landfill/Stockpile Area	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	340	AC	0.00	2.56	20.87	26.43	0	870	7,096	8,986	16,952	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Sludge/Waste Handling During Landfill Construction	1200	HR	0.00	0.00	14.00	75.00	0	0	16,800	90,000	106,800	see assumptions
4) Landfill Maintenance	300	HR	0.00	0.00	10.09	0.00	0	0	3,027	0	3,027	see assumptions
CONFIRMATORY SAMPLING/ANALYSES												
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Waste/On-Site Landfill Characterization Samples	150	EA	750.00	0.00	0.00	0.00	112,500	0	0	0	112,500	see assumptions
TRANSPORTATION AND DISPOSAL												
1) Transport Area 1 Sludge to Canadian Landfill	1375000	MI	2.26	0.00	0.00	0.00	3,107,500	0	0	0	3,107,500	
2) Disposal Fees	41250	TON	150.00	0.00	0.00	0.00	6,187,500	0	0	0	6,187,500	
LANDFILL CLOSURE												
1) Gas Venting Layer												
1a) Sand/Gravel Layer	1300	CY	0.00	5.72	2.56	1.91	0	7,436	3,328	2,483	13,247	[17 03 0430]
1b) Slotted Pipe Network	5000	LF	0.00	2.25	7.50	1.20	0	11,250	37,500	6,000	54,750	[33 26 0803]
1c) Gas Vent Piping System	250	LF	0.00	6.10	9.00	2.40	0	1,525	2,250	600	4,375	[33 07 0201]
1d) Off-Gas Treatment Unit	5	EA	0.00	44,000.00	0.00	0.00	0	220,000	0	0	220,000	[33 13 9101]
2) Upper Clay Layer	2000	CY	0.00	6.26	2.68	4.86	0	12,520	5,360	9,720	27,600	[17 03 0428]
3) Upper Filter Layer	3850	SY	0.00	2.00	0.00	0.00	0	7,700	0	0	7,700	[33 08 0572]
4) Soil Cover	2600	CY	0.00	5.29	0.90	2.07	0	13,754	2,340	5,382	21,476	[17 03 0423]
5) Topsoil Cover	650	CY	0.00	18.13	3.64	3.79	0	11,785	2,366	2,464	16,614	[18 05 0301]

TABLE L-2C (cont.)
CAPITAL COSTS FOR ALTERNATIVE 2C - EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL (AREA 1 SLUDGE TO OFF-SITE LANDFILL)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE
PAGE 3 OF 3

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
LANDFILL CLOSURE (cont)												
6) Vegetative Cover	0.80	AC	0.00	14,654.04	60.94	55.03	0	11,723	49	44	11,816	[18 05 0402]
7) Perimeter Fencing												
7a) 7' Galvanized Chain Link Fence	675	LF	0.00	27.35	1.37	0.00	0	18,461	925	0	19,386	[18 04 0108]
7b) 12' Wide Swing Gate	1	EA	0.00	362.48	69.48	85.13	0	362	69	85	517	[18 04 0118]
7c) Three-Strand Barbed Wire	675	LF	0.00	0.23	0.57	0.36	0	155	385	243	783	[18 04 0111]
8) Installation of Monitoring Wells												
8a) Mobilize Drill Rig and Crew	1	LS	0.00	0.00	629.09	1,272.81	0	0	629	1,273	1,902	[33 01 0101]
8b) Vehicle/Equipment Rental	5	DAY	0.00	500.00	0.00	0.00	0	2,500	0	0	2,500	
8c) Drilling	150	LF	0.00	20.00	0.00	0.00	0	3,000	0	0	3,000	
8d) Well Construction	150	LF	0.00	15.00	0.00	0.00	0	2,250	0	0	2,250	
8e) Drilling Crew Labor	80	HR	0.00	0.00	13.00	0.00	0	0	1,040	0	1,040	
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	45,325	9,100	9,475	63,900	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	16	MO	0.00	0.00	3200.00	0.00	0	0	38,400	0	38,400	
2) Site Engineer	16	MO	0.00	0.00	3200.00	0.00	0	0	38,400	0	38,400	
4) Sampler/Site Safety Officer	16	MO	0.00	0.00	2400.00	0.00	0	0	28,800	0	28,800	
5) Sampler/Technician	16	MO	0.00	0.00	2400.00	0.00	0	0	28,800	0	28,800	
6) Travel Expenses	320	DAY	0.00	0.00	492.00	0.00	0	0	104,550	0	104,550	see assumptions
SUBTOTAL DIRECT COST							10,357,890	1,040,332	623,325	824,070	12,845,619	

	Total Cost ($)				Total Cost ($)	Comments
	Sub.	Mat.	Labor	Equip.		
Subtotal Direct Cost	10,357,890	1,040,332	623,325	824,070	12,845,619	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	31,166	41,204	72,370	
Subtotal	10,357,890	1,040,332	654,491	865,274	12,917,989	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	72,823	0	0	72,823	
G&A @ 10% of Equipment, Material, and Labor	0	104,033	65,449	86,527	256,010	
SubContract @ 5% of Sub. Cost	517,895	0	0	0	517,895	
Field Construction Labor Overhead @ 60%	0	0	80,640	0	80,640	
Subtotal Direct and Indirect	10,875,785	1,217,189	800,581	951,801	13,845,357	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					1,384,536	
Engineering @ 6% of Subtotal Direct and Indirect					830,721	
Home Office Mgmt. And Support @ 5% Direct and Indirect					692,268	
Total Field Cost					16,752,882	
Contingency @ 10% of Total Field Cost					1,675,288	
TOTAL COST					18,428,170	

TETRA TECH NUS, INC.		COST ESTIMATE ASSUMPTIONS	
CLIENT: EPA	FILE NO.: N4111-3.5	BY: SAV	PAGE: 1 of 2
SUBJECT: Assumptions and basis of costs for Alternative 3		REVIEWED BY: DMB/GB	DATE: July 2002

Mohawk Tannery EE/CA
Alternatives 3-US and 3-CAN – Excavation, Off-Site Treatment and Disposal

ASSUMPTIONS:

1. Alternative 3 site activities are the same as detailed for Alternative 1.
2. Unit costs were derived from same sources as identified for Alternative 1.
3. Hourly labor costs for construction activities were derived from the same source as identified for Alternative 1.
4. The *Engineering News-Record* Construction Cost Index (CCI) was used to adjust construction costs by the same method used for Alternative 1.
5. Abbreviations: LF = linear feet; SF = square feet; SY = square yard; CF = cubic feet; CY = cubic yard; AC = acre; WK = week; MO = month; LS = lump sum; KGAL = 1,000 gallons PDI = pre-design investigation; TCLP = toxicity characteristic leaching procedure; VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds
6. Discount rate for net present worth analysis at 7% per OSWER Directive No. 9355.3-20, June 25, 1993 (same as Alternative 1).
7. Estimated time to complete Alternative 3 would be the same as for Alternative 1 (see Figure 5-1).
8. PRSC cost schedule for Alternative 3 as presented for Alternative 1.

CAPITAL COST ITEMS:

Project Documents would be the same as described for Alternative 1.

Pre-Design Investigation, Mobilization, and Decontamination Facilities assumptions and basis of cost would be as detailed for Alternative 1.

Site Preparation activities for Alternative 3 would be as detailed for Alternative 1.

Sludge/Waste Excavation, **Dewatering**, and **Confirmatory Sampling/Analysis** assumptions and basis of cost would be the same as detailed for Alternative 1.

Transportation and Off-Site Treatment/Disposal for Alternative 3 provide the only difference in cost from Alternative 1. A transportation, treatment, and disposal cost of $0.25/LB or $500/TON was used for costing purposes for incineration within the United States. This estimate is based on discussions with a vendor, and research of incineration projects implemented at other EPA sites. A transportation, treatment, and disposal cost of $350/TON was used for incineration at a Canadian treatment facility based on discussions and previous experience with vendors permitted to incinerate dioxin-containing waste.

Site Restoration and **Site Staffing** assumptions would be the same as detailed for Alternative 1.

Post Removal Site Control assumptions would be the same as described for Alternative 1.

TABLE L-3PW
PRESENT WORTH ANALYSIS - ALTERNATIVES 3-US AND 3-CAN
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Alternative 3 - Off-Site Treatment and Disposal at an American Incinerator

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	69,715,077		69,715,077
1	0.935		4,000	3,738
2	0.873		4,000	3,494

TOTAL PRESENT WORTH **$69,722,309**

Alternative 3A - Off-Site Treatment and Disposal at a Canadian Incinerator

PRESENT WORTH ANALYSIS				
YEAR	PRESENT WORTH FACTOR[1]	CAPITAL COSTS ($)	O & M COSTS ($)	PRESENT WORTH ($)
0	1.000	50,152,281		50,152,281
1	0.935		4,000	3,738
2	0.873		4,000	3,494

TOTAL PRESENT WORTH **$50,159,513**

[1] Discount rate of 7% per OSWER Directive

TABLE L-3US
CAPITAL COSTS FOR ALTERNATIVE 3-US - EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150.00	0.00	0.00	0.00	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	11	MO	0.00	0.00	0.00	385.00	0	0	0	4,235	4,235	historical costs
3) Storage Trailer (1 ea)	11	MO	0.00	0.00	0.00	75.00	0	0	0	825	825	historical costs
4) Portable Communication Equipment	11	MO	0.00	0.00	0.00	300.00	0	0	0	3,300	3,300	historical costs
5) Site Utilities	11	MO	200.00	0.00	0.00	0.00	2,200	0	0	0	2,200	historical costs
6) Sanitary Facilities	11	MO	105.00	0.00	0.00	0.00	1,155	0	0	0	1,155	historical costs
7) Security	11	MO	6,000.00	0.00	0.00	0.00	66,000	0	0	0	66,000	historical costs
8) Sampling Equipment	11	MO	0.00	0.00	0.00	2,000.00	0	0	0	22,000	22,000	historical costs
9) Dumpster Rental/Service	11	MO	230.00	0.00	0.00	0.00	2,530	0	0	0	2,530	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) Decontamination Services												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	300	HR	0.00	7.84	29.58	0.00	0	2,352	8,874	0	11,226	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	9,900	0	0	9,900	see assumptions
SITE PREPARATION												
1) Site Access Road Construction												
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]

TABLE L-3US (cont.)
CAPITAL COSTS FOR ALTERNATIVE 3-US - EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE PREPARATION (cont.)												
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to Stockpile Areas	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	300	AC	0.00	2.56	20.87	26.43	0	768	6,261	7,929	14,958	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE STOCKPILING AND HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Stockpile Maintenance	1200	HR	0.00	0.00	0.00	75.00	0	0	0	90,000	90,000	see assumptions
CONFIRMATORY SAMPLING/ANALYSES												
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Stockpile Characterization Samples	200	EA	750.00	0.00	0.00	0.00	150,000	0	0	0	150,000	see assumptions
OFFSITE DISPOSAL OF SLUDGE/WASTE												
1) Load Dump Trucks	66000	CY	0.00	0.00	0.73	1.78	0	0	48,180	117,480	165,660	[17 03 0277]
2) Transportation and Treatment/Disposal Costs	99000	TON	500.00	0.00	0.00	0.00	49,500,000	0	0	0	49,500,000	see assumptions

TABLE L-3US (cont.)
CAPITAL COSTS FOR ALTERNATIVE 3-US - EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	30,549	6,133	6,386	43,069	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	11	MO	0.00	0.00	3,200.00	0.00	0	0	35,200	0	35,200	
2) Site Engineer	11	MO	0.00	0.00	3,200.00	0.00	0	0	35,200	0	35,200	
4) Sampler/Site Safety Officer	11	MO	0.00	0.00	2,400.00	0.00	0	0	26,400	0	26,400	
5) Sampler/Technician	11	MO	0.00	0.00	2,400.00	0.00	0	0	26,400	0	26,400	
6) Travel Expenses	210	DAY	0.00	0.00	492.00	0.00	0	0	103,320	0	103,320	see assumptions
SUBTOTAL DIRECT COST							50,567,715	559,383	529,441	858,710	52,515,249	

	Total Cost ($)				Total Cost ($)	Comments
	Sub.	Mat.	Labor	Equip.		
Subtotal Direct Cost	50,567,715	559,383	529,441	858,710	52,515,249	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	26,472	42,936	69,408	
Subtotal	50,567,715	559,383	555,913	901,646	52,584,657	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	39,157	0	0	39,157	
G&A @ 10% of Equipment, Material, and Labor	0	55,938	55,591	90,165	201,694	
SubContract @ 4% of Sub. Cost	2,022,709	0	0	0	2,022,709	
Labor Overhead @ 60%	0	0	73,920	0	73,920	
Subtotal Direct and Indirect	52,590,424	654,478	685,424	991,811	54,922,136	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					5,492,214	
Engineering @ 6% of Construction Cost and 2% of Transportation, Treatment/Disposal Cost					1,315,328	
Home Office Mgmt. And Support @ 3% Direct and Indirect					1,647,664	
Total Project Cost					63,377,342	
Contingency @ 10% of Total Project Cost					6,337,734	
TOTAL COST					69,715,077	

TABLE L-3CAN
CAPITAL COSTS FOR ALTERNATIVE 3-CAN - EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL (CANADIAN FACILITY)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
MOB/DEMOB AND MONTHLY COSTS												
1) Equipment Mobilization/Demobilization	1	LS	23,150.00	0.00	0.00	0.00	23,150	0	0	0	23,150	see assumptions
2) Office Trailer (1 ea)	11	MO	0.00	0.00	0.00	385.00	0	0	0	4,235	4,235	historical costs
3) Storage Trailer (1 ea)	11	MO	0.00	0.00	0.00	75.00	0	0	0	825	825	historical costs
4) Portable Communication Equipment	11	MO	0.00	0.00	0.00	300.00	0	0	0	3,300	3,300	historical costs
5) Site Utilities	11	MO	200.00	0.00	0.00	0.00	2,200	0	0	0	2,200	historical costs
6) Sanitary Facilities	11	MO	105.00	0.00	0.00	0.00	1,155	0	0	0	1,155	historical costs
7) Security	11	MO	6,000.00	0.00	0.00	0.00	66,000	0	0	0	66,000	historical costs
8) Sampling Equipment	11	MO	0.00	0.00	0.00	2,000.00	0	0	0	22,000	22,000	historical costs
9) Dumpster Rental/Service	11	MO	230.00	0.00	0.00	0.00	2,530	0	0	0	2,530	historical costs
DECONTAMINATION FACILITIES AND SERVICES												
1) Truck Decontamination Pad												
1a) Gravel Base, Delivered and Dumped	15	CY	0.00	12.00	1.54	1.75	0	180	23	26	229	[18 01 0102]
1b) 40 mil Polyethylene Liner	800	SF	0.00	0.34	0.03	0.00	0	272	24	0	296	[33 08 0563]
1c) Stone Drainage Layer	10	CY	0.00	12.00	2.50	1.21	0	120	25	12	157	[17 03 0419]
1d) Splash Guard	800	SF	0.00	1.25	1.00	0.00	0	1,000	800	0	1,800	
2) Decontamination Services												
2a) Pressure Washer	2	EA	0.00	0.00	0.00	2,876.89	0	0	0	5,754	5,754	[33 17 0816]
2b) Operate Pressure Washer	300	HR	0.00	7.84	29.58	0.00	0	2,352	8,874	0	11,226	[33 17 0823]
3) Personnel Decontamination Pad												
3a) Gravel Base, Delivered and Dumped	2	CY	0.00	12.00	1.54	1.75	0	24	3	4	31	[18 01 0102]
3b) 40 mil Polyethylene Liner	100	SF	0.00	0.34	0.03	0.00	0	34	3	0	37	[33 08 0563]
3c) Stone Drainage Layer	2	CY	0.00	12.00	2.50	1.21	0	24	5	2	31	[17 03 0419]
4) Clean and Spent Water Storage Tanks	22	MO	0.00	450.00	0.00	0.00	0	9,900	0	0	9,900	see assumptions
SITE PREPARATION												
1) Site Access Road Construction												
1a) Clearing	1	AC	0.00	0.00	36.27	28.43	0	0	36	28	65	[17 01 0101]
1b) Gravel, Delivered and Dumped	1100	CY	0.00	12.00	1.59	1.69	0	13,200	1,749	1,859	16,808	[18 01 0102]
1c) Spread, Grade, and Compact	3300	SY	0.00	0.00	0.26	0.49	0	0	858	1,617	2,475	[022 308 0400]
2) Building/Foundation Demolition												
2a) Foundation Removal	750	CY	0.00	0.00	0.86	1.11	0	0	645	833	1,478	[16 01 0104]
2b) Foundation Debris Transportation and Disposal	1200	TON	70.00	0.00	0.00	0.00	84,000	0	0	0	84,000	[17 02 0402]
2c) Clarifier Tank Evacuation/Removal	1	EA	930.00	0.00	483.12	389.79	930	0	483	390	1,803	[020 880]
2d) Wood-Frame Building Demolition	27000	CF	0.00	0.00	0.05	0.08	0	0	1,350	2,160	3,510	[17 02 0108]
2e) Building Debris Transportation & Disposal	1000	CY	0.00	0.00	4.85	7.23	0	0	4,850	7,230	12,080	[17 02 0409]
3) Clear Medium Brush	10	AC	0.00	0.00	67.55	88.32	0	0	676	883	1,559	[17 01 0102]

TABLE L-3CAN (cont.)
CAPITAL COSTS FOR ALTERNATIVE 3-CAN - EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL (CANADIAN FACILITY)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

			Unit Cost ($)				Total Cost ($)				Total Direct Cost ($)	Comments/ References
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.		
SITE PREPARATION (cont.)												
4) Erosion Controls												
4a) Silt Fences	2500	LF	0.00	0.63	1.26	0.00	0	1,575	3,150	0	4,725	[18 05 0206]
4b) Hay Bales	20	TON	0.00	54.90	183.37	61.49	0	1,098	3,667	1,230	5,995	[022 704 1200]
5) Haul Road Construction												
5a) Gravel, Delivered and Dumped	2200	CY	0.00	12.00	1.59	1.69	0	26,400	3,498	3,718	33,616	[18 01 0102]
5b) Spread, Grade, and Compact	6667	SY	0.00	0.00	0.26	0.49	0	0	1,733	3,267	5,000	[022 308 0400]
6) Prepare Stockpile/Staging Areas												
6a) Rough Grade	1850	SY	0.00	0.00	0.85	2.50	0	0	1,573	4,625	6,198	[17 03 0101]
6b) Sand/Gravel, Delivered and Dumped	910	CY	0.00	12.00	1.59	1.69	0	10,920	1,447	1,538	13,905	[18 01 0102]
6b) 40-mil Polyethylene Liner	16400	SF	0.00	0.34	0.03	0.00	0	5,576	492	0	6,068	[33 08 0563]
6d) Erosion and Sedimentation Controls	750	LF	0.00	1.70	4.80	1.10	0	1,275	3,600	825	5,700	
7) Dust suppression (watering) per acre-pass	48400	SY	0.00	0.00	0.00	0.01	0	0	0	484	484	[33 08 0585]
DEWATERING (Areas 1 and 2)												
1) Pumps (rental, 3 units)	60	WK	0.00	243.00	0.00	0.00	0	14,580	0	0	14,580	[17 03 1003]
2) Discharge Hose (3")	1000	LF	0.00	0.00	0.00	4.00	0	0	0	4,000	4,000	
3) Fractionation Tanks (2 @ 11 months each)	22	MO	0.00	0.00	0.00	900.00	0	0	0	19,800	19,800	see assumptions
4) Analytical Samples	10	EA	500.00	0.00	0.00	0.00	5,000	0	0	0	5,000	see assumptions
5) Disposal Fees	250	KGAL	2.00	0.00	0.00	0.00	500	0	0	0	500	see assumptions
SLUDGE/WASTE/SOIL EXCAVATION												
1) Excavate and Load Overlying Soil	9500	CY	0.00	0.00	0.73	1.78	0	0	6,935	16,910	23,845	[17 03 0277]
2) Excavate and Load Sludge/Waste	60000	CY	0.00	0.00	1.10	2.67	0	0	66,000	160,200	226,200	see assumptions
3) Transport to Stockpile Areas	2720	HR	0.00	0.00	12.70	33.43	0	0	34,544	90,930	125,474	[17 03 0285]
4) Dust Suppression	300	AC	0.00	2.56	20.87	26.43	0	768	6,261	7,929	14,958	see assumptions
5) Odor Control	1	LS	140000.00	0.00	0.00	0.00	140,000	0	0	0	140,000	see assumptions
6) Air Monitoring	300	EA	1000.00	0.00	0.00	0.00	300,000	0	0	0	300,000	see assumptions
SLUDGE/WASTE STOCKPILING AND HANDLING												
1) Odor/Moisture Control (lime)	9000	TON	0.00	7.84	0.00	0.00	0	70,560	0	0	70,560	[33 15 0407]
2) Sludge Dewatering/Moisture Control	1200	HR	0.00	0.00	14.36	75.00	0	0	17,232	90,000	107,232	see assumptions
3) Stockpile Maintenance	1200	HR	0.00	0.00	0.00	75.00	0	0	0	90,000	90,000	see assumptions
CONFIRMATORY SAMPLING/ANALYSES												
1) Shipping Cost	150	EA	65.00	0.00	0.00	0.00	9,750	0	0	0	9,750	see assumptions
2) Analytical Cost (dioxin, SVOCs, metals)	250	EA	1130.00	0.00	0.00	0.00	282,500	0	0	0	282,500	see assumptions
3) Stockpile Characterization Samples	200	EA	750.00	0.00	0.00	0.00	150,000	0	0	0	150,000	see assumptions
OFFSITE DISPOSAL OF SLUDGE/WASTE												
1) Load Dump Trucks	66000	CY	0.00	0.00	0.73	1.78	0	0	48,180	117,480	165,660	[17 03 0277]
2) Transportation and Treatment/Disposal Costs	99000	TON	350.00	0.00	0.00	0.00	34,650,000	0	0	0	34,650,000	see assumptions

TABLE L-3CAN (cont.)
CAPITAL COSTS FOR ALTERNATIVE 3-CAN - EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL (CANADIAN FACILITY)
ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Item	Qty	Unit	Unit Cost ($) Sub.	Unit Cost ($) Mat.	Unit Cost ($) Labor	Unit Cost ($) Equip.	Total Cost ($) Sub.	Total Cost ($) Mat.	Total Cost ($) Labor	Total Cost ($) Equip.	Total Direct Cost ($)	Comments/ References
SITE RESTORATION												
1) Backfill and Compaction												
1a) with Overlying Soil	9500	CY	0.00	0.31	1.66	4.75	0	2,945	15,770	45,125	63,840	[17 03 0422]
1b) with Clean Fill From Off-Site Location	69000	CY	0.00	5.29	0.90	2.07	0	365,010	62,100	142,830	569,940	[17 03 0423]
2) Place topsoil (4")	1685	CY	0.00	18.13	3.64	3.79	0	30,549	6,133	6,386	43,069	[18 05 0301]
3) Revegetate	3	AC	0.00	340.36	66.98	92.07	0	1,021	201	276	1,498	[18 05 0401]
SITE STAFFING												
1) Site Supervisor/Field Operations Leader	11	MO	0.00	0.00	3,200.00	0.00	0	0	35,200	0	35,200	
2) Site Engineer	11	MO	0.00	0.00	3,200.00	0.00	0	0	35,200	0	35,200	
4) Sampler/Site Safety Officer	11	MO	0.00	0.00	2,400.00	0.00	0	0	26,400	0	26,400	
5) Sampler/Technician	11	MO	0.00	0.00	2,400.00	0.00	0	0	26,400	0	26,400	
6) Travel Expenses	210	DAY	0.00	0.00	492.00	0.00	0	0	103,320	0	103,320	see assumptions
SUBTOTAL DIRECT COST							35,717,715	559,383	529,441	858,710	37,665,249	

	Total Cost ($) Sub.	Total Cost ($) Mat.	Total Cost ($) Labor	Total Cost ($) Equip.	Total Cost ($)	Comments
Subtotal Direct Cost	35,717,715	559,383	529,441	858,710	37,665,249	
Direct Cost Adjustment Factors:						
Health and Safety on Labor and Equipment @ 5%	0	0	26,472	42,936	69,408	
Subtotal	35,717,715	559,383	555,913	901,646	37,734,657	
Indirect Cost Adjustment Factors:						
Tax on materials @ 7%	0	39,157	0	0	39,157	
G&A @ 10% of Equipment, Material, and Labor	0	55,938	55,591	90,165	201,694	
SubContract @ 4% of Sub. Cost	1,428,709	0	0	0	1,428,709	
Labor Overhead @ 60%	0	0	73,920	0	73,920	
Subtotal Direct and Indirect	37,146,424	654,478	685,424	991,811	39,478,136	
Other Costs:						
Profit @ 10% of Subtotal Direct and Indirect					3,947,814	
Engineering @ 6% of Construction Cost and 2% of Transportation, Treatment/Disposal Cost					982,688	
Home Office Mgmt. And Support @ 3% Direct and Indirect					1,184,344	
Total Project Cost					45,592,982	
Contingency @ 10% of Total Project Cost					4,559,298	
TOTAL COST					50,152,281	

Appendix C

Appendix D Table 1
Mohawk Tannery Site, EE/CA Addendum
Chemical-Specific ARARs and TBCs

Regulatory Authority	Requirement	Status	Requirement Synopsis	Changes in ARAR/TBC since the 2002 Action Memorandum	Alternative 1a-c: Off-Site Disposal Action to be Taken to Attain Requirement	Alternative 4: On-Site Treatment (Solidification/Stabilization) Action to be Taken to Attain Requirement	Alternatives 5a, a1, a2, b, and c Encapsulation and Capping Action to be Taken to Attain Requirement
Federal	EPA Risk Reference Doses (RfDs)	To Be Considered (TBC)	RfDs are the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	No change.	RfDs to be used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels. The Alternative would remove all contaminants exceeding the calculated risk-based standards and dispose of them off-site.	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to contaminants exceeding non-carcinogenic risk-based standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of non-carcinogenic risk-based standards developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.
Federal	EPA Carcinogenicity Slope Factor (CSFs)	TBC	Slope factors are developed by EPA from Health Effects Assessments and present the most up-to-date information on cancer risk potency. Slope factors are developed by EPA from Health Effects Assessments by the Carcinogenic Assessment Group.	No change.	CFCs to be used to compute the carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels. The Alternative would remove all contaminants exceeding the calculated risk-based standards and dispose of them off-site.	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to contaminants exceeding carcinogenic risk-based standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of carcinogenic risk-based standards developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.
Federal	Carcinogenic Risk Assessment (EPA, 2005) EPA/630/P-	TBC	Framework and guidelines for	Not cited.	This guidance to be used to compute the carcinogenic risk	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will	Exceedances of carcinogenic risk-based standards developed using this guidance will be

	03/001F (EPA Risk Assessment Forum, March 2005)		assessing potential cancer risks.		resulting from exposure to contaminants and in the development of acceptable contaminant levels. The Alternative would remove all contaminants exceeding the calculated risk-based standards and dispose of them off-site.	prevent release/exposure to contaminants exceeding carcinogenic risk-based standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.
Federal	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005) EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	TBC	Guidance on assessing cancer risks to children.	Not cited.	This guidance to be used to compute the carcinogenic risks to children resulting from exposure to contaminants and in the development of acceptable contaminant levels. The Alternative would remove all contaminants exceeding the calculated risk-based standards and dispose of them off-site. .	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to contaminants exceeding carcinogenic risk-based standards for children developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of carcinogenic risk-based standards for children developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.
Federal	Recommendations of the Technical Review Workgroup for Lead for an approach to Assessing Risks Associated with Adult Exposure to Lead in Soil; EPA-540-R-03-001 (January 2003)	TBC	EPA Guidance for evaluating risks posed to adults by lead in soil. Used to develop lead risk-based cleanup standards.	Not cited	This guidance was used to develop the residential PRG for lead. All lead-contaminated material exceeding the PRG developed using this guidance will be excavated and disposed of off-site.	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to lead exceeding standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of lead standards developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.

Federal	Updated Scientific Considerations for Lead in Soil Cleanups (OLEM Directive 9200.2-167), December 22, 2016	TBC	Based on updated science and health effects, the Region is addressing risks posed by lead, particularly for children, on a site-specific basis.	Not cited.	This guidance was used to develop the residential PRG for lead. All lead-contaminated material exceeding the PRG developed using this guidance will be excavated and disposed of off-site.	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to lead exceeding standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of lead standards developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.
Federal	EPA Carcinogenic Assessment Group Potency Factors	TBC	These factors are used to evaluate an acceptable risk from a carcinogen (, dioxin).	Not cited.	This guidance was used to develop the PRG for dioxin. All dioxin-contaminated material exceeding the PRG developed using this guidance will be excavated and disposed of off-site.	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to dioxin exceeding standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of dioxin standards developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.
Federal	Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites (April 13, 1998) OSWER Directive 9200.4-26,	TBC	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 µg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEO) for soils involving residential exposure scenarios	Cited	This guidance was used to develop the PRG for dioxin. All dioxin-contaminated material exceeding the PRG developed using this guidance will be excavated and disposed of off-site.	Solidification/stabilization of consolidated soil/sludge prior to capping on-site will prevent release/exposure to dioxin exceeding standards developed using this guidance. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of dioxin standards developed using this guidance will be addressed by consolidating wastes, encapsulation and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.

State	Contaminated Site Management, Soil Remediation Criteria; New Hampshire Code of Administrative Rules Chapter Env-Or-606.19, Table 600-2	Applicable	Promulgated numeric soil remediation standards.	Not cited.	All contaminated soil/sludge exceeding these standards will be excavated and disposed of off-site.	Exceedances of these numeric standards will be addressed through solidification/ stabilization of consolidated soil/sludge and capping on-site. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.	Exceedances of these numeric standards will be addressed by consolidating wastes, encapsulation, and capping. Monitoring and ICs will ensure the protectiveness of the cap during the NTCRA and thereafter.

Appendix D Table 2
Mohawk Tannery Site, EE/CA Addendum
Location-Specific ARARs and TBCs

Regulatory Authority	**Requirement**	**Status**	**Requirement Synopsis**	**Changes in ARAR/TBC since the 2002 Action Memorandum**	**Alternative 1a-c: Off-Site Disposal** **Action to be Taken to Attain Requirement**	**Alternative 4: On-Site Treatment (Solidification/Stabilization) and Capping** **Action to be Taken to Attain Requirement**	**Alternatives 5a, a1, a2, b, and c Encapsulation and Capping** **Action to be Taken to Attain Requirement**
Federal	Floodplain Management and Protection of Wetlands (44 C.F.R. § 9)	Relevant and Appropriate	FEMA regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use. Requires the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain and to avoid development within floodplain wherever	Not cited in Action Memo, instead regulations at 40 C.F.R. 6.302(a) and 40 C.F.R. 6, App. A were cited that have since been deleted.	Any work in the floodplain or federal jurisdiction wetlands associated with removing contaminated material would minimize impacts to floodplain and wetland resources. If this alternative is selected public comment will be solicited concerning the proposed impacts to floodplain and federal wetlands resources.	Any work in federal jurisdiction wetlands associated with the excavation, consolidation, treatment and capping of contaminated material, will minimize impacts to wetland resources, including instituting erosion and sedimentation control measures, and may require mitigation. Excavation and consolidation work within floodplain will be conducted to minimize impacts to floodplain resources. Any flood storage lost from the capping of contaminated materials at or below the 100-year flood elevation will be replaced on-site. Lost flood storage between the 100-year and 500-year flood elevation is expected to be *de minimus* within the waterway but may be replaced, to the extent practicable. The cap will be designed and maintained to not release contamination if	Any work in federal jurisdiction wetlands associated with the excavation, consolidation, encapsulation, and capping of contaminated material will minimize impacts to wetland resources, including instituting erosion and sedimentation control measures, and may require mitigation. Excavation and consolidation work within floodplain will be conducted to minimize impacts to floodplain resources. Any flood storage lost from the encapsulation/capping of contaminated materials at or below the 100-year flood elevation will be replaced on-site. Lost flood storage between the 100-year and 500-year flood elevation is expected to be *de minimus* within the waterway but may be replaced, to the extent practicable. The cap will be designed and maintained to not release contamination if flooded, up to a 500-year event. If this alternative is selected public comment will be solicited concerning the proposed impacts to floodplain and federal wetlands resources.

			there is a practicable alternative. An assessment of impacts to 500-year floodplain is required for critical actions – which includes siting contaminated sediment management facilities in a floodplain. Requires public notice when proposing any action in or affecting floodplain or wetlands.			flooded, up to a 500-year event. If this alternative is selected public comment will be solicited concerning the proposed impacts to floodplain and federal wetlands resources.	
Federal	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste that would to pose a hazard to human life, wildlife, or land or water resources.	Cited	Engineering controls will be used during the excavation and stockpiling of any sludge/waste within the 100-year floodplain to comply with these requirements.	To the extent solid waste will be treated and capped within the 100-year floodplain any flood storage lost at or below the 100-year flood elevation will be replaced on-site and the cap designed and maintained to not release contamination if flooded.	To the extent solid waste will be encapsulated and capped within the 100-year floodplain any flood storage lost at or below the 100-year flood elevation will be replaced on-site and the cap designed and maintained to not release contamination if flooded.
Federal	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Cited	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.	To the extent hazardous waste may be consolidated and capped within the 100-year floodplain, the capped lagoons will be designed, constructed, and maintained to meet RCRA floodplain standards for hazardous waste disposal facilities.	To the extent hazardous waste may be consolidated, encapsulated, and capped within the 100-year floodplain, the capped lagoons will be designed, constructed, and maintained to meet RCRA floodplain standards for hazardous waste disposal facilities.

Federal	Fish and Wildlife Coordination Act, 16 U.S.C. §661 *et seq*.	Applicable	Any modification of a body of water or wetland requires consultation with the U.S. Fish and Wildlife Service and the appropriate state wildlife agency to develop measures to prevent, mitigate, or compensate for losses of fish and wildlife.	Not cited	Contact with appropriate federal agencies would be maintained during the removal action that may alter protected resource areas.	Contact with appropriate federal agencies would be maintained during the planning and implementation of the removal action that may alter protected resource areas.	Contact with appropriate federal agencies would be maintained during the planning and implementation of the removal action that may alter protected resource areas.
Federal	National Historical Preservation Act, 16 U.S.C. 469 *et seq.*; 36 C.F.R. Part 65	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	Not cited	If, during the removal action, it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.	If, during the removal action, it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.	If, during the removal action, it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
State	Native Plant Protection Act, R.S.A. 217-A	Applicable	Prohibits damaging plant species listed as endangered in the State.	Not cited	Any removal action that may take state-listed species will need to meet these standards.	Any removal action that may take state-listed species will need to meet these standards.	Any removal action that may take state-listed species will need to meet these standards.

State	Endangered Species Conservation Act, R.S.A. 212-A	Applicable	Prohibits the taking of State-listed endangered species and regulates such activities regarding State-listed threatened species.	Not cited.	Any removal action that may take state-listed species will need to meet these standards.	Any removal action that may take state-listed species will need to meet these standards.	Any removal action that may take state-listed species will need to meet these standards.
State	Siting requirements for hazardous waste facilities and variances, Env-Hw 304.08 (Existing facilities) and 304.09 (New facilities).	Relevant and Appropriate	Flood control measures must be identified for any facility within the 100-year floodplain. Similarly, new facilities located within 3,000 feet of faults displaced in Holocene times must show that no faults pass within 200 feet of the facility.	Cited as Env-Wm 353.08 and 353.09 which have been re-designated by the State as Env-Hw 304.08 and 304.09.	Siting and operation of the treatment process, if in the 100-year floodplain, will be done in accordance with these regulations.	Any flood storage lost from the capping of contaminated materials at or below the 100-year flood elevation will be replaced on-site. Seismic requirements are also met.	Any flood storage lost from the encapsulation/capping of contaminated materials at or below the 100-year flood elevation will be replaced on-site. Seismic requirements are also met.
State	Terrain Alteration, Env-Wq 1500 and RSA 485-A:17	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Cited as "Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env- Ws 415)" re-designated by the State as "Terrain	The alternative will involve erosion and sedimentation controls to prevent impacts to the Nashua River.	The alternative will involve erosion and sedimentation controls to prevent impacts to the Nashua River	The alternative will involve erosion and sedimentation controls to prevent impacts to the Nashua River

				Alteration, Env-Wq 1500."			
State	Criteria and Conditions for Fill and Dredge in Wetlands: RSA Ch. 482-A and NH Admin. Code Env-Wt Parts 100-900	Applicable	These standards regulate filling and other activities in or adjacent to wetland resource areas (including the 100-year floodplain), and buffer zones and establish criteria for the protection of wetlands from adverse impacts on fish, wildlife, commerce, and public recreation.	Not cited.	Any work in the 100-year floodplain or state jurisdiction wetlands/buffer zone associated with removing contaminated material would minimize impacts to floodplain and wetland resources.	Any work in state jurisdiction wetlands/buffer zone associated with the excavation, consolidation, treatment and capping of contaminated material, will minimize impacts to wetland resources, including instituting erosion and sedimentation control measures, and may require mitigation. Excavation and consolidation work within the 100-year floodplain will be conducted to minimize impacts to floodplain resources. Any flood storage lost from the capping of contaminated materials at or below the 100-year flood elevation will be replaced on-site. The cap will be designed and maintained to not release contamination if flooded.	Any work in state jurisdiction wetlands/buffer zone associated with the excavation, consolidation, encapsulation, and capping of contaminated material will minimize impacts to wetland resources, including instituting erosion and sedimentation control measures, and may require mitigation. Excavation and consolidation work within the 100-year floodplain will be conducted to minimize impacts to floodplain resources. Any flood storage lost from the encapsulation/ capping of contaminated materials at or below the 100-year flood elevation will be replaced on-site. The cap will be designed and maintained to not release contamination if flooded.
State	Shore land Water Quality Protection: RSA 483-B and NH Admin, Code Env-Wq 1400	Applicable	These standards regulate activities conducted along shore lands to protect, restore and preserve these fragile natural resources.	Not cited	Any work within the protected shore land will need to comply with these rules including but not limited to storm water and erosion control, maintenance of woodland buffers, and restoration.	Any work within the protected shore land will need to comply with these rules including but not limited to storm water and erosion control, maintenance of woodland buffers, and restoration.	Any work within the protected shore land will need to comply with these rules including but not limited to storm water and erosion control, maintenance of woodland buffers, and restoration.

Appendix D Table 3
Mohawk Tannery Site, EE/CA
Action-Specific ARARs and TBCs

Regulatory Authority	Requirement	Status	Requirement Synopsis	Changes in ARAR/TBC since the 2002 Action Memorandum	Alternative 1a-c: Off-Site Disposal Action to be Taken to Attain Requirement	Alternative 4: On-Site Treatment (Solidification/Stabilization) and Capping Action to be Taken to Attain Requirement	Alternatives 5a, a1, a2, b, and c Encapsulation and Capping Action to be Taken to Attain Requirement
Federal	Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901, *et seq.*, 40 C.F.R. Parts 261, 262 and 264	Applicable	New Hampshire has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations (Env-Hw 100-1100). These provisions have been adopted by the State.	Not cited	Any wastes generated by removal activity will be analyzed by appropriate test methods. If found to be hazardous wastes, then they will be managed and disposed of off-site in accordance with the substantive requirements of the State hazardous waste regulations.	Any wastes generated by removal activity to be sent off-site will be analyzed by appropriate test methods. If found to be hazardous wastes, then they will be managed in accordance with the substantive requirements of the State hazardous waste regulations. The lagoons will be capped in accordance with State hazardous waste closure standards which will include consolidation of all wastes from the site without further characterization testing. O&M of the capped lagoons will meet post-closure standards.	Any wastes generated by removal activity to be sent off-site will be analyzed by appropriate test methods. If found to be hazardous wastes, then they will be managed in accordance with the substantive requirements of the State hazardous waste regulations. The lagoons will be capped in accordance with State hazardous waste closure standards which will include consolidation of all wastes from the site without further characterization testing. O&M of the capped lagoons will meet post-closure standards.
Federal	Clean Water Act - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the	Cited	Any surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure	Any surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations.	Any surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations.

			local pretreatment program.		compliance with these regulations.		
Federal	Clean Water Act (CWA), Section 402, 33 U.S.C. § 1342; 40 C.F.R.122,125, 131, 136, 450 - Discharge of Pollutants	Applicable	These standards address water discharges which may be directed to surface water. Also establishes storm water standards for construction and development projects that are over one acre.	Not cited.	If a discharge from the removal action, is directed to surface water the discharge will be treated, if necessary, so that these standards will be achieved. Any removal action that will disturb one acre or more, including excavation and management of contaminated materials will meet these storm water standards.	If a discharge from the removal action, is directed to surface water the discharge will be treated, if necessary, so that these standards will be achieved. Any removal action that will disturb one acre or more, including excavation, consolidation and capping of contaminated materials will meet these storm water standards.	If a discharge from the removal action, is directed to surface water the discharge will be treated, if necessary, so that these standards will be achieved. Any removal action that will disturb one acre or more, including excavation, consolidation and capping of contaminated materials will meet these storm water standards.
Federal	Clean Air Act (CAA), Hazardous Air Pollutants, 42.U.S.C. § 112(b)(1), National Emission Standards for Hazardous Air Pollutants (NESHAPS), 40 C.F.R. Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	Not cited	If the excavation and management of wastes generates regulated air pollutants, then measures will be implemented to meet these standards.	If the excavation, consolidation, treatment and/or capping of wastes generates regulated air pollutants, then measures will be implemented to meet these standards.	If the excavation, consolidation, encapsulation and/or capping generates regulated air pollutants, then measures will be implemented to meet these standards.
Federal	CAA, National Emission Standards for Hazardous Air Pollutants (NESHAPS), Standards tor	Relevant and Appropriate	NESHAPS standards for preventing air releases from inactive asbestos disposal sites, including cover standards, dust	Not cited.	Asbestos contaminated material will not be disposed of on-site.	Any asbestos contaminated soil/debris will be consolidated either under the lagoon cap or adjacent to the lagoon cap under a separate cap meeting the asbestos-capping standards of these	Any asbestos contaminated soil/debris will be consolidated either under the lagoon cap or adjacent to the lagoon cap under a separate cap meeting the asbestos-capping standards of these regulations. O&M and

	Inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations, 40 C.F.R. § 61.151		suppression, and land use controls.			regulations. O&M and ICs will be established to maintain the cap and to address any potential asbestos exposure in case the cap is disturbed.	ICs will be established to maintain the cap and to address any potential asbestos exposure in case the cap is disturbed.
Federal	Framework for Investigating Asbestos-Contaminated Superfund Sites, OSWER Directive #9200.0-68 (Sept. 2008)	TBC	Guidance on investigating and characterizing the potential human exposure from asbestos contamination in outdoor soil at Superfund sites.	Not cited.	Any areas that are suspected of containing asbestos contamination will be investigated under these guidance standards.	Any areas that are suspected of containing asbestos contamination will be investigated under these guidance standards.	Any areas that are suspected of containing asbestos contamination will be investigated under these guidance standards.
Federal	Toxic Substances Control Act (Transport and Disposal of Asbestos Waste) 40 CFR Subpart E, Appendix D	Applicable	Provides standards for transport and disposal of materials that contain asbestos. Requires proper wetting and containerization.	Not cited	Asbestos will be managed in compliance with these standards.	Asbestos will be managed in compliance with these standards.	Asbestos will be managed in compliance with these standards.
State	Contaminated Site Management, Activity and Use Restrictions; NH Admin. Code Env-Or 608	Relevant and Appropriate	Env-Or Part 608 establishes standards for setting institutional controls to protect human health and components of the remedy.	Not cited	Not relevant to this alternative since all waste to be taken off-site	ICs will be established for wastes left in place that meet State recording standards under these regulations.	ICs will be established for wastes left in place that meet State recording standards under these regulations.
State	Identification and Listing of Hazardous Wastes, N.H. Admin. Code Env-Hw 400	Applicable	These standards list particular hazardous wastes and identify the maximum concentration of contaminants for	Cited, but as Env-Wm 400, State reclassified the regulation as Env-Hw 400.	Any wastes generated by removal activity will be analyzed by appropriate test methods. If found	Any wastes generated by removal activity to be taken off-site will be analyzed by appropriate test methods. Wastes to be consolidated on-site in the capped lagoons do	Any wastes generated by removal activity to be taken off-site will be analyzed by appropriate test methods. Wastes to be consolidated on-site in the capped lagoons do

			which the waste would be a RCRA characteristic waste. The analytical test set out in Appendix II of 40 C.F.R. Part 261 is referred to as the Toxicity Characteristic Leaching Procedure (TCLP). The federal requirements 40 C.F.R. Part 261 are incorporated by reference.		to be hazardous wastes, then they will be managed and disposed of off-site in accordance with the substantive requirements of the State hazardous waste regulations.	not need to be tested if the capped lagoons meet RCRA closure standards.	not need to be tested if the capped lagoons meet RCRA closure standards.
State	Requirements for Hazardous Waste Generators, N.H. Admin. Code Env-Hw 500	Applicable	Requires a determination as to whether waste materials are hazardous and, if so, requirements for managing such materials on site prior to shipment off site. The federal requirements 40 C.F.R. Part 262 are incorporated by reference.	Cited, but as Env-Wm 500, State reclassified the regulation as Env-Hw 500.	If removal activity generates hazardous wastes, then they will be managed and disposed of off-site in accordance with the substantive requirements of these regulations.	If removal activity generates hazardous wastes, then they will be managed in accordance with the substantive requirements of these regulations.	If removal activity generates hazardous wastes, then they will be managed in accordance with the substantive requirements of these regulations.
State	Hazardous Waste, Technical Requirements (Surface Impoundment Closure/Post Closure) Env-Hw 708.03 Technical Requirements.	Relevant and Appropriate	The operator of a facility shall: (a) Treat, store, or dispose of wastes according to best engineering judgment and with the best available technology; (b) Design and operate the facility so as to	Not cited.	Not applicable since all wastes will be disposed of off-site.	Closure of the lagoon with the consolidated solidified/ stabilized waste will meet the following substantive closure standards: (2)(i) Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues; (ii) Stabilize remaining wastes to a bearing capacity sufficient to support	Closure of the lagoon with the consolidated encapsulated waste will meet the following substantive closure standards: (2)(i) Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues; (ii) Stabilize remaining wastes to a bearing capacity sufficient to support final cover; and (iii)

			minimize the quantity and impact of planned and non-planned releases of hazardous waste or waste constituents into the environment; (c) Use the best available solution for managing the hazardous wastes received; and (d) Comply with the following requirements and standards as set forth under 40 CFR Part 264, in particular closure/post-closure performance standards at 40 C.F.R. 264.228			final cover; and (iii) Cover the surface impoundment with a final cover designed and constructed to: (A) Provide long-term minimization of the migration of liquids through the closed impoundment; (B) Function with minimum maintenance; (C) Promote drainage and minimize erosion or abrasion of the final cover; (D) Accommodate settling and subsidence so that the cover's integrity is maintained; and (E) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. O&M and ICs will meet post-closure standards under these regulations.	Cover the surface impoundment with a final cover designed and constructed to: (A) Provide long-term minimization of the migration of liquids through the closed impoundment; (B) Function with minimum maintenance; (C) Promote drainage and minimize erosion or abrasion of the final cover; (D) Accommodate settling and subsidence so that the cover's integrity is maintained; and (E) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. O&M and ICs will meet post-closure standards under these regulations.
State	Air Pollution Control: RSA Ch. 125-C; Fugitive Dust, N.H. Admin. Rule Env-A 1002; Regulated Toxic Air Pollutants, NH Admin. Rule Env-A 1400	Applicable	Part 1002 requires precautions to prevent, abate and control fugitive dust during specified activities, including excavation, maintenance, and construction. Part 1400 identifies toxic air pollutants discharge standards. These pollutants are also listed by EPA in 40 CFR 261	Cited	If the excavation and management generates regulated air pollutants, then measures will be implemented to meet these standards.	If the excavation, consolidation, treatment and/or capping generates regulated air pollutants, then measures will be implemented to meet these standards.	If the excavation, consolidation, encapsulation and/or capping generates regulated air pollutants, then measures will be implemented to meet these standards.
State	Management and Control of	Applicable	Requirements for managing certain	Not cited	Manage asbestos wastes excavated	Manage asbestos wastes excavated from asbestos	Manage asbestos wastes excavated from asbestos

	Asbestos Disposal Sites Not Operated After July 9, 1981; New Hampshire Code of Administrative Rules Chapter Env-Sw 2100 and RSA 141-E		pre-1981 asbestos disposal sites.		from asbestos disposal sites (ADS) in accordance with Env-Sw 2100. Use authorized personnel/contractors as required.	disposal sites (ADS) in accordance with Env-Sw 2100. Construct, manage and record relocated ADS in accordance with Env-Sw2100. Use authorized personnel/contractors as required.	disposal sites (ADS) in accordance with Env-Sw 2100. Construct, manage and record relocated ADS in accordance with Env-Sw2100. Use authorized personnel/contractors as required.
State	Management of Certain Wastes; New Hampshire Code of Administrative Rules Part Env-Sw 901	Applicable	Management of asbestos waste from the point of waste origination to the point of waste disposal.	Not cited	Manage and dispose of asbestos wastes generated (*e.g.*, excavated) accordance with Env-Sw 901. Asbestos waste shall not be intentionally combined or mixed with other waste types prior to disposal. Use authorized personnel/contractors as required.	Manage and treat/dispose of asbestos wastes generated (*e.g.*, excavated and treated/capped) accordance with Env-Sw 901. Asbestos waste shall not be intentionally combined or mixed with other waste types prior to disposal. Use authorized personnel/contractors as required.	Manage asbestos and dispose of wastes generated (*e.g.*, excavated and encapsulated/capped) accordance with Env-Sw 901. Asbestos waste shall not be intentionally combined or mixed with other waste types prior to disposal. Use authorized personnel/contractors as required.
State	Asbestos Management and Control; New Hampshire Code of Administrative Rules Chapter Env-A 1800	Applicable	Requirements for managing asbestos in a manner that prevents the release of asbestos fibers to the environment and human exposure thereto.	Not cited	Manage asbestos wastes generated (*e.g.*, excavated) accordance with Env- A 1800. Use authorized personnel/contractors as required.	Manage asbestos wastes generated (*e.g.*, excavated and treated/capped) accordance with Env- A 1800. Use authorized personnel/contractors as required.	Manage asbestos wastes generated (*e.g.*, excavated an encapsulated/capped) accordance with Env- A 1800. Use authorized personnel/contractors as required.
State	Solid Waste landfill requirements: New Hampshire Code of Administrative Rules Part Env-	Relevant and appropriate	Requirements for excavating a portion or an entire solid waste landfill.	Not cited	Prepare and follow a landfill reclamation plan as described in Env-Sw 808 for removal of the	Prepare and follow a landfill reclamation plan as described in Env-Sw 808 for removal of the Fimbel Door Landfill.	Prepare and follow a landfill reclamation plan as described in Env-Sw 808 for removal of the Fimbel Door Landfill.

	808, Landfill Reclamation				Fimbel Door Landfill		
State	Drinking Water Quality Standards: NH Admin. Code Env-Dw 700	Relevant and Appropriate for MCLs and non-zero MCLGs only; MCLGs set as zero are To Be Considered.	State MCLs and MCLGs establish maximum contaminant levels permitted in public water supplies and are the basis of State Ambient Groundwater Quality Standards (AGQS) that are applicable to site ground water. The regulations are generally equivalent to the Federal Safe Drinking Water Act (SDWA).	Not cited.	Not applicable to this alternative because no contamination will be left in place.	Used to establish Performance Standards for monitoring groundwater at the capped lagoon compliance boundary to ensure there is no migration of contaminated groundwater exceeding these standards beyond the boundary. Inside of the compliance boundary, ICs will be required to prevent contact/ingestion of groundwater that exceeds these standards.	Used to establish Performance Standards for monitoring groundwater at the capped lagoon compliance boundary to ensure there is no migration of contaminated groundwater exceeding these standards beyond the boundary. Inside of the compliance boundary, ICs will be required to prevent contact/ingestion of groundwater that exceeds these standards.
State	New Hampshire Ambient Groundwater Quality Standards (NH AGQS): Env-Or 603.03, Table 600-1,	Relevant and Appropriate	Establishes maximum concentration levels for regulated contaminants in groundwater which result from human operations or activities. NH AGQS are equivalent to MCLs for contaminants that have MCLs. NH AGQS have been established for site groundwater contaminants for which no MCLs are established, and are derived to be protective for	Not cited.	Not applicable to this alternative because no contamination will be left in place.	Used to establish Performance Standards for monitoring groundwater at the capped lagoon compliance boundary to ensure there is no migration of contaminated groundwater exceeding these standards beyond the boundary. Inside of the compliance boundary, ICs will be required to prevent contact/ingestion of groundwater that exceeds these standards.	Used to establish Performance Standards for monitoring groundwater at the capped lagoon compliance boundary to ensure there is no migration of contaminated groundwater exceeding these standards beyond the boundary. Inside of the compliance boundary, ICs will be required to prevent contact/ingestion of groundwater that exceeds these standards.

			drinking water uses. The NH AGQS will be used for site contaminants where MCLs are not currently established.				
State	Non-degradation of Groundwater to Protect Surface Water: NH Admin. Code Env-Or 603.01 (c)	Applicable	Wm-Or 603.01(c) provides that, unless naturally occurring, groundwater shall not contain any contaminants at concentrations such that groundwater to surface water results in a violation of surface water standards in any surface water body within or adjacent to the site. Env-Or 603.01 (c) therefore incorporates surface water standards set forth at Env-Ws 1700.	Not cited.	Not applicable to this alternative because no contamination will be left in place.	Used to establish Performance Standards for monitoring groundwater at the capped lagoon compliance boundary to ensure there is no migration of contaminated groundwater exceeding these standards beyond the boundary. Inside of the compliance boundary, ICs will be required to prevent contact/ingestion of groundwater that exceeds these standards.	Used to establish Performance Standards for monitoring groundwater at the capped lagoon compliance boundary to ensure there is no migration of contaminated groundwater exceeding these standards beyond the boundary. Inside of the compliance boundary, ICs will be required to prevent contact/ingestion of groundwater that exceeds these standards.
State	Standards for Construction, Maintenance and Abandonment of Wells, NH Admin. Code We 600	Applicable for drinking water wells; Relevant and Appropriate for monitoring wells	This provision requires that wells be constructed, maintained, relocated, and/or abandoned according to these regulations. We 602.05 address restrictions on location wells in contaminated areas.	Not cited	Not applicable to this alternative because no contamination will be left in place.	Wells used for monitoring the remedy will be created, operated, and closed in compliance with these standards. Well restriction standards shall be incorporated into institutional controls to prevent groundwater use around the capped lagoon.	Wells used for monitoring the remedy will be created, operated, and closed in compliance with these standards. Well restriction standards shall be incorporated into institutional controls to prevent groundwater use around the capped lagoon.

Appendix D

Attachment B-1 - Table 1-PW
Present Worth for Alternatives 1A, 1B, and 1C
Mohawk Tannery Site
Nashua, New Hampshire

Alternative 1 - Disposal of 100% of Sludge/Waste at U.S. RCRA D Landfill

Present Worth Analysis				
Year	**Present Worth Factor (1)**	**Capital Costs ($)**	**O&M Costs ($)**	**Present Worth ($)**
0	1.000	$ 32,564,467.46	$ -	$ 32,564,467.46
1	0.935		$ 3,144.00	$ 2,938.32
2	0.873		$ 3,144.00	$ 2,746.09
			TOTAL	**$ 32,570,151.87**

Alternative 1B - Disposal of Area 1 Sludge at U.S. RCRA C Landfill, Remainder to U.S. RCRA D Landfill

Attachment B-1 - Table 1A-CC
Capital Costs for Alternative 1A - Excavation and Off-Site Disposal (Subtitle D)
Mohawk Tannery Site
Nashua, New Hampshire

				2017 Unit Cost ($)				2017 Total Cost ($)				2017 Total Direct Cost ($)	Comments/Reference
Item No.	Item	Qty.	Unit	Sub.	Mat.	Labor	Equip	Sub.	Mat.	Labor	Equip	**1.951**	**ENR 2002-2017 Multiplier**
01 - TEMPORARY FACILITIES & MOBILIZATIONDEMOBILIZATION													
01-001	Temp. Fac/Equip. Mobe/Demobe	1	LS	$ 45,165.65	$ -	$ -	$ -	$ 45,165.65	$ -	$ -	$ -	$ 45,165.65	CCI Updated
01-002	Office Trailer (1 each)	11	MO	$ -	$ -	$ -	$ 751.14	$ -	$ -	$ -	$ 8,262.49	$ 8,262.49	CCI Updated
01-003	Storage Container (1 each)	11	MO	$ -	$ -	$ -	$ 146.33	$ -	$ -	$ -	$ 1,609.58	$ 1,609.58	CCI Updated
01-004	Portable Comm. Equip.	11	MO	$ -	$ -	$ -	$ 585.30	$ -	$ -	$ -	$ 6,438.30	$ 6,438.30	CCI Updated
01-005	Site Utilities	11	MO	$ 390.20	$ -	$ -	$ -	$ 4,292.20	$ -	$ -	$ -	$ 4,292.20	CCI Updated
01-006	Sanitary Facilities	11	MO	$ 204.86	$ -	$ -	$ -	$ 2,253.41	$ -	$ -	$ -	$ 2,253.41	CCI Updated
01-007	Site Security	11	MO	$ 11,706.00	$ -	$ -	$ -	$ 128,766.00	$ -	$ -	$ -	$ 128,766.00	CCI Updated
01-008	Sampling Equipment	11	MO	$ -	$ -	$ -	$ 3,902.00	$ -	$ -	$ -	$ 42,922.00	$ 42,922.00	CCI Updated
01-009	Dumpster/MSW Disposal	11	MO	$ 448.73	$ -	$ -	$ -	$ 4,936.03	$ -	$ -	$ -	$ 4,936.03	CCI Updated
02 - DECONTAMINATION FACILITIES & SERVICES													
02-001	Vehicle Decontamination												
02-001a	Gravel Base Delivered and Placed	15	CY	$ -	$ 23.41	$ 3.00	$ 3.41	$ -	$ 351.18	$ 45.07	$ 51.21	$ 447.46	CCI Updated
02-001b	40-mil HDPE Liner Delivered and Placed	800	SF	$ -	$ 0.66	$ 0.06	$ -	$ -	$ 530.67	$ 46.82	$ -	$ 577.50	CCI Updated
02-001c	Stone Drainage Layer Delivered and Placed	10	CY	$ -	$ 23.41	$ 4.88	$ 2.36	$ -	$ 234.12	$ 48.78	$ 23.61	$ 306.50	CCI Updated
02-001d	Splash Guard Placed	800	SF	$ -	$ 2.44	$ 1.95	$ -	$ -	$ 1,951.00	$ 1,560.80	$ -	$ 3,511.80	CCI Updated
02-002	Decontamination												
02-002a	Pressure Washer	2	Ea	$ -	$ -	$ -	$ 5,612.81	$ -	$ -	$ -	$ 11,225.62	$ 11,225.62	CCI Updated
02-002b	Decontamination Labor	300	HR	$ -	$ 15.30	$ 57.71	$ -	$ -	$ 4,588.75	$ 17,313.17	$ -	$ 21,901.93	CCI Updated
02-003	Personnel Decontamination												
02-003a	Gravel Base Delivered and Placed	2	CY	$ -	$ 23.41	$ 3.00	$ 3.41	$ -	$ 46.82	$ 6.01	$ 6.83	$ 59.66	CCI Updated
02-003b	40-mil HDPE Liner Delivered and Placed	100	SF	$ -	$ 0.66	$ 0.06	$ -	$ -	$ 66.33	$ 5.85	$ -	$ 72.19	CCI Updated
02-003c	Stone Drainage Layer Delivered and Placed	2	CY	$ -	$ 23.41	$ 4.88	$ 2.36	$ -	$ 46.82	$ 9.76	$ 4.72	$ 61.30	CCI Updated
02-004	Water Storage Tanks (clean and contaminated)	22	MO	$ -	$ 877.95	$ -	$ -	$ -	$ 19,314.90	$ -	$ -	$ 19,314.90	CCI Updated
03 - SITE PREPARATION													
03-001	Access Road Construction												
03-001a	Clearing	1	AC	$ -	$ -	$ 2,800.00	$ 2,400.00	$ -	$ -	$ 2,800.00	$ 2,400.00	$ 5,200.00	Project experience
03-001b	Gravel Delivered	1100	CY	$ -	$ 23.41	$ 3.10	$ 3.30	$ -	$ 25,753.20	$ 3,412.30	$ 3,626.91	$ 32,792.41	CCI Updated
03-001c	Gravel Spread, Grade, Compact	3300	SY	$ -	$ -	$ 0.51	$ 0.96	$ -	$ -	$ 1,673.96	$ 3,154.77	$ 4,828.73	CCI Updated
03-002	Building/Foundation Demolition												
03-002a	Foundation Removal	750	CY	$ -	$ -	$ 1.68	$ 2.17	$ -	$ -	$ 1,258.40	$ 1,624.21	$ 2,882.60	CCI Updated
03-002b	Foundation Debris Transportation & Disposal	1200	Ton	$ 136.57	$ -	$ -	$ -	$ 163,884.00	$ -	$ -	$ -	$ 163,884.00	CCI Updated
03-002c	Clarifier Tank Evacuation/Removal	1	Ea	$ 1,814.43	$ -	$ 942.57	$ 760.48	$ 1,814.43	$ -	$ 942.57	$ 760.48	$ 3,517.48	CCI Updated
03-002d	Wood-Frame Building Demolition	0	CF	$ -	$ -	$ 0.10	$ 0.16	$ -	$ -	$ -	$ -	$ -	Demolition completed
03-002e	Building Debris Transportation & Disposal	0	CY	$ -	$ -	$ 9.46	$ 14.11	$ -	$ -	$ -	$ -	$ -	Demolition completed
03-003	Clear Medium Trees	10	AC	$ -	$ -	$ 2,800.00	$ 2,400.00	$ -	$ -	$ 28,000.00	$ 24,000.00	$ 52,000.00	Project experience
03-004	Erosion Controls												
03-004a	Silt Fence	2500	LF	$ -	$ 1.23	$ 2.46	$ -	$ -	$ 3,072.83	$ 6,145.65	$ -	$ 9,218.48	CCI Updated
03-004b	Hay Bales	20	Ton	$ -	$ 107.11	$ 357.75	$ 119.97	$ -	$ 2,142.20	$ 7,155.10	$ 2,399.34	$ 11,696.64	CCI Updated
03-005	Haul Road Construction												
03-005a	Gravel Delivered	2200	CY	$ -	$ 23.41	$ 3.10	$ 3.30	$ -	$ 51,506.40	$ 6,824.60	$ 7,253.82	$ 65,584.82	CCI Updated
03-005b	Gravel Spread, Grade, Compact	6667	SY	$ -	$ -	$ 0.51	$ 0.96	$ -	$ -	$ 3,381.90	$ 6,373.59	$ 9,755.49	CCI Updated
03-006	Prepare Stockpile/Staging Areas												
03-006a	Rough Grade	1850	SY	$ -	$ -	$ 1.66	$ 4.88	$ -	$ -	$ 3,067.95	$ 9,023.38	$ 12,091.32	CCI Updated
03-006b	Sand/Gravel Delivered	910	CY	$ -	$ 23.41	$ 3.10	$ 3.30	$ -	$ 21,304.92	$ 2,822.90	$ 3,000.44	$ 27,128.26	CCI Updated
03-006c	40-mil HDPE Liner Delivered and Placed	16400	SF	$ -	$ 0.66	$ 0.06	$ -	$ -	$ 10,878.78	$ 959.89	$ -	$ 11,838.67	CCI Updated
03-006d	Erosion & Sediment Controls	750	LF	$ -	$ 3.32	$ 9.36	$ 2.15	$ -	$ 2,487.53	$ 7,023.60	$ 1,609.58	$ 11,120.70	CCI Updated
03-007	Dust Suppression (Water Spray)	48400	SY	$ -	$ -	$ -	$ 0.02	$ -	$ -	$ -	$ 944.28	$ 944.28	CCI Updated

Attachment B-1 - Table 1A-CC
Capital Costs for Alternative 1A - Excavation and Off-Site Disposal (Subtitle D)
Mohawk Tannery Site
Nashua, New Hampshire

				2017 Unit Cost ($)				2017 Total Cost ($)				2017 Total Direct Cost ($)	Comments/Reference
Item No.	Item	Qty.	Unit	Sub.	Mat.	Labor	Equip	Sub.	Mat.	Labor	Equip	**1.951**	**ENR 2002-2017 Multiplier**
04 - DEWATERING (Areas 1 and 2)													
04-001	Rental Pumps (3 ea)	60	Wk	$ -	$ 474.09	$ -	$ -	$ -	$ 28,445.58	$ -	$ -	$ 28,445.58	CCI Updated
04-002	3-inch Discharge Hose	1000	LF	$ -	$ -	$ -	$ 7.80	$ -	$ -	$ -	$ 7,804.00	$ 7,804.00	CCI Updated
04-003	Fractionation Tanks (2 each at 11 months)	22	MO	$ -	$ -	$ -	$ 1,755.90	$ -	$ -	$ -	$ 38,629.80	$ 38,629.80	CCI Updated
04-004	Analytical Samples	10	Ea	$ 975.50	$ -	$ -	$ -	$ 9,755.00	$ -	$ -	$ -	$ 9,755.00	CCI Updated
04-005	Waste Disposal Fees	250	Kgal	$ 3.90	$ -	$ -	$ -	$ 975.50	$ -	$ -	$ -	$ 975.50	CCI Updated
05 - SLUDGE/WASTE/SOIL EXCAVATION													
05-001	Excavate & Load Overlying Soil	12400	CY	$ -	$ -	$ 1.42	$ 3.47	$ -	$ -	$ 17,660.45	$ 43,062.47	$ 60,722.92	CCI Updated
05-002	Excavate & Load Sludge/Waste	68900	CY	$ -	$ -	$ 2.15	$ 5.21	$ -	$ -	$ 147,866.29	$ 358,911.81	$ 506,778.10	CCI Updated
05-003	Transport to Stockpile Areas	3445	Hr	$ -	$ -	$ 24.78	$ 65.22	$ -	$ -	$ 85,359.18	$ 224,689.55	$ 310,048.73	CCI Updated
05-004	Dust Suppression	300	Ac	$ -	$ 4.99	$ 40.72	$ 51.56	$ -	$ 1,498.37	$ 12,215.21	$ 15,469.48	$ 29,183.06	CCI Updated
05-005	Odor Control	1	LS	$ 273,140.00	$ -	$ -	$ -	$ 273,140.00	$ -	$ -	$ -	$ 273,140.00	CCI Updated
05-006	Air Monitoring	300	Ea	$ 1,951.00	$ -	$ -	$ -	$ 585,300.00	$ -	$ -	$ -	$ 585,300.00	CCI Updated
06 - SLUDGE/WASTE STOCKPILING AND HANDLING													
06-001	Odor/Moisture Control (Lime)	9900	Ton	$ -	$ 30.00	$ -	$ -	$ -	$ 297,000.00	$ -	$ -	$ 297,000.00	Project experience
06-002	Sludge Dewatering/Moisture Control	1300	Hr	$ -	$ -	$ 28.02	$ 146.33	$ -	$ -	$ 36,421.27	$ 190,222.50	$ 226,643.77	CCI Updated
06-003	Stockpile Maintenance	1300	Hr	$ -	$ -	$ -	$ 146.33	$ -	$ -	$ -	$ 190,222.50	$ 190,222.50	CCI Updated
07 - SAMPLE ANALYSES													
07-001	Sample Shipping	150	Ea	$ 80.00	$ -	$ -	$ -	$ 12,000.00	$ -	$ -	$ -	$ 12,000.00	Project experience
07-002	Confirmation Analytical Costs (Dioxin/SVOCs/Metals)	250	Ea	$ 750.00	$ -	$ -	$ -	$ 187,500.00	$ -	$ -	$ -	$ 187,500.00	Project experience
07-003	Waste Characterization Samples	200	Ea	$ 1,463.25	$ -	$ -	$ -	$ 292,650.00	$ -	$ -	$ -	$ 292,650.00	CCI Updated
08 - OFFSITE DISPOSAL OF SLUDGE/WASTE													
08-001	Load Dump Trucks	75790	CY	$ -	$ -	$ 1.42	$ 3.47	$ -	$ -	$ 107,942.39	$ 263,202.00	$ 371,144.39	CCI Updated
08-002	Transportation & Disposal	123537.7	Ton	$ 156.08	$ -	$ -	$ -	$ 19,281,764.22	$ -	$ -	$ -	$ 19,281,764.22	CCI Updated
09 - SITE RESTORATION													
09-001	Backfill Placement & Compaction												
09-001a	Use Overlying Soil	9500	CY	$ -	$ 0.60	$ 3.24	$ 9.27	$ -	$ 5,745.70	$ 30,767.27	$ 88,038.88	$ 124,551.84	CCI Updated
09-001b	Use Off-Site Borrow	72000	CY	$ -	$ 10.32	$ 1.76	$ 4.04	$ -	$ 743,096.88	$ 126,424.80	$ 290,777.04	$ 1,160,298.72	CCI Updated
09-002	Place Topsoil (4")	2500	CY	$ -	$ 35.37	$ 7.10	$ 7.39	$ -	$ 88,429.08	$ 17,754.10	$ 18,485.73	$ 124,668.90	CCI Updated
09-003	Revegetate	4.5	AC	$ -	$ 664.04	$ 130.68	$ 179.63	$ -	$ 2,988.19	$ 588.05	$ 808.33	$ 4,384.57	CCI Updated
10 - SITE STAFFING													
10-001	Site Supervisor	11	MO	$ -	$ -	$ 6,243.20	$ -	$ -	$ -	$ 68,675.20	$ -	$ 68,675.20	CCI Updated
10-002	Site Engineer	11	MO	$ -	$ -	$ 6,243.20	$ -	$ -	$ -	$ 68,675.20	$ -	$ 68,675.20	CCI Updated
10-003	Site Sampler/Safety Officer	11	MO	$ -	$ -	$ 4,682.40	$ -	$ -	$ -	$ 51,506.40	$ -	$ 51,506.40	CCI Updated
10-004	Site Sampler/Field Technician	11	MO	$ -	$ -	$ 4,682.40	$ -	$ -	$ -	$ 51,506.40	$ -	$ 51,506.40	CCI Updated
10-005	Travel Expenses	210	Days	$ -	$ -	$ 959.89	$ -	$ -	$ -	$ 201,577.32	$ -	$ 201,577.32	CCI Updated
							SUBTOTAL DIRECT COST	$ 20,994,196.43	$ 1,311,480.24	$ 1,119,444.60	$ 1,867,039.22	$ 25,292,160.48	

	TOTAL COST ($)				Total Cost ($)	Comments
	Sub.	Mat.	Labor	Equip		
Subtotal Direct Cost	$ 20,994,196.43	$ 1,311,480.24	$ 1,119,444.60	$ 1,867,039.22	$ 25,292,160.48	
Direct Cost Adjustments						
Health and Safety on Labor and Equipment (5%)	$ -	$ -	$ 55,972.23	$ 93,351.96	$ 149,324.19	
Subtotal	*$ 20,994,196.43*	*$ 1,311,480.24*	*$ 1,175,416.83*	*$ 1,960,391.18*	$ 25,441,484.67	
Indirect Cost Adjustments						
Tax on Materials (7%)	$ -	$ 91,803.62	$ -	$ -	$ 91,803.62	
G&A @10% of Equipment, Material, and Labor	$ -	$ 140,328.39	$ 117,541.68	$ 196,039.12	$ 453,909.19	
Subcontract Fee @ 4%	$ 839,767.86	$ -	$ -	$ -	$ 839,767.86	
Labor OH @60%	$ -	$ -	$ 671,666.76	$ -	$ 671,666.76	
Subtotal Direct & Indirect	*$ 21,833,964.29*	*$ 1,543,612.24*	*$ 1,964,625.27*	*$ 2,156,430.30*	$ 27,498,632.09	
Other Costs						
Profit @ 10% of Subtotal Direct & Indirect	$ 2,183,396.43	$ 154,361.22	$ 196,462.53	$ 215,643.03	$ 2,749,863.21	
Engineering Contingency at 6% of Construction Cost and 2% of T&D Cost					$ 1,491,013.20	
Office Support @ 3% Direct & Indirect	$ 655,018.93	$ 46,308.37	$ 58,938.76	$ 64,692.91	$ 824,958.96	
				TOTAL COST	**$ 32,564,467.46**	

Attachment B-1 - Table 2-PRSC
Post-Removal Site Control Costs for Alternative 1 - Excavation with Off-Site Disposal
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Post-Construction Monitoring						
01-001	Vegetation/Erosion Verification	8	Event	$ 786.00	$ 6,288.00	Previous project experience. Mobilize to the site quarterly for 2 years, document cap conditions, document deficiencies, prepare/issue inspection report.
				SUBTOTAL COST	**$ 6,288.00**	

Attachment B-4 - Table 2-PW
Present Worth for Alternative 4 - Stabilization/Solidification
Mohawk Tannery Site
Nashua, New Hampshire

Alternative 4 - In-Situ Solidification/Stabilization

Present Worth Analysis				
Year	**Present Worth Factor (1)**	**Capital Costs ($)**	**O&M Costs ($)**	**Present Worth ($)**
0	1.000	$ 18,414,466.15	$ -	$ 18,414,466.15
1	0.935	$ -	$ 24,344.00	$ 22,751.40
2	0.873	$ -	$ 24,344.00	$ 21,262.99
3	0.816	$ -	$ 21,200.00	$ 17,305.51
4	0.763	$ -	$ 21,200.00	$ 16,173.38
5	0.713	$ -	$ 21,200.00	$ 15,115.31
6	0.666	$ -	$ 21,200.00	$ 14,126.46
7	0.623	$ -	$ 21,200.00	$ 13,202.29
8	0.582	$ -	$ 21,200.00	$ 12,338.59
9	0.544	$ -	$ 21,200.00	$ 11,531.40
10	0.508	$ -	$ 21,200.00	$ 10,777.00
11	0.475	$ -	$ 21,200.00	$ 10,071.97
12	0.444	$ -	$ 21,200.00	$ 9,413.05
13	0.415	$ -	$ 21,200.00	$ 8,797.25
14	0.388	$ -	$ 21,200.00	$ 8,221.73
15	0.362	$ -	$ 21,200.00	$ 7,683.86
16	0.339	$ -	$ 21,200.00	$ 7,181.17
17	0.317	$ -	$ 21,200.00	$ 6,711.38
18	0.296	$ -	$ 21,200.00	$ 6,272.32
19	0.277	$ -	$ 21,200.00	$ 5,861.98
20	0.258	$ -	$ 21,200.00	$ 5,478.48
21	0.242	$ -	$ 21,200.00	$ 5,120.08
22	0.226	$ -	$ 21,200.00	$ 4,785.12
23	0.211	$ -	$ 21,200.00	$ 4,472.07
24	0.197	$ -	$ 21,200.00	$ 4,179.51
25	0.184	$ -	$ 21,200.00	$ 3,906.08
26	0.172	$ -	$ 21,200.00	$ 3,650.54
27	0.161	$ -	$ 21,200.00	$ 3,411.72
28	0.150	$ -	$ 21,200.00	$ 3,188.53
29	0.141	$ -	$ 21,200.00	$ 2,979.93
30	0.131	$ -	$ 21,200.00	$ 2,784.98
			TOTAL	**$ 18,683,222.23**

Notes:

1 - Discount rate of 7% per OSWER Directive

Attachment B-4 - Table 2-CC
Capital Costs for Alternative 4 - Stabilization/Solidification
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Pre-Construction Work						
01-001	Pre-Design Investigation					
01-001a	Test-Pit Sample Collection & Extent Verification	5	DAY	$ 7,500.00	$ 37,500.00	Previous Project Experience - Excavate/delineate to the edge of the sludge in each area. Collect treatability samples.
01-001b	Stabilization Bench Testing	1	LS	$ 20,000.00	$ 20,000.00	Previous Project Experience - Bench samples to replicate previous work & verify adequacy below groundwater.
01-001c	Odor control verification testing	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience - Verify selected foam will provide adequate temporary odor control
01-002	Engineering & Removal Designs and Specifications	1	LS	$ 779,205.00	$ 779,205.00	Assume 6% of physical construction capital cost in accordance with costing guidance manual EPA 540-R-00-002
01-003	Project Bonding	1	LS	$ 140,000.00	$ 140,000.00	Industry-Based Estimate (1% of physical construction capital costs)
01-004	Project Planning & Submittals					
01-004a	Construction Work Plan and Schedule	1	LS	$ 20,000.00	$ 20,000.00	Previous Project Experience
01-004b	Health and Safety Plan	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004c	Erosion/Sediment Control Plan	1	LS	$ 10,000.00	$ 10,000.00	Previous Project Experience
01-004d	Storm water and water control plan	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience
01-004e	Construction QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004f	Analytical QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
02 - Project Management and Staffing						
02-001	Site Superintendent	9	MO	$ 20,000.00	$ 180,000.00	Vendor Estimate
02-002	Health & Safety Manager	9	MO	$ 15,000.00	$ 135,000.00	Vendor Estimate
02-003	Contractor QC Manager	9	MO	$ 12,000.00	$ 108,000.00	Vendor Estimate
02-004	Office & Accounting Support	9	MO	$ 3,000.00	$ 27,000.00	Vendor Estimate
03 - Mobilization, Site Preparation, and Temp Facilities						
03-001	Mobilization	1	LS	$ 200,000.00	$ 200,000.00	Vendor Estimate
03-002	Temporary Facilities			$ 8,000.00		
03-002a	Temporary Facilities - Trailer; Storage containers; Phone; Internet; Site Staff Travel Expenses	9	MO	$ 7,500.00	$ 67,500.00	1 Trailer, 1 Storage Container, Phone, Internet, Site Management Travel Expenses
03-002b	Temporary Facilities - Electric; water	9	MO	$ 7,500.00	$ 67,500.00	600-Amp service for the life of the project, includes installation of a power drop and meter establishment
03-002c	Temporary Facilities - MSW Disposal	500	TON	$ 100.00	$ 50,000.00	Weekly pickup at the site
03-002d	Temporary Facilities - Fencing/Dust Screens	2500	LF	$ 15.00	$ 37,500.00	6' secured panel fencing, wind screen, dust fabric
03-002e	Water Management Facilities (tanks, pumps, hose)	9	MO	$ 10,000.00	$ 90,000.00	2 Fractionation tanks, Suction pumps; Transfer pumps; hoses; in-line meter; tank cleanout
03-002f	Water discharge to PTOW	150,000	GAL	$ 0.05	$ 7,500.00	Vendor Estimate; based on known water levels
03-003	Site Preparation					
03-003a	Site Prep. Install/Maintain E&S Controls	3500	LF	$ 8.00	$ 28,000.00	Silt fencing & straw wattles around entire work area. Double silt fence along the Nashua River
03-003b	Clearing/Chipping/Grubbing Work Areas	7	Ac	$ 15,000.00	$ 105,000.00	Medium-thickness clearing to 6" above grade. Off-site recycling.

Attachment B-4 - Table 2-CC
Capital Costs for Alternative 4 - Stabilization/Solidification
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
03-003c	Disposal of below-grade vegetation	400	TON	$ 100.00	$ 40,000.00	Grub stumps from cleared areas; Remove soil/sludge to the extent practicable. Size for off-site disposal
03-003d	Decontamination Facilities	4	Ea	$ 5,000.00	$ 20,000.00	1 Stabilized construction entrance; 3 equipment/personnel decontamination stations located on-site
03-003e	Access Road Construction/Improvement	1	LS	$ 36,000.00	$ 36,000.00	1,000 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric. Installed to access Broad Street Parkway
03-003f	On-site Haul Road Improvement	1	LS	$ 27,000.00	$ 27,000.00	750 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric for on-site access roads.
03-003g	Stockpile/Staging Area Preparation	1	LS	$ 25,000.00	$ 25,000.00	Graded 100'X100' pad with soil berms, water collection sump, and bedded with a 40-mil liner over crushed stone
03-003h	By-Pass/Remove/Replace Sewer	350	LF	$ 300.00	$ 105,000.00	Locate and protect 48-inch RCP during construction.
03-003I	Abandon Monitoring Wells	5	Ea	$ 2,000.00	$ 10,000.00	Abandon GZ-9, GZ-10, SH-16S/D, and the supply well
04 - Project Controls						
04-001	Health and Safety Equipment Purchase/Maintenance	9	MO	$ 13,000.00	$ 117,000.00	Purchase, store, and use Tyvek suits, full-face respirators, respirator cartridges, PIDs, Multi-gas meters, ammonia meters, perimeter air monitoring equipment
04-002	Dust Control Equipment	9	MO	$ 5,000.00	$ 45,000.00	Air misting equipment, water truck with water bar/sprayer, multiple layers of ballasted polyethylene sheeting over stockpiles
04-003	Work Area Odor Control Equipment and Materials					
04-003a	Odor Foam Machines	9	MO	$ 5,000.00	$ 45,000.00	Purchase and operate two Rusmar foam disperser pumps
04-003b	Odor Foam 40 drums per month	360	DRUMS	$ 550.00	$ 198,000.00	Delivery and store Rusmar anti-odor foam
04-003c	Hood/Shroud Over Stabilization Working Zones	2	Ea	$ 62,000.00	$ 124,000.00	Steel, plastic, and filter fabric shrouds for each solidification method
04-004	Perimeter Odor Control Equipment and Materials	9	MO	$ 7,500.00	$ 67,500.00	Air-misting equipment at the site perimeter with the neighborhood with anti-odor scents
04-005	Establishment of Survey Controls	1	LS	$ 100,000.00	$ 100,000.00	Surveys for the following: pre-construction, post-construction, performance & progress payments, post-stabilization, post-cap/as-builts.
04-006	Materials/QC Testing	1	LS	$ 100,000.00	$ 100,000.00	Materials QC testing, strength testing, permeability testing, compaction testing, and engineering submittal testing
05 - Excavation of Overlying Soil, SRS-Exceeding Soil, and Expansion Cell Soil						
05-001	Area 1 -Excavate Soil Berms, Transport, Stockpile	1500	CY	$ 20.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-002	Area 2 - Excavate 3 feet, Transport, Stockpile	9000	CY	$ 20.00	$ 180,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-003	Area 3 - Excavate 2 feet, Transport, Stockpile	225	CY	$ 25.00	$ 5,625.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-004	Area 4 - Excavate 3 feet, Transport, Stockpile	400	CY	$ 25.00	$ 10,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer

Attachment B-4 - Table 2-CC
Capital Costs for Alternative 4 - Stabilization/Solidification
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
05-005	Area 6 - Excavate 3 feet, Transport, Stockpile	675	CY	$ 25.00	$ 16,875.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-006	Area 7 - Excavate 4 feet, Transport, Stockpile	2250	CY	$ 20.00	$ 45,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-007	SRS-Exceeding Soil, Transport to Area 2	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-008	Southern Parcel - Excavate 1 foot, Transport to Area 2	2500	CY	$ 25.00	$ 62,500.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-008	Expansion Cell Excavation - Sloped Sidewalls	16000	CY	$ 20.00	$ 320,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
06 - Sludge Consolidation						
06-001	Area 3 - Excavate 5 feet Transport to Ex. Cell	550	CY	$ 25.00	$ 13,750.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-002	Area 4 - Excavate 6 feet Transport to Ex. Cell	800	CY	$ 25.00	$ 20,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-003	Area 6 - Excavate 5 feet Transport to Ex. Cell	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-004	Area 7 - Excavate 8 feet Transport to Ex. Cell	4500	CY	$ 20.00	$ 90,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
07 - Solidification/Stabilization						
07-001	Deliver and Store Portland Cement	16000	TON	$ 150.00	$ 2,400,000.00	Vendor estimate
07-002	Deliver and Store Powdered Activated Carbon	200	TON	$ 1,100.00	$ 220,000.00	Vendor estimate
07-003	Debris Removal During Stabilization	100	TON	$ 750.00	$ 75,000.00	Vendor estimate. Extraction using a long-arm excavator and grapple.
07-004	Debris Disposal (non-haz)	100	TON	$ 100.00	$ 10,000.00	Vendor Estimate
07-005	Auger Stabilization Method Demonstration	5	DAY	$ 10,000.00	$ 50,000.00	Subcontractor-led demonstration
07-006	Area 1 Stabilization - 25% vol Sand; 25% wt Cement	23560	CY	$ 160.00	$ 3,769,600.00	Vendor estimate - assumed approximately 200 CY of stabilization insitu per-day
07-007	Area 2 Stabilization Method Demonstration	5	DAY	$ 10,000.00	$ 50,000.00	Vendor estimate
07-007	Area 2 Stabilization - 16% wt Cement	33330	CY	$ 40.00	$ 1,333,200.00	Vendor estimate - assumed approximately 500 CY of stabilization insitu per-day
07-008	Expansion Cell Stabilization - 16% wt Cement	16000	CY	$ 40.00	$ 640,000.00	Vendor estimate - assumed approximately 500 CY of stabilization insitu per-day
07-009	Solidification/Stabilization Swell Management	6000	CY	$ 20.00	$ 120,000.00	Vendor estimate - On-going activity to use expansion cell as an overflow for swell volume
08 - Cap & Vent System Construction						
08-001	Place Reuse Soil Over Stabilized Materials	6000	CY	$ 20.00	$ 120,000.00	Vendor estimate - assumes up to 3 feet of fill over the 17,500 SY area.
08-002	Deliver and Install 12-Inches of 3/4-Inch Vent Stone	1300	TON	$ 60.00	$ 78,000.00	Vendor estimate - assumes 3' wide, 1' thick pipe trenches.
08-003	Furnish and Install 6-Inch Multi-Flow Vent Strip	7500	LF	$ 15.00	$ 112,500.00	Vendor estimate
08-004	Furnish and Install Vent Risers	15	EA	$ 7,500.00	$ 112,500.00	Vendor estimate along a 25-foot center
08-005	Furnish and Install 15-Mil Vapor Barrier	17500	SY	$ 7.50	$ 131,250.00	Vendor estimate - overlapping barrier
08-006	Deliver and Place 8-Inches of Well-Draining Sand	7000	CY	$ 45.00	$ 315,000.00	Vendor estimate - imported DOT-spec materials
08-007	Fine-Grading/Compaction	17500	SY	$ 3.00	$ 52,500.00	Vendor estimate - Promote positive water-shedding off the stabilization area

Attachment B-4 - Table 2-CC
Capital Costs for Alternative 4 - Stabilization/Solidification
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
08-008	Deliver 4-Inches of Topsoil	1500	CY	$ 45.00	$ 67,500.00	Vendor estimate - Deliver and transfer topsoil to work area
08-009	Fine-Grade Topsoil	17500	SY	$ 2.00	$ 35,000.00	Vendor estimate to fine-grade and track-harrow topsoil to promote seed stabilization
08-010	Hydroseed Cap Area	17500	SY	$ 3.00	$ 52,500.00	Vendor estimate - Hydroseed and mulch the stabilized area.
09 - Backfill & Site Restoration						
09-001	Place Reuse Soil Into Areas 6 and 7	8600	CY	$ 20.00	$ 172,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil
09-002	Fine-Grade/Compact Areas 6 and 7	2000	SY	$ 3.00	$ 6,000.00	Vendor estimate - Fine-grade and compact top lifts
09-003	Deliver and Place 4-Inches of Topsoil - Areas 6 and 7	200	CY	$ 45.00	$ 9,000.00	Vendor estimate - Deliver and transfer topsoil to work area
09-004	Place Reuse Soil Into Areas 3 and 4	2000	CY	$ 20.00	$ 40,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil
09-005	Fine-Grade/Compact Areas 3 and 4	800	SY	$ 3.00	$ 2,400.00	Vendor estimate - Fine-grade and compact top lifts
09-006	Deliver and Place 4-Inches of Topsoil - Areas 3 and 4	70	CY	$ 45.00	$ 3,150.00	Vendor estimate - Deliver and transfer topsoil to work area
09-007	Place Reuse Soil Into Southern Parcel	2500	CY	$ 20.00	$ 50,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil
09-008	Fine-Grade/Compact Southern Parcel	7500	SY	$ 3.00	$ 22,500.00	Vendor estimate - Fine-grade and compact top lifts
09-007	Hydroseed Areas 3, 4, 6, 7, Southern Parcel	10300	SY	$ 3.00	$ 30,900.00	Vendor estimate - Hydroseed and mulch the stabilized area.
09-008	Replace Abandoned Monitoring Wells	4	Ea	$ 2,500.00	$ 10,000.00	Previous project experience. Install 4 replacement wells (GZ-09, GZ-10, SH-16S/D) supply well will not be re-drilled
09-010	Place/grade remaining re-use soil	15500	CY	$ 20.00	$ 310,000.00	
10 - Decontamination, Temp. Facilities Removal & Demobilization						
10-001	Decontaminate Equipment	20	Ea	$ 1,500.00	$ 30,000.00	Vendor estimate - decontaminate all heavy equipment, hand tools, subcontractor equipment and tools
10-002	Remove Temporary Facilities and E&S Controls	1	LS	$ 40,000.00	$ 40,000.00	Vendor estimate
10-003	Demobilize Equipment	1	LS	$ 150,000.00	$ 150,000.00	Vendor estimate
				SUBTOTAL COST	**$ 14,677,455.00**	

Attachment B-4 - Table 2-PRSC
Post-Removal Site Control Costs for Alternative 4 - Stabilization/Solidification
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Post-Construction Monitoring						
01-001	Vegetation/Erosion Verification	8	Event	$ 786.00	$ 6,288.00	Previous project experience. Mobilize to the site quarterly for 2 years, document cap conditions, document deficiencies, prepare/issue inspection report.
01-002	Groundwater Monitoring	60	Event	$ 8,300.00	$ 498,000.00	Previous project experience. Biannual groundwater monitoring of 8 monitoring wells using standard sampling methods. Estimate assumes dedicated sampling equipment for each sampling round, and two field personnel. Assumes 30 years of monitoring, submittal of a data report for each sampling event, and an annual groundwater monitoring report.
01-003	Annual Groundwater Reporting	30	Year	$ 4,600.00	$ 138,000.00	Previous project experience. Biannual groundwater monitoring of 8 monitoring wells using standard sampling methods. Estimate assumes dedicated sampling equipment for each sampling round, and two field personnel. Assumes 30 years of monitoring, submittal of a data report for each sampling event, and an annual groundwater monitoring report.
01-004	Annual Cap Inspection	30	Year	$ 4,600.00	$ 138,000.00	Previous project experience. Assumes annual inspections and simplified inspection report submittals. For an assumed period of 30 years.
				SUBTOTAL COST	**$ 780,288.00**	

Attachment B-5 - Table 3-PW
Present Worth for Alternative 5 - Encapsulation/Capping
Mohawk Tannery Site
Nashua, New Hampshire

Alternative 5a - Encapsulation (Sheet Piling) and Capping (Geosynthetics)

Present Worth Analysis				
Year	**Present Worth Factor (1)**	**Capital Costs ($)**	**O&M Costs ($)**	**Present Worth ($)**
0	1.000	$ 6,434,587.32	$ -	$ 6,434,587.32
1	0.935	$ -	$ 35,344.00	$ 33,031.78
2	0.873	$ -	$ 35,344.00	$ 30,870.82
3	0.816	$ -	$ 32,200.00	$ 26,284.79
4	0.763	$ -	$ 32,200.00	$ 24,565.23
5	0.713	$ -	$ 32,200.00	$ 22,958.15
6	0.666	$ -	$ 32,200.00	$ 21,456.22
7	0.623	$ -	$ 32,200.00	$ 20,052.54
8	0.582	$ -	$ 32,200.00	$ 18,740.69
9	0.544	$ -	$ 32,200.00	$ 17,514.67
10	0.508	$ -	$ 32,200.00	$ 16,368.85
11	0.475	$ -	$ 32,200.00	$ 15,297.99
12	0.444	$ -	$ 32,200.00	$ 14,297.19
13	0.415	$ -	$ 32,200.00	$ 13,361.86
14	0.388	$ -	$ 32,200.00	$ 12,487.72
15	0.362	$ -	$ 32,200.00	$ 11,670.76
16	0.339	$ -	$ 32,200.00	$ 10,907.25
17	0.317	$ -	$ 32,200.00	$ 10,193.70
18	0.296	$ -	$ 32,200.00	$ 9,526.82
19	0.277	$ -	$ 32,200.00	$ 8,903.57
20	0.258	$ -	$ 32,200.00	$ 8,321.09
21	0.242	$ -	$ 32,200.00	$ 7,776.72
22	0.226	$ -	$ 32,200.00	$ 7,267.96
23	0.211	$ -	$ 32,200.00	$ 6,792.49
24	0.197	$ -	$ 32,200.00	$ 6,348.12
25	0.184	$ -	$ 32,200.00	$ 5,932.82
26	0.172	$ -	$ 32,200.00	$ 5,544.69
27	0.161	$ -	$ 32,200.00	$ 5,181.96
28	0.150	$ -	$ 32,200.00	$ 4,842.95
29	0.141	$ -	$ 32,200.00	$ 4,526.12
30	0.131	$ -	$ 32,200.00	$ 4,230.02
			TOTAL	**$ 6,839,842.86**

Notes:

1 - Discount rate of 7% per OSWER Directive

Attachment B-5 - Table 3-PW
Present Worth for Alternative 5 - Encapsulation/Capping
Mohawk Tannery Site
Nashua, New Hampshire

Alternative 5b - Encapsulation (Slurry Wall) and Impervious Capping

Present Worth Analysis				
Year	**Present Worth Factor (1)**	**Capital Costs ($)**	**O&M Costs ($)**	**Present Worth ($)**
0	1.000	$ 11,750,362.32	$ -	$ 11,750,362.32
1	0.935	$ -	$ 35,344.00	$ 33,031.78
2	0.873	$ -	$ 35,344.00	$ 30,870.82
3	0.816	$ -	$ 32,200.00	$ 26,284.79
4	0.763	$ -	$ 32,200.00	$ 24,565.23
5	0.713	$ -	$ 32,200.00	$ 22,958.15
6	0.666	$ -	$ 32,200.00	$ 21,456.22
7	0.623	$ -	$ 32,200.00	$ 20,052.54
8	0.582	$ -	$ 32,200.00	$ 18,740.69
9	0.544	$ -	$ 32,200.00	$ 17,514.67
10	0.508	$ -	$ 32,200.00	$ 16,368.85
11	0.475	$ -	$ 32,200.00	$ 15,297.99
12	0.444	$ -	$ 32,200.00	$ 14,297.19
13	0.415	$ -	$ 32,200.00	$ 13,361.86
14	0.388	$ -	$ 32,200.00	$ 12,487.72
15	0.362	$ -	$ 32,200.00	$ 11,670.76
16	0.339	$ -	$ 32,200.00	$ 10,907.25
17	0.317	$ -	$ 32,200.00	$ 10,193.70
18	0.296	$ -	$ 32,200.00	$ 9,526.82
19	0.277	$ -	$ 32,200.00	$ 8,903.57
20	0.258	$ -	$ 32,200.00	$ 8,321.09
21	0.242	$ -	$ 32,200.00	$ 7,776.72
22	0.226	$ -	$ 32,200.00	$ 7,267.96
23	0.211	$ -	$ 32,200.00	$ 6,792.49
24	0.197	$ -	$ 32,200.00	$ 6,348.12
25	0.184	$ -	$ 32,200.00	$ 5,932.82
26	0.172	$ -	$ 32,200.00	$ 5,544.69
27	0.161	$ -	$ 32,200.00	$ 5,181.96
28	0.150	$ -	$ 32,200.00	$ 4,842.95
29	0.141	$ -	$ 32,200.00	$ 4,526.12
30	0.131	$ -	$ 32,200.00	$ 4,230.02
			TOTAL	**$ 12,155,617.86**

Notes:

1 - Discount rate of 7% per OSWER Directive

Attachment B-5 - Table 3-PW
Present Worth for Alternative 5 - Encapsulation/Capping
Mohawk Tannery Site
Nashua, New Hampshire

Alternative 5c - Encapsulation (Secant Wall) and Imperveous Capping

Present Worth Analysis				
Year	**Present Worth Factor (1)**	**Capital Costs ($)**	**O&M Costs ($)**	**Present Worth ($)**
0	1.000	$ 6,597,872.36	$ -	$ 6,597,872.36
1	0.935	$ 6,597,872.36	$ 35,344.00	$ 6,199,267.63
2	0.873	$ -	$ 35,344.00	$ 30,870.82
3	0.816	$ -	$ 32,200.00	$ 26,284.79
4	0.763	$ -	$ 32,200.00	$ 24,565.23
5	0.713	$ -	$ 32,200.00	$ 22,958.15
6	0.666	$ -	$ 32,200.00	$ 21,456.22
7	0.623	$ -	$ 32,200.00	$ 20,052.54
8	0.582	$ -	$ 32,200.00	$ 18,740.69
9	0.544	$ -	$ 32,200.00	$ 17,514.67
10	0.508	$ -	$ 32,200.00	$ 16,368.85
11	0.475	$ -	$ 32,200.00	$ 15,297.99
12	0.444	$ -	$ 32,200.00	$ 14,297.19
13	0.415	$ -	$ 32,200.00	$ 13,361.86
14	0.388	$ -	$ 32,200.00	$ 12,487.72
15	0.362	$ -	$ 32,200.00	$ 11,670.76
16	0.339	$ -	$ 32,200.00	$ 10,907.25
17	0.317	$ -	$ 32,200.00	$ 10,193.70
18	0.296	$ -	$ 32,200.00	$ 9,526.82
19	0.277	$ -	$ 32,200.00	$ 8,903.57
20	0.258	$ -	$ 32,200.00	$ 8,321.09
21	0.242	$ -	$ 32,200.00	$ 7,776.72
22	0.226	$ -	$ 32,200.00	$ 7,267.96
23	0.211	$ -	$ 32,200.00	$ 6,792.49
24	0.197	$ -	$ 32,200.00	$ 6,348.12
25	0.184	$ -	$ 32,200.00	$ 5,932.82
26	0.172	$ -	$ 32,200.00	$ 5,544.69
27	0.161	$ -	$ 32,200.00	$ 5,181.96
28	0.150	$ -	$ 32,200.00	$ 4,842.95
29	0.141	$ -	$ 32,200.00	$ 4,526.12
30	0.131	$ -	$ 32,200.00	$ 4,230.02
			TOTAL	**$ 13,169,363.75**

Notes:

1 - Discount rate of 7% per OSWER Directive

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Sheet Pile)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Pre-Construction Work						
01-001	Pre-Design Investigation					
01-001a	Test-Pit Sample Collection & Extent Verification & Engineering Parameter Samples	1	LS	$ 75,000.00	$ 75,000.00	Previous Project Experience - Excavate/delineate to the edge of the sludge in each area. Collect engineering parameter samples for preload and parking surface design.
01-001c	Odor control verification testing	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience - Verify selected foam will provide adequate temporary odor control
01-002	Engineering & Removal Designs and Specifications	1	LS	$ 347,144.00	$ 347,144.00	Assume 8% of physical construction capital cost in accordance with costing guidance manual EPA 540-R-00-002
01-003	Project Bonding	1	LS	$ 50,000.00	$ 50,000.00	Industry-Based Estimate (1% of physical construction capital costs)
01-004	Project Planning & Submittals					
01-004a	Construction Work Plan and Schedule	1	LS	$ 20,000.00	$ 20,000.00	Previous Project Experience
01-004b	Health and Safety Plan	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004c	Erosion/Sediment Control Plan	1	LS	$ 10,000.00	$ 10,000.00	Previous Project Experience
01-004d	Storm water and water control plan	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience
01-004e	Construction QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004f	Analytical QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
02 - Project Management and Staffing						
02-001	Site Superintendent	7	MO	$ 20,000.00	$ 140,000.00	Vendor Estimate
02-002	Health & Safety Manager	7	MO	$ 15,000.00	$ 105,000.00	Vendor Estimate
02-003	Contractor QC Manager	7	MO	$ 7,500.00	$ 52,500.00	Vendor Estimate
02-004	Office & Accounting Support	7	MO	$ 3,000.00	$ 21,000.00	Vendor Estimate
03 - Mobilization, Site Preparation, and Temp Facilities						
03-001	Mobilization	1	LS	$ 50,000.00	$ 50,000.00	Vendor Estimate
03-002	Temporary Facilities					
03-002a	Temporary Facilities - Trailer; Storage containers; Phone; Internet; Site Staff Travel Expenses	13	MO	$ 4,500.00	$ 58,500.00	1 Trailer, 1 Storage Container, Phone, Internet, Site Management Travel Expenses
03-002b	Temporary Facilities - Electric; water	13	MO	$ 4,000.00	$ 52,000.00	600-Amp service for the life of the project, includes installation of a power drop and meter establishment
03-002c	Temporary Facilities - MSW Disposal	500	TON	$ 100.00	$ 50,000.00	Weekly pickup at the site
03-002d	Temporary Facilities - Fencing/Dust Screens	2500	LF	$ 15.00	$ 37,500.00	6' secured panel fencing, wind screen, dust fabric
03-002e	Water Management Facilities (tanks, pumps, hose)	5	MO	$ 10,000.00	$ 50,000.00	2 Fractionation tanks, Suction pumps; Transfer pumps; hoses; in-line meter; tank cleanout
03-002f	Water discharge to PTOW	150,000	GAL	$ 0.05	$ 7,500.00	Vendor Estimate; based on known water levels
03-003	Site Preparation					
03-003a	Site Prep. Install/Maintain E&S Controls	3500	LF	$ 8.00	$ 28,000.00	Silt fencing & straw wattles around entire work area. Double silt fence along the Nashua River
03-003b	Clearing/Chipping/Grubbing Work Areas	5	Ac	$ 15,000.00	$ 75,000.00	Medium-thickness clearing to 6" above grade. Off-site recycling.
03-003c	Disposal of below-grade vegetation	250	TON	$ 100.00	$ 25,000.00	Grub stumps from cleared areas; Remove soil/sludge to the extent practicable. Size for off-site disposal

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Sheet Pile)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
03-003d	Decontamination Facilities	4	Ea	$ 5,000.00	$ 20,000.00	1 Stabilized construction entrance; 3 equipment/personnel decontamination stations located on-site
03-003e	Access Road Construction/Improvement	1	LS	$ 36,000.00	$ 36,000.00	1,000 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric. Installed to access Broad Street Parkway
03-003f	On-site Haul Road Improvement	1	LS	$ 27,000.00	$ 27,000.00	750 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric for on-site access roads.
03-003g	Stockpile/Staging Area Preparation	1	LS	$ 20,000.00	$ 20,000.00	Graded 100'X100' pad with soil berms, water collection sump, and bedded with a nonwoven geotextile over crushed stone
03-003h	By-Pass/Remove/Replace Sewer	350	LF	$ 300.00	$ 105,000.00	Locate and protect 48-inch RCP during construction.
03-003I	Abandon Monitoring Wells	3	Ea	$ 2,000.00	$ 6,000.00	Abandon GZ-9, GZ-10, and the supply well
04 - Project Controls						
04-001	Health and Safety Equipment Purchase/Maintenance	7	MO	$ 4,500.00	$ 31,500.00	Purchase, store, and use Tyvek suits, full-face respirators, respirator cartridges, PIDs, Multi-gas meters, ammonia meters, perimeter air monitoring equipment
04-002	Dust Control Equipment	7	MO	$ 5,000.00	$ 35,000.00	Air misting equipment, water truck with water bar/sprayer, multiple layers of ballasted polyethylene sheeting over stockpiles
04-003	Work Area Odor Control Equipment and Materials					
04-003a	Odor Foam Machines	7	MO	$ 5,000.00	$ 35,000.00	Purchase and operate two Rusmar foam disperser pumps
04-003b	Odor Foam 40 drums per month	140	DRUMS	$ 550.00	$ 77,000.00	Delivery and store Rusmar anti-odor foam
04-004	Perimeter Odor Control Equipment and Materials	7	MO	$ 7,500.00	$ 52,500.00	Air-misting equipment at the site perimeter with the neighborhood with anti-odor scents
04-005	Establishment of Survey Controls	1	LS	$ 50,000.00	$ 50,000.00	Surveys for the following: pre-construction, post-construction, performance & progress payments
04-006	Materials/QC Testing	1	LS	$ 25,000.00	$ 25,000.00	Materials QC testing, strength testing, permeability testing, compaction testing, and engineering submittal testing
05 - Excavation of Overlying Soil and SRS-Exceeding Soil						
05-001	Area 1 -Excavate Soil Berms, Transport, Stockpile	1500	CY	$ 20.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-002	Area 3 - Excavate 2 feet, Transport, Stockpile	225	CY	$ 25.00	$ 5,625.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-003	Area 4 - Excavate 3 feet, Transport, Stockpile	400	CY	$ 25.00	$ 10,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-004	Area 6 - Excavate 3 feet, Transport, Stockpile	675	CY	$ 25.00	$ 16,875.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-005	Area 7 - Excavate 4 feet, Transport, Stockpile	2250	CY	$ 20.00	$ 45,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-006	SRS-Exceeding Soil, Transport to Area 1	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Sheet Pile)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
05-006	Southern Parcel - Excavate, containment wedge	1100	CY	$ 25.00	$ 27,500.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
06 - Sludge Consolidation						
06-001	Area 3 - Excavate 5 feet Transport to Area 1/2	550	CY	$ 25.00	$ 13,750.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-002	Area 4 - Excavate 6 feet Transport to Area 1/2	800	CY	$ 25.00	$ 20,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-003	Area 6 - Excavate 5 feet Transport to Area 1/2	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-004	Area 7 - Excavate 8 feet Transport to Area 1/2	4500	CY	$ 20.00	$ 90,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
07 - Sheetpile Wall Vertical Encapsulation						
07-001	Deliver and Store 22-foot steel sheets	951000	LBS	$ 0.80	$ 760,800.00	Vendor estimate. 2000 feet of 22-foot-long sheets delivered and staged.
07-002	Install Sheet Piles	35200	SF	$ 18.00	$ 633,600.00	Vendor estimate. Install and connect 2000 linear feet of 22-foot-long sheet pile
07-003	Flush sheet pile knuckle-joints	18000	LF	$ 2.00	$ 36,000.00	Vendor estimate. Clean the sheet pile joints and prepare for sealing
07-004	Install water-tight sealant in knuckle-joints	18000	LF	$ 2.00	$ 36,000.00	Vendor estimate. Install Adeka Water Sealant in each knuckle-joint
08 - Impermeable Cap Over Sludge & Vent System Construction						
08-001	Furnish and install 1 layer of triaxial geo-grid	14000	SY	$ 4.00	$ 56,000.00	Vendor estimate. Geo-grid to diffuse cap loads
08-002	Deliver and Install 12-Inches of 3/4-Inch Vent Stone	1400	TON	$ 60.00	$ 84,000.00	Vendor estimate - assumes 3' wide, 1' thick pipe trenches.
08-003	Furnish and Install 6-Inch Multi-Flow Vent Strip	7700	LF	$ 15.00	$ 115,500.00	Vendor estimate
08-004	Import, place, and rough-grade 12 inch sublayer	5000	CY	$ 39.00	$ 195,000.00	NH DOT weighted average materials sheet & vendor estimate
08-005	Furnish and install geosynthetic membrane	14000	SY	$ 6.00	$ 84,000.00	Previous project estimate - up to 60-mil textured membrane, field-extrusion welded
08-006	Furnish and Install Vent Risers	14	EA	$ 1,500.00	$ 21,000.00	Vendor estimate along a 25-foot center
08-007	Construct riser boots	14	EA	$ 100.00	$ 1,400.00	Previous project estimate - seal boot to geomembrane with extrusion welds
08-008	Furnish and install biplanar geocomposite	14000	SY	$ 8.30	$ 116,200.00	Biplaner geocompsite drainage layer in-lieu of sand/gravel drainage layer
08-009	Screen/place/compact/fine grade 12" reuse protective layer	5000	CY	$ 33.00	$ 165,000.00	Vendor estimate - Promote positive water-shedding off the cap screened to 4" minus
08-010	Drainage swale and underdrain construction	1500	LF	$ 37.00	$ 55,500.00	7-inch minus rip-rap downchutes and swale to detention pond. Swales unerlain by 8-inch corrugated HDPE pipe to direct percolated water to the detention pond
08-011	Excavate stormwater detention basin	3700	CY	$ 20.00	$ 74,000.00	4-foot deep detention pond
08-012	Storm water detention system construction	1	Lump	$ 12,000.00	$ 12,000.00	Vegetated detention pond w/high water release to river
08-013	Furninsh & place armoring subgrade/cushion aggregate materials	1000	CY	$ 36.00	$ 36,000.00	NH DOT weighted average materials sheet. 3-inch minus stone and gravel mixture.
08-014	Furninsh & place armoring stone w/in floodplain	2500	CY	$ 40.00	$ 100,000.00	NH DOT weighted average materials sheet - Class B Stone
08-015	Furnish and place 6" topsoil layer	2300	CY	$ 45.00	$ 103,500.00	Vendor estimate
09 - Backfill & Site Restoration						
09-001	Place Reuse Soil Into Areas 6 and 7	8600	CY	$ 20.00	$ 172,000.00	Vendor estimate

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Sheet Pile)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
09-002	Fine-Grade/Compact Areas 6 and 7	2000	SY	$ 3.00	$ 6,000.00	Vendor estimate - Fine-grade and compact top lifts
09-003	Deliver and Place 4-Inches of Topsoil - Areas 6 and 7	200	CY	$ 45.00	$ 9,000.00	Vendor estimate - Deliver and transfer topsoil to work area
09-004	Place Reuse Soil Into Areas 3 and 4	2000	CY	$ 20.00	$ 40,000.00	Vendor estimate
09-005	Fine-Grade/Compact Areas 3 and 4	800	SY	$ 3.00	$ 2,400.00	Vendor estimate - Fine-grade and compact top lifts
09-006	Deliver and Place 4-Inches of Topsoil - Areas 3 and 4	70	CY	$ 45.00	$ 3,150.00	Vendor estimate - Deliver and transfer topsoil to work area
09-007	Hydroseed Encapsulation Area	14000	SY	$ 3.00	$ 42,000.00	Vendor estimate - Hydroseed and mulch the stabilized area.
09-008	Replace Abandoned Monitoring Wells	2	Ea	$ 2,500.00	$ 5,000.00	Previous project experience. Install 2 replacement wells (GZ-09, GZ-10) supply well will not be re-drilled
10 - Decontamination, Temp. Facilities Removal & Demobilization						
10-001	Decontaminate Equipment	8	Ea	$ 1,500.00	$ 12,000.00	Vendor estimate - decontaminate all heavy equipment, hand tools, subcontractor equipment and tools
10-002	Remove Temporary Facilities and E&S Controls	1	LS	$ 40,000.00	$ 40,000.00	Vendor estimate
10-003	Demobilize Equipment	1	LS	$ 50,000.00	$ 50,000.00	Vendor estimate

SUBTOTAL COST **$ 5,193,944.00**

Direct Cost Adjustments		
Health and Safety on Labor and Equipment (5%)	$ -	Health and Safety included in performance rates (assumed Level C)
Indirect Cost Adjustments		
Tax on Materials (7%)	$ -	Taxes (if any) are included in the presented rates
G&A @10% of Equipment, Material, and Labor	$ -	G&A is included in the presented rates
Subcontract Fee @ 4%	$ -	Fee is included in the presented rates
Labor OH @60%	$ -	Overhead is included in labor rates
Other Costs		
Profit @ 10% of Subtotal Direct & Indirect	$ -	10% profit is included on capital costs
Engineering Contingency at 15%; Construction Contingency at 10% of Construction Cost	$ 1,084,825.00	
Office & Management Support @ 3% Direct & Indirect	$ 155,818.32	

TOTAL COST **$ 6,434,587.32**

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Slurry Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Pre-Construction Work						
01-001	Pre-Design Investigation					
01-001a	Test-Pit Sample Collection & Extent Verification & Engineering Parameter Samples	1	LS	$ 75,000.00	$ 75,000.00	Previous Project Experience - Excavate/delineate to the edge of the sludge in each area. Collect engineering parameter samples for pile design.
01-001c	Odor control verification testing	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience - Verify selected foam will provide adequate temporary odor control
01-002	Engineering & Removal Designs and Specifications	1	LS	$ 485,544.00	$ 485,544.00	Assume 6% of physical construction capital cost in accordance with costing guidance manual EPA 540-R-00-002
01-003	Project Bonding	1	LS	$ 90,000.00	$ 90,000.00	Industry-Based Estimate (1% of physical construction capital costs)
01-004	Project Planning & Submittals					
01-004a	Construction Work Plan and Schedule	1	LS	$ 20,000.00	$ 20,000.00	Previous Project Experience
01-004b	Health and Safety Plan	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004c	Erosion/Sediment Control Plan	1	LS	$ 10,000.00	$ 10,000.00	Previous Project Experience
01-004d	Storm water and water control plan	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience
01-004e	Construction QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004f	Analytical QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
02 - Project Management and Staffing						
02-001	Site Superintendent	14	MO	$ 20,000.00	$ 280,000.00	Vendor Estimate
02-002	Health & Safety Manager	14	MO	$ 15,000.00	$ 210,000.00	Vendor Estimate
02-003	Contractor QC Manager	14	MO	$ 7,500.00	$ 105,000.00	Vendor Estimate
02-004	Office & Accounting Support	14	MO	$ 3,000.00	$ 42,000.00	Vendor Estimate
03 - Mobilization, Site Preparation, and Temp Facilities						
03-001	Mobilization	1	LS	$ 50,000.00	$ 50,000.00	Vendor Estimate
03-002	Temporary Facilities					
03-002a	Temporary Facilities - Trailer; Storage containers; Phone; Internet; Site Staff Travel Expenses	14	MO	$ 7,500.00	$ 105,000.00	1 Trailers, 1 Storage Container, Phone, Internet, Site Management Travel Expenses
03-002b	Temporary Facilities - Electric; water	14	MO	$ 4,000.00	$ 56,000.00	600-Amp service for the life of the project, includes installation of a power drop and meter establishment
03-002c	Temporary Facilities - MSW Disposal	500	TON	$ 100.00	$ 50,000.00	Weekly pickup at the site
03-002d	Temporary Facilities - Fencing/Dust Screens	2500	LF	$ 15.00	$ 37,500.00	6' secured panel fencing, wind screen, dust fabric
03-002e	Water Management Facilities (tanks, pumps, hose)	14	MO	$ 10,000.00	$ 140,000.00	2 Fractionation tanks, Suction pumps; Transfer pumps; hoses; in-line meter; tank cleanout
03-002f	Water discharge to PTOW	150,000	GAL	$ 0.05	$ 7,500.00	Vendor Estimate; based on known water levels
03-003	Site Preparation					
03-003a	Site Prep. Install/Maintain E&S Controls	3500	LF	$ 8.00	$ 28,000.00	Silt fencing & straw wattles around entire work area. Double silt fence along the Nashua River
03-003b	Clearing/Chipping/Grubbing Work Areas	5	Ac	$ 15,000.00	$ 75,000.00	Medium-thickness clearing to 6" above grade. Off-site recycling.
03-003c	Disposal of below-grade vegetation	250	TON	$ 100.00	$ 25,000.00	Grub stumps from cleared areas; Remove soil/sludge to the extent practicable. Size for off-site disposal

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Slurry Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
03-003d	Decontamination Facilities	4	Ea	$ 5,000.00	$ 20,000.00	1 Stabilized construction entrance; 3 equipment/personnel decontamination stations located on-site
03-003e	Access Road Construction/Improvement	1	LS	$ 36,000.00	$ 36,000.00	1,000 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric. Installed to access Broad Street Parkway
03-003f	On-site Haul Road Improvement	1	LS	$ 27,000.00	$ 27,000.00	750 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric for on-site access roads.
03-003g	Stockpile/Staging Area Preparation	1	LS	$ 20,000.00	$ 20,000.00	Graded 100'X100' pad with soil berms, water collection sump, and bedded with a nonwoven geotextile over crushed stone
03-003h	By-Pass/Remove/Replace Sewer	350	LF	$ 300.00	$ 105,000.00	Locate and protect 48-inch RCP during construction.
03-003I	Abandon Monitoring Wells	3	Ea	$ 2,000.00	$ 6,000.00	Abandon GZ-9, GZ-10, and the supply well
04 - Project Controls						
04-001	Health and Safety Equipment Purchase/Maintenance	14	MO	$ 4,500.00	$ 63,000.00	Purchase, store, and use Tyvek suits, full-face respirators, respirator cartridges, PIDs, Multi-gas meters, ammonia meters, perimeter air monitoring equipment
04-002	Dust Control Equipment	14	MO	$ 5,000.00	$ 70,000.00	Air misting equipment, water truck with water bar/sprayer, multiple layers of ballasted polyethylene sheeting over stockpiles
04-003	Work Area Odor Control Equipment and Materials					
04-003a	Odor Foam Machines	14	MO	$ 5,000.00	$ 70,000.00	Purchase and operate two Rusmar foam disperser pumps
04-003b	Odor Foam 40 drums per month	280	DRUMS	$ 550.00	$ 154,000.00	Delivery and store Rusmar anti-odor foam
04-004	Perimeter Odor Control Equipment and Materials	14	MO	$ 7,500.00	$ 105,000.00	Air-misting equipment at the site perimeter with the neighborhood with anti-odor scents
04-005	Establishment of Survey Controls	1	LS	$ 50,000.00	$ 50,000.00	Surveys for the following: pre-construction, post-construction, performance & progress payments
04-006	Materials/QC Testing	1	LS	$ 25,000.00	$ 25,000.00	Materials QC testing, strength testing, permeability testing, compaction testing, and engineering submittal testing
05 - Excavation of Overlying Soil and SRS-Exceeding Soil						
05-001	Area 1 -Excavate Soil Berms, Transport, Stockpile	1500	CY	$ 20.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-002	Area 2 - Excavate 3 feet, Transport, Stockpile	9000	CY	$ 20.00	$ 180,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-003	Area 3 - Excavate 2 feet, Transport, Stockpile	225	CY	$ 25.00	$ 5,625.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-004	Area 4 - Excavate 3 feet, Transport, Stockpile	400	CY	$ 25.00	$ 10,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-005	Area 6 - Excavate 3 feet, Transport, Stockpile	675	CY	$ 25.00	$ 16,875.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-006	Area 7 - Excavate 4 feet, Transport, Stockpile	2250	CY	$ 20.00	$ 45,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Slurry Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
05-007	SRS-Exceeding Soil, Transport to Area 1	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
06 - Sludge Consolidation						
06-001	Area 3 - Excavate 5 feet Transport to Area 1/2	550	CY	$ 25.00	$ 13,750.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-002	Area 4 - Excavate 6 feet Transport to Area 1/2	800	CY	$ 25.00	$ 20,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-003	Area 6 - Excavate 5 feet Transport to Area 1/2	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-004	Area 7 - Excavate 8 feet Transport to Area 1/2	4500	CY	$ 20.00	$ 90,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
07 - Slurry Wall Vertical Encapsulation						
07-001	Install Guidewalls for Slurry Wall	1600	LF	$ 50.00	$ 80,000.00	RS Means - 4-feet deep trench 3 feet wide along the proposed alignment; reinforced at the surface with cast in-place concrete
07-002	Install Soldier Pile Slurry Wall	36000	SF	$ 125.00	$ 4,500,000.00	Vendor Estimate & R.S. Means Slurry Trench - 1,600 feet of 22-foot trench; H-Piles 8' on center. Inject Slurry. Slurry management crew cost included
07-003	Management of Slurry & Consolidation with Sludge	140000	GAL	$ 0.75	$ 105,000.00	Construct a lagoon on-site to allow slurry to dewater. Excavate and transport dewatered slurry to be interred with sludge.
08 - Impermeable Cap Over Sludge & Vent System Construction						
08-001	Furnish and install 1 layer of triaxial geo-grid	14000	SY	$ 4.00	$ 56,000.00	Vendor estimate. Geo-grid to diffuse cap loads
08-002	Deliver and Install 12-Inches of 3/4-Inch Vent Stone	1400	TON	$ 60.00	$ 84,000.00	Vendor estimate - assumes 3' wide, 1' thick pipe trenches.
08-003	Furnish and Install 6-Inch Multi-Flow Vent Strip	7700	LF	$ 15.00	$ 115,500.00	Vendor estimate
08-004	Import, place, and rough-grade 12 inch sublayer	5000	CY	$ 39.00	$ 195,000.00	NH DOT weighted average materials sheet & vendor estimate
08-005	Furnish and install geosynthetic membrane	14000	SY	$ 6.75	$ 94,500.00	Previous project estimate - up to 60-mil textured membrane, field-extrusion welded
08-006	Furnish and Install Vent Risers	14	EA	$ 1,500.00	$ 21,000.00	Vendor estimate along a 25-foot center
08-007	Construct riser boots	14	EA	$ 100.00	$ 1,400.00	Previous project estimate - seal boot to geomembrane with extrusion welds
08-008	Furnish and install biplanar geocomposite	14000	SY	$ 8.30	$ 116,200.00	Biplaner geocompsite drainage layer in-lieu of sand/gravel drainage layer
08-009	Screen/place/compact/fine grade 12" reuse protective layer	5000	CY	$ 33.00	$ 165,000.00	Vendor estimate - Promote positive water-shedding off the cap screened to 4" minus
08-010	Drainage swale and underdrain construction	1500	LF	$ 37.00	$ 55,500.00	7-inch minus rip-rap downchutes and swale to detention pond. Swales unerlain by 8-inch corrugated HDPE pipe to direct percolated water to the detention pond
08-011	Excavate stormwater detention basin	3700	CY	$ 20.00	$ 74,000.00	4-foot deep detention pond
08-012	Storm water detention system construction	1	Lump	$ 12,000.00	$ 12,000.00	Vegetated detention pond w/high water release to river
08-013	Furninsh & place armoring subgrade/cushion aggregate materials	1000	CY	$ 36.00	$ 36,000.00	NH DOT weighted average materials sheet. 3-inch minus stone and gravel mixture.
08-014	Furninsh & place armoring stone w/in floodplain	2500	CY	$ 40.00	$ 100,000.00	NH DOT weighted average materials sheet - Class B Stone
08-015	Furnish and place 6" topsoil layer	2300	CY	$ 45.00	$ 103,500.00	Vendor estimate
09 - Backfill & Site Restoration						
09-001	Place Reuse Soil Into Areas 6 and 7	8600	CY	$ 20.00	$ 172,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil
09-002	Fine-Grade/Compact Areas 6 and 7	2000	SY	$ 3.00	$ 6,000.00	Vendor estimate - Fine-grade and compact top lifts

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Slurry Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
09-003	Deliver and Place 4-Inches of Topsoil - Areas 6 and 7	200	CY	$ 45.00	$ 9,000.00	Vendor estimate - Deliver and transfer topsoil to work area
09-004	Place Reuse Soil Into Areas 3 and 4	2000	CY	$ 20.00	$ 40,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil
09-005	Fine-Grade/Compact Areas 3 and 4	800	SY	$ 3.00	$ 2,400.00	Vendor estimate - Fine-grade and compact top lifts
09-006	Deliver and Place 4-Inches of Topsoil - Areas 3 and 4	70	CY	$ 45.00	$ 3,150.00	Vendor estimate - Deliver and transfer topsoil to work area
09-007	Hydroseed Encapsulation Area	14000	SY	$ 3.00	$ 42,000.00	Vendor estimate - Hydroseed and mulch the stabilized area.
09-008	Replace Abandoned Monitoring Wells	2	Ea	$ 2,500.00	$ 5,000.00	Previous project experience. Install 2 replacement wells (GZ-09, GZ-10) supply well will not be re-drilled
10 - Decontamination, Temp. Facilities Removal & Demobilization						
10-001	Decontaminate Equipment	8	Ea	$ 1,500.00	$ 12,000.00	Vendor estimate - decontaminate all heavy equipment, hand tools, subcontractor equipment and tools
10-002	Remove Temporary Facilities and E&S Controls	1	LS	$ 40,000.00	$ 40,000.00	Vendor estimate
10-003	Demobilize Equipment	1	LS	$ 50,000.00	$ 50,000.00	Vendor estimate
				SUBTOTAL COST	**$ 9,443,944.00**	

Direct Cost Adjustments		
Health and Safety on Labor and Equipment (5%)	$ -	Health and Safety included in performance rates (assumed Level C)
Indirect Cost Adjustments		
Tax on Materials (7%)	$ -	Taxes (if any) are included in the presented rates
G&A @10% of Equipment, Material, and Labor	$ -	G&A is included in the presented rates
Subcontract Fee @ 4%	$ -	Fee is included in the presented rates
Labor OH @60%	$ -	Overhead is included in labor rates
Other Costs		
Profit @ 10% of Subtotal Direct & Indirect	$ -	10% profit is included on capital costs
Engineering Contingency at 15%; Construction Contingency at 10% of Construction Cost	$ 2,023,100.00	
Office & Management Support @ 3% Direct & Indirect	$ 283,318.32	
TOTAL COST	**$ 11,750,362.32**	

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Secant Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Pre-Construction Work						
01-001	Pre-Design Investigation					
01-001a	Test-Pit Sample Collection & Extent Verification & Engineering Parameter Samples	1	LS	$ 75,000.00	$ 75,000.00	Previous Project Experience - Excavate/delineate to the edge of the sludge in each area. Collect engineering parameter samples for pile design.
01-001c	Odor control verification testing	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience - Verify selected foam will provide adequate temporary odor control
01-002	Engineering & Removal Designs and Specifications	1	LS	$ 527,124.00	$ 527,124.00	Assume 6% of physical construction capital cost in accordance with costing guidance manual EPA 540-R-00-002
01-003	Project Bonding	1	LS	$ 90,000.00	$ 90,000.00	Industry-Based Estimate (1% of physical construction capital costs)
01-004	Project Planning & Submittals					
01-004a	Construction Work Plan and Schedule	1	LS	$ 20,000.00	$ 20,000.00	Previous Project Experience
01-004b	Health and Safety Plan	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004c	Erosion/Sediment Control Plan	1	LS	$ 10,000.00	$ 10,000.00	Previous Project Experience
01-004d	Storm water and water control plan	1	LS	$ 5,000.00	$ 5,000.00	Previous Project Experience
01-004e	Construction QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
01-004f	Analytical QAPP	1	LS	$ 8,000.00	$ 8,000.00	Previous Project Experience
02 - Project Management and Staffing						
02-001	Site Superintendent	25	MO	$ 20,000.00	$ 500,000.00	Vendor Estimate
02-002	Health & Safety Manager	25	MO	$ 15,000.00	$ 375,000.00	Vendor Estimate
02-003	Contractor QC Manager	25	MO	$ 7,500.00	$ 187,500.00	Vendor Estimate
02-004	Office & Accounting Support	25	MO	$ 3,000.00	$ 75,000.00	Vendor Estimate
03 - Mobilization, Site Preparation, and Temp Facilities						
03-001	Mobilization	1	LS	$ 50,000.00	$ 50,000.00	Vendor Estimate
03-002	Temporary Facilities					
03-002a	Temporary Facilities - Trailer; Storage containers; Phone; Internet; Site Staff Travel Expenses	25	MO	$ 7,500.00	$ 187,500.00	1 Trailers, 1 Storage Container, Phone, Internet, Site Management Travel Expenses
03-002b	Temporary Facilities - Electric; water	25	MO	$ 4,000.00	$ 100,000.00	600-Amp service for the life of the project, includes installation of a power drop and meter establishment
03-002c	Temporary Facilities - MSW Disposal	500	TON	$ 100.00	$ 50,000.00	Weekly pickup at the site
03-002d	Temporary Facilities - Fencing/Dust Screens	2500	LF	$ 15.00	$ 37,500.00	6' secured panel fencing, wind screen, dust fabric
03-002e	Water Management Facilities (tanks, pumps, hose)	25	MO	$ 10,000.00	$ 250,000.00	2 Fractionation tanks, Suction pumps; Transfer pumps; hoses; in-line meter; tank cleanout
03-002f	Water discharge to PTOW	150,000	GAL	$ 0.05	$ 7,500.00	Vendor Estimate; based on known water levels
03-003	Site Preparation					
03-003a	Site Prep. Install/Maintain E&S Controls	3500	LF	$ 8.00	$ 28,000.00	Silt fencing & straw wattles around entire work area. Double silt fence along the Nashua River
03-003b	Clearing/Chipping/Grubbing Work Areas	5	Ac	$ 15,000.00	$ 75,000.00	Medium-thickness clearing to 6" above grade. Off-site recycling.
03-003c	Disposal of below-grade vegetation	250	TON	$ 100.00	$ 25,000.00	Grub stumps from cleared areas; Remove soil/sludge to the extent practicable. Size for off-site disposal

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Secant Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
03-003d	Decontamination Facilities	4	Ea	$ 5,000.00	$ 20,000.00	1 Stabilized construction entrance; 3 equipment/personnel decontamination stations located on-site
03-003e	Access Road Construction/Improvement	1	LS	$ 36,000.00	$ 36,000.00	1,000 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric. Installed to access Broad Street Parkway
03-003f	On-site Haul Road Improvement	1	LS	$ 27,000.00	$ 27,000.00	750 feet of 16-foot wide 1.5-inch crushed stone-bedded with filter fabric for on-site access roads.
03-003g	Stockpile/Staging Area Preparation	1	LS	$ 20,000.00	$ 20,000.00	Graded 100'X100' pad with soil berms, water collection sump, and bedded with a nonwoven geotextile over crushed stone
03-003h	By-Pass/Remove/Replace Sewer	350	LF	$ 300.00	$ 105,000.00	Locate and protect 48-inch RCP during construction.
03-003I	Abandon Monitoring Wells	3	Ea	$ 2,000.00	$ 6,000.00	Abandon GZ-9, GZ-10, and the supply well
04 - Project Controls						
04-001	Health and Safety Equipment Purchase/Maintenance	25	MO	$ 4,500.00	$ 112,500.00	Purchase, store, and use Tyvek suits, full-face respirators, respirator cartridges, PIDs, Multi-gas meters, ammonia meters, perimeter air monitoring equipment
04-002	Dust Control Equipment	25	MO	$ 5,000.00	$ 125,000.00	Air misting equipment, water truck with water bar/sprayer, multiple layers of ballasted polyethylene sheeting over stockpiles
04-003	Work Area Odor Control Equipment and Materials					
04-003a	Odor Foam Machines	25	MO	$ 5,000.00	$ 125,000.00	Purchase and operate two Rusmar foam disperser pumps
04-003b	Odor Foam 40 drums per month	280	DRUMS	$ 550.00	$ 154,000.00	Delivery and store Rusmar anti-odor foam
04-004	Perimeter Odor Control Equipment and Materials	25	MO	$ 7,500.00	$ 187,500.00	Air-misting equipment at the site perimeter with the neighborhood with anti-odor scents
04-005	Establishment of Survey Controls	1	LS	$ 50,000.00	$ 50,000.00	Surveys for the following: pre-construction, post-construction, performance & progress payments
04-006	Materials/QC Testing	1	LS	$ 25,000.00	$ 25,000.00	Materials QC testing, strength testing, permeability testing, compaction testing, and engineering submittal testing
05 - Excavation of Overlying Soil and SRS-Exceeding Soil						
05-001	Area 1 -Excavate Soil Berms, Transport, Stockpile	1500	CY	$ 20.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-002	Area 2 - Excavate 3 feet, Transport, Stockpile	9000	CY	$ 20.00	$ 180,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-003	Area 3 - Excavate 2 feet, Transport, Stockpile	225	CY	$ 25.00	$ 5,625.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-004	Area 4 - Excavate 3 feet, Transport, Stockpile	400	CY	$ 25.00	$ 10,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-005	Area 6 - Excavate 3 feet, Transport, Stockpile	675	CY	$ 25.00	$ 16,875.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
05-006	Area 7 - Excavate 4 feet, Transport, Stockpile	2250	CY	$ 20.00	$ 45,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Secant Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

				Unit Cost ($)	Total Cost ($)	Comments/Reference
Item No.	Item	Qty.	Unit			
05-007	SRS-Exceeding Soil, Transport to Area 1	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, D5-dozer
06 - Sludge Consolidation						
06-001	Area 3 - Excavate 5 feet Transport to Area 1	550	CY	$ 25.00	$ 13,750.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-002	Area 4 - Excavate 6 feet Transport to Area 1	800	CY	$ 25.00	$ 20,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-003	Area 6 - Excavate 5 feet Transport to Area 1	1200	CY	$ 25.00	$ 30,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
06-004	Area 7 - Excavate 8 feet Transport to Area 1	4500	CY	$ 20.00	$ 90,000.00	Vendor estimate - 300 Series excavator, 30-ton haul truck
07 - Secant Wall Vertical Encapsulation						
07-001	Installation of Secant Pile Wall	1	EA	$ 4,200,000.00	$ 4,200,000.00	Vendor Estimate-Single Rig & Slurry support crew
07-002	Installation of Reinforcing Steel	500	EA	$ 1,210.00	$ 605,000.00	R.S. Means - Driven H-Pile; Size 14X73; 22 feet long; apprx. 4 feet O.C.
07-002	Excavation spoils management	3500	CY	$ 30.00	$ 105,000.00	Vendor estimate - 300-series excavator, 3 CY bucket, 30-ton haul truck, significant stand-by time
08 - Impermeable Cap Over Sludge & Vent System Construction						
08-001	Furnish and install 1 layer of triaxial geo-grid	14000	SY	$ 4.00	$ 56,000.00	Vendor estimate. Geo-grid to diffuse cap loads
08-002	Deliver and Install 12-Inches of 3/4-Inch Vent Stone	1400	TON	$ 60.00	$ 84,000.00	Vendor estimate - assumes 3' wide, 1' thick pipe trenches.
08-003	Furnish and Install 6-Inch Multi-Flow Vent Strip	7700	LF	$ 15.00	$ 115,500.00	Vendor estimate
08-004	Import, place, and rough-grade 12 inch sublayer	5000	CY	$ 39.00	$ 195,000.00	NH DOT weighted average materials sheet & vendor estimate
08-005	Furnish and install geosynthetic membrane	14000	SY	$ 6.00	$ 84,000.00	Previous project estimate - up to 60-mil textured membrane, field-extrusion welded
08-006	Furnish and Install Vent Risers	14	EA	$ 1,500.00	$ 21,000.00	Vendor estimate along a 25-foot center
08-007	Construct riser boots	14	EA	$ 100.00	$ 1,400.00	Previous project estimate - seal boot to geomembrane with extrusion welds
08-008	Furnish and install biplanar geocomposite	14000	SY	$ 8.30	$ 116,200.00	Biplaner geocompsite drainage layer in-lieu of sand/gravel drainage layer
08-009	Screen/place/compact/fine grade 12" reuse protective layer	5000	CY	$ 33.00	$ 165,000.00	Vendor estimate - Promote positive water-shedding off the cap screened to 4" minus
08-010	Drainage swale and underdrain construction	1500	LF	$ 37.00	$ 55,500.00	7-inch minus rip-rap downchutes and swale to detention pond. Swales unerlain by 8-inch corrugated HDPE pipe to direct percolated water to the detention pond
08-011	Excavate stormwater detention basin	3700	CY	$ 20.00	$ 74,000.00	4-foot deep detention pond
08-012	Storm water detention system construction	1	Lump	$ 12,000.00	$ 12,000.00	Vegetated detention pond w/high water release to river
08-013	Furninsh & place armoring subgrade/cushion aggregate materials	1000	CY	$ 36.00	$ 36,000.00	NH DOT weighted average materials sheet. 3-inch minus stone and gravel mixture.
08-014	Furninsh & place armoring stone w/in floodplain	2500	CY	$ 40.00	$ 100,000.00	NH DOT weighted average materials sheet - Class B Stone
08-015	Furnish and place 6" topsoil layer	2300	CY	$ 45.00	$ 103,500.00	Vendor estimate
09 - Backfill & Site Restoration						
09-001	Place Reuse Soil Into Areas 6 and 7	8600	CY	$ 20.00	$ 172,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil
09-002	Fine-Grade/Compact Areas 6 and 7	2000	SY	$ 3.00	$ 6,000.00	Vendor estimate - Fine-grade and compact top lifts
09-003	Deliver and Place 4-Inches of Topsoil - Areas 6 and 7	200	CY	$ 45.00	$ 9,000.00	Vendor estimate - Deliver and transfer topsoil to work area
09-004	Place Reuse Soil Into Areas 3 and 4	2000	CY	$ 20.00	$ 40,000.00	Vendor estimate - Load, transport, backfill, compact re-use soil

Attachment B-5 - Table 3-CC
Capital Costs for Alternative 5 - Encapsulation (Secant Wall)/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
09-005	Fine-Grade/Compact Areas 3 and 4	800	SY	$ 3.00	$ 2,400.00	Vendor estimate - Fine-grade and compact top lifts
09-006	Deliver and Place 4-Inches of Topsoil - Areas 3 and 4	70	CY	$ 45.00	$ 3,150.00	Vendor estimate - Deliver and transfer topsoil to work area
09-007	Hydroseed Encapsulation Area	14000	SY	$ 3.00	$ 42,000.00	Vendor estimate - Hydroseed and mulch the stabilized area.
09-008	Replace Abandoned Monitoring Wells	2	Ea	$ 2,500.00	$ 5,000.00	Previous project experience. Install 2 replacement wells (GZ-09, GZ-10) supply well will not be re-drilled
10 - Decontamination, Temp. Facilities Removal & Demobilization						
10-001	Decontaminate Equipment	8	Ea	$ 1,500.00	$ 12,000.00	Vendor estimate - decontaminate all heavy equipment, hand tools, subcontractor equipment and tools
10-002	Remove Temporary Facilities and E&S Controls	1	LS	$ 40,000.00	$ 40,000.00	Vendor estimate
10-003	Demobilize Equipment	1	LS	$ 50,000.00	$ 50,000.00	Vendor estimate
				SUBTOTAL COST	**$ 10,679,024.00**	

Direct Cost Adjustments		
Health and Safety on Labor and Equipment (5%)	$ -	Health and Safety included in performance rates (assumed Level C)
Indirect Cost Adjustments		
Tax on Materials (7%)	$ -	Taxes (if any) are included in the presented rates
G&A @10% of Equipment, Material, and Labor	$ -	G&A is included in the presented rates
Subcontract Fee @ 4%	$ -	Fee is included in the presented rates
Labor OH @60%	$ -	Overhead is included in labor rates
Other Costs		
Profit @ 10% of Subtotal Direct & Indirect	$ -	10% profit is included on capital costs
Engineering Contingency at 15%; Construction Contingency at 10% of Construction Cost	$ 2,196,350.00	
Office & Management Support @ 3% Direct & Indirect	$ 320,370.72	
TOTAL COST	**$ 13,195,744.72**	

Attachment B-5 - Table 3-PRSC
Post-Removal Site Control Costs for Alternative 5 - Encapsulation/Impermeable Capping
Mohawk Tannery Site
Nashua, New Hampshire

Item No.	Item	Qty.	Unit	Unit Cost ($)	Total Cost ($)	Comments/Reference
01 - Post-Construction Monitoring						
01-001	Vegetation/Erosion Verification	8	Event	$ 786.00	$ 6,288.00	Previous project experience. Mobilize to the site quarterly for 2 years, document cap conditions, document deficiencies, prepare/issue inspection report.
01-002	Groundwater Monitoring	60	Event	$ 8,300.00	$ 498,000.00	Previous project experience. Biannual groundwater monitoring of 8 monitoring wells using standard sampling methods. Estimate assumes dedicated sampling equipment for each sampling round, and two field personnel. Assumes 30 years of monitoring, submittal of a data report for each sampling event, and an annual groundwater monitoring report.
01-003	Annual Groundwater Reporting	30	Year	$ 4,600.00	$ 138,000.00	Previous project experience. Biannual groundwater monitoring of 8 monitoring wells using standard sampling methods. Estimate assumes dedicated sampling equipment for each sampling round, and two field personnel. Assumes 30 years of monitoring, submittal of a data report for each sampling event, and an annual groundwater monitoring report.
01-004	Annual Cap Inspection	30	Year	$ 7,500.00	$ 225,000.00	Previous project experience. Assumes annual inspections and cap inspection report submittals consistent with solid waste cap inspection reports. For an assumed period of 30 years.
04-005	Cap maintenance	30	Year	$ 3,500.00	$ 105,000.00	Cap mowing twice per year using a tractor-pulled brush mower. Cuttings allowed to mulch in-place. Animal burrow mainteance assumed to require approximately $500 annually.
				SUBTOTAL COST	**$ 972,288.00**	

Direct Cost Adjustments		
Health and Safety on Labor and Equipment (5%)	$ -	Health and Safety included in performance rates
Indirect Cost Adjustments		
Tax on Materials (7%)	$ -	Taxes (if any) are included in the presented rates
G&A @10% of Equipment, Material, and Labor	$ -	G&A is included in the presented rates
Subcontract Fee @ 4%	$ -	Fee is included in the presented rates
Labor OH @60%	$ -	Overhead is included in labor rates
Other Costs		
Profit @ 10% of Subtotal Direct & Indirect	$ -	10% profit is included on capital costs
Engineering Contingency at 10% of PRSC Cost	$ 97,228.80	Factors applied consistent with EPA cost guidance 540-R-00-002.
Office & Management Support @ 3% Direct & Indirect	$ 97,228.80	Factors applied consistent with EPA cost guidance 540-R-00-002.
TOTAL COST	**$ 1,166,745.60**	

Appendix E

 | **Issue Date: May 30, 2014** | **Effective Date: September 19, 2014** | **Case No.: 14-01-0876P** | LOMR-APP

Follows Conditional Case No.: 12-01-0740R

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	City of Nashua Hillsborough County New Hampshire COMMUNITY NO.: 330097	DAM	FLOODWAY HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
IDENTIFIER	Jackson Mills Crest Gate Project	APPROXIMATE LATITUDE & LONGITUDE: 42.768, -71.489 SOURCE: Other DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES

TYPE	NO.	DATE
FIRM*	33011C0494D	September 25, 2009
FIRM	33011C0513D	September 25, 2009
FIRM	33011C0514E	April 18, 2011

ANNOTATED STUDY ENCLOSURES

DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 25, 2009
PROFILE(S): 161P AND 162P
FLOODWAY DATA TABLE: 8

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Nashua River - From approximately 920 feet upstream of B & M Railroad Bridge to approximately 320 feet downstream of Mine Falls Dam

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Nashua River	Zone AE	Zone AE	YES	YES
	Zone X (unshaded)	Zone X (unshaded)	YES	YES
	BFEs*	BFEs	YES	YES
	Floodway	Floodway	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

FLOODING SOURCE(S) & REVISED REACH(ES)

Nashua River - From approximately 920 feet upstream of B & M Railroad Bridge to approximately 320 feet downstream of Mine Falls Dam

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Nashua River	Zone X (shaded)	Zone X (shaded)	YES	YES

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, dams, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Kevin Merli
Director, Mitigation Division
Federal Emergency Management Agency, Region I
99 High Street, Sixth Floor
Boston, MA 02110
(617) 832-4761

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

A notice of changes will be published in the *Federal Register*. This information will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *The Telegraph of Nashua*
Dates: June 5, 2014 and June 12, 2014

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Nashua River								
A **REVISED DATA**	0	325	2,193	9.2	113.6	91.3[2]	92.3	1.0
B	845	93	1,048	19.3	113.6	99.3[2]	99.3	0.0
C	3,712	180	3,188	6.3	113.6	107.5[2]	108.2	0.7
D	5,338	160	3,024	6.7	113.6	109.3[2]	109.8	0.5
E	6,373	155	2,540	7.9	113.6	111.3[2]	111.8	0.5
F	6,831	269	3,398	5.9	120.8	120.8	120.8	0.0
G	7,686	227	3,102	6.5	122.6	122.6	122.6	0.0
H	9,046	182	2,502	8.1	123.6	123.6	123.7	0.1
I	10,920	385	3,545	5.7	125.6	125.6	125.7	0.1
J	14,082	572	7,164	2.8	127.1	127.1	127.3	0.2
K	17,109	223	3,713	5.4	127.7	127.7	128.1	0.4
L	19,189	813	6,738	3.0	128.8	128.8	129.2	0.4
M	20,720	246	3,836	5.3	129.2	129.2	129.7	0.5
N	21,800	217	3,652	5.5	129.6	129.6	130.2	0.6
O	24,543	196	2,928	6.9	131.5	131.5	132.0	0.5
P	24,947	176	3,259	6.2	131.9	131.9	132.6	0.7
Q	26,488	666	6,706	3.0	133.4	133.4	134.1	0.7
R	28,818	940	10,196	2.0	164.1	164.1	164.1	0.0
S	30,846	673	7,860	2.6	164.4	164.4	164.4	0.0
T	33,792	251	4,972	4.1	164.9	164.9	164.9	0.0
U	37,536	206	4,132	4.9	165.6	165.6	166.0	0.4
V	40,255	972	7,858	2.6	166.2	166.2	166.8	0.6
W	44,194	184	3,005	6.7	168.0	168.0	168.6	0.6
X	47,673	874	6,553	3.1	170.7	170.7	171.3	0.6
Y	50,683	156	2,120	15.4	173.3	173.3	174.3	1.0
Z	52,573	882	8,110	2.2	175.3	175.3	176.0	0.7

[1]Feet above confluence with Merrimack River
[2]Elevation computed without consideration of backwater effects from the Merrimack River

TABLE 8

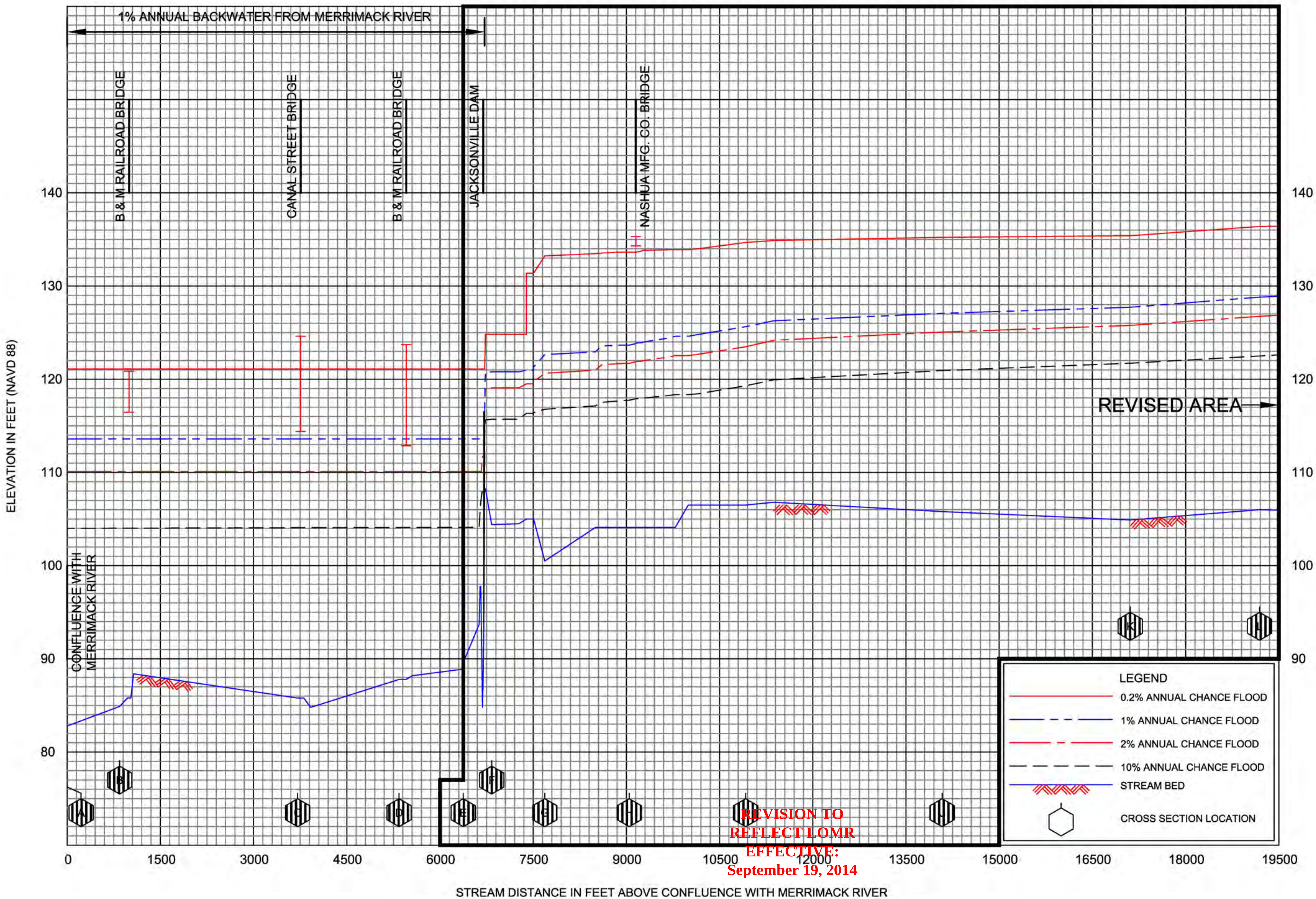
FEDERAL EMERGENCY MANAGEMENT AGENCY

HILLSBOROUGH COUNTY, NH
(ALL JURISDICTIONS)

FLOODWAY DATA

NASHUA RIVER

REVISION TO REFLECT LOMR EFFECTIVE: September 19, 2014



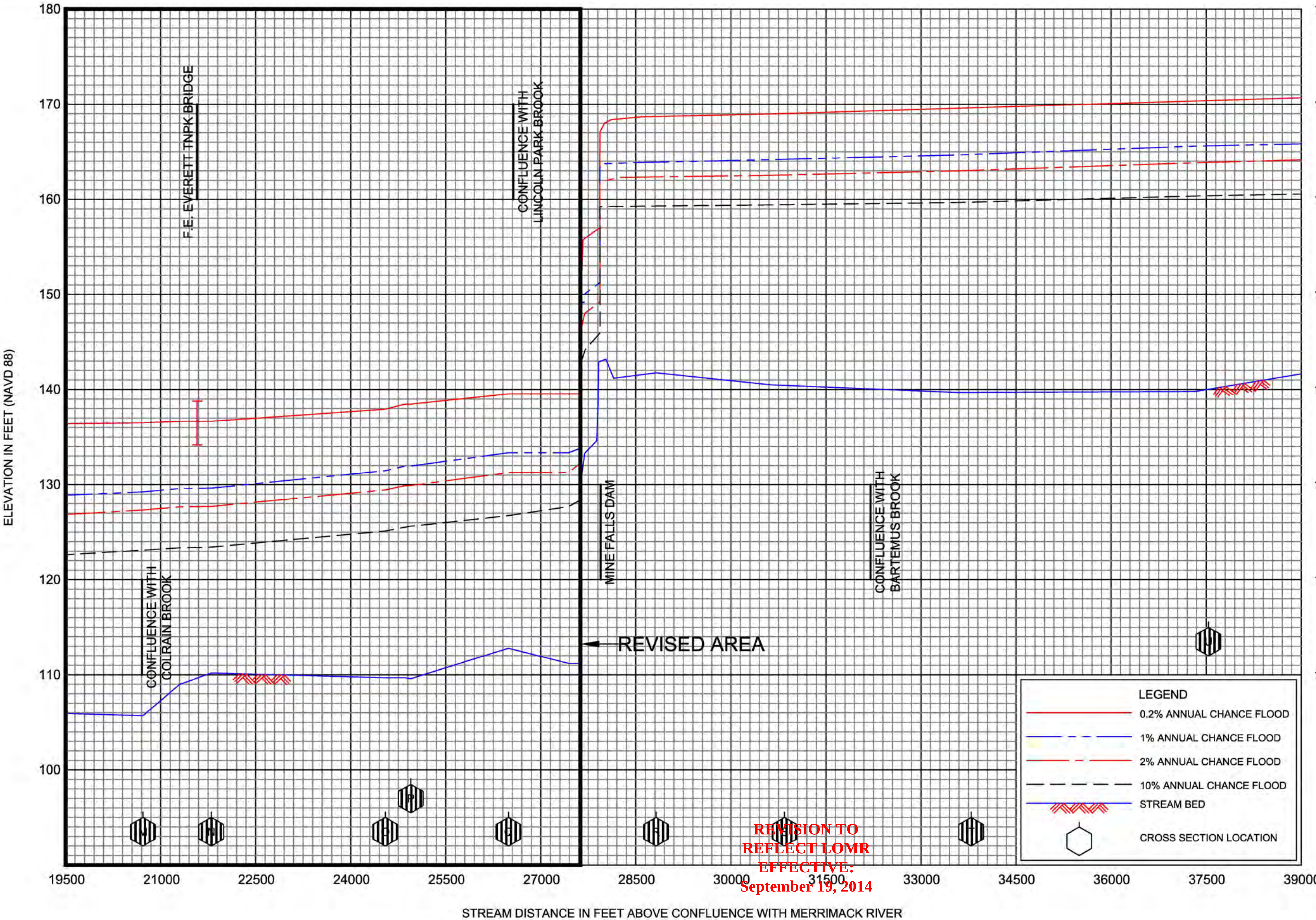
FLOOD PROFILES

NASHUA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HILLSBOROUGH COUNTY, NH

(ALL JURISDICTIONS)



FLOOD PROFILES

NASHUA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HILLSBOROUGH COUNTY, NH

(ALL JURISDICTIONS)

95000 FT

JOINS PANEL 0513

1025000 FT

JOINS PANEL 0632

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*	
	With BFE or Depth *Zone AE, AO, AH, VE, AR*	
	Regulatory Floodway	
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*	
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*	
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*	

SCALE

N

Map Projection:
NAD 1983 StatePlane New Hampshire FIPS 2800 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 270 540 1,080 Feet

0 75 150 300 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

HILLSBOROUGH COUNTY, NH.
ALL JURISDICTIONS

PANEL 494 OF 701

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
HOLLIS, TOWN OF	330091	0494	D
NASHUA, CITY OF	330097	0494	D

REVISION TO REFLECT LOMR EFFECTIVE: September 19, 2014

VERSION NUMBER
1.0.0.0

MAP NUMBER
33011C0494D

EFFECTIVE DATE
September 25, 2009

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
OTHER AREAS	NO SCREEN Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Accredited or Provisionally Accredited Levee, Dike, or Floodwall
	Non-accredited Levee, Dike, or Floodwall
	E 18.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2010.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

This map includes approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

CBRS Area

Otherwise Protected Area

SCALE

N

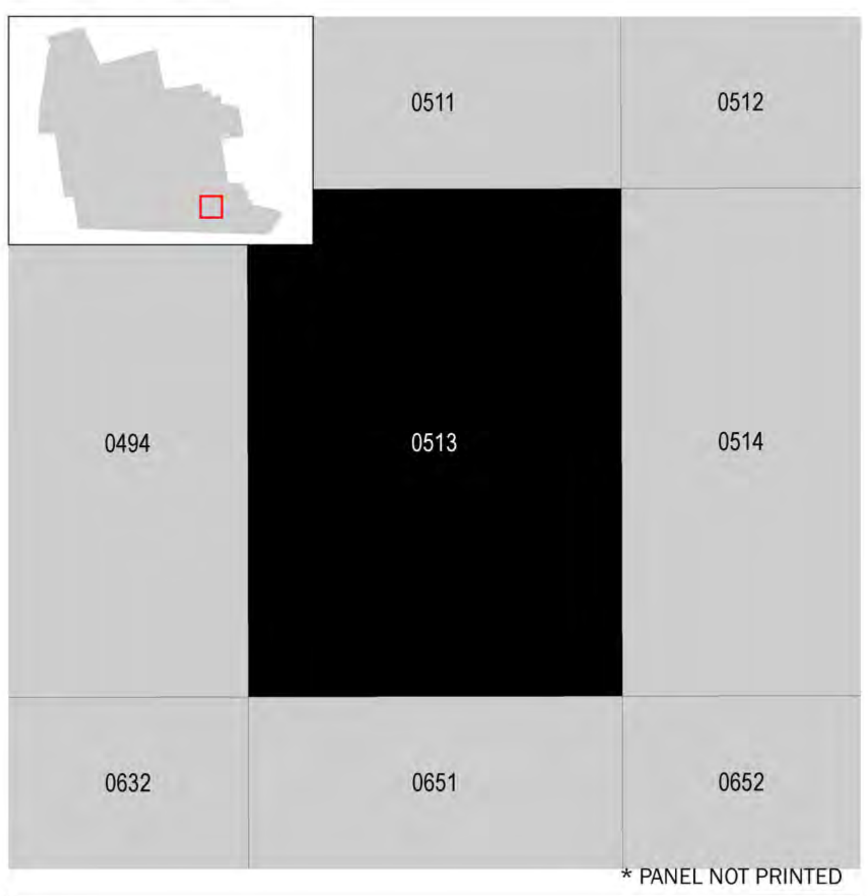
Map Projection:
NAD 1983 StatePlane New Hampshire FIPS 2800 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

Meters 0 130 260 520

PANEL LOCATOR



* PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

HILLSBOROUGH COUNTY, NH.
ALL JURISDICTIONS

PANEL **513** OF **701**

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
NASHUA, CITY OF	330097	0513	D

REVISION TO REFLECT LOMR EFFECTIVE: September 19, 2014

VERSION NUMBER
1.0.0.0

MAP NUMBER
33011C0513D

EFFECTIVE DATE
September 25, 2009

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) *Zone A,V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
		Future Conditions 1% Annual Chance Flood Hazard *Zone X*
		Area with Reduced Flood Risk due to Levee See Notes. *Zone X*

SCALE

Map Projection:
NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; Western Hemisphere; Vertical Datum: NAVD 88

N

1 inch = 500 feet 1:6,000

0 270 540 1,080 Feet

0 75 150 300 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

HILLSBOROUGH COUNTY, NH.
ALL JURISDICTIONS

PANEL **514** OF **701**

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
HUDSON, TOWN OF	330092	0514	E
NASHUA, CITY OF	330097	0514	E

REVISION TO REFLECT LOMR EFFECTIVE: September 19, 2014

VERSION NUMBER
1.0.0.0

MAP NUMBER
33011C0514E

EFFECTIVE DATE
April 18, 2011

JOINS PANEL 0513

95000 FT