U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 1

RECORD OF DECISION

DURHAM MEADOWS SUPERFUND SITE
DURHAM, CONNECTICUT
SEPTEMBER, 2005

APPENDICES

DECLARATION FOR THE RECORD OF DECISION

Durham Meadows Superfund Site
Durham, Middlesex County, Connecticut
CTD001452093

A. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Durham Meadows Superfund Site (Site), in Durham, Connecticut, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration has been delegated the authority to approve this Record of Decision (ROD).

This decision was based on the Administrative Record, which has been developed in accordance with Section 113(k) of CERCLA, and which is available for review at the Site repository at the Durham Public Library, 7 Maple Avenue in Durham, CT, and at the United States Environmental Protection Agency (EPA) Region 1 Office of Site Remediation and Restoration Records Center in Boston, Massachusetts. The Administrative Record Index in Appendix G identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of Connecticut partially concurs with the Selected Remedy.

B. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

C. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the Durham Meadows Superfund Site. The selected remedy is a comprehensive remedy which addresses principal Site risks by mitigating all current and potential future human health risks at the Merriam Manufacturing Company (MMC) Study

Area, the Durham Manufacturing Company (DMC) Study Area, and the Site-wide Groundwater Study Area. The MMC Study Area consists of the facility property, and includes the abutting residential property at 275 Main Street. The DMC Study Area consists of the facility property, excluding the portion of the property located east of Ball Brook. The Site-wide Groundwater Study Area consists generally of groundwater in the bedrock aquifer within the limits of the Site, including the MMC and DMC facilities, as well as residential areas impacted by groundwater contamination from the source areas.

Soil vapor extraction, and soil excavation and off-site disposal, as well as institutional controls, shall be implemented at the MMC Study Area such that principal threats in soil and soil vapor will no longer present an unacceptable risk to current and future residents via ingestion, dermal contact, or inhalation, and making the MMC Study Area available for reuse as a residential or industrial/commercial parcel, with certain restrictions to ensure the remedy continues to be protective of human health and the environment.

Soil excavation and off-site disposal, and institutional controls, shall be implemented at the DMC Study Area such that principal threats in overburden (shallow) groundwater will no longer present an unacceptable risk to future construction workers at the DMC Study Area via dermal contact and inhalation, or to future onsite residents via inhalation. Mass contaminant removal may also have the additional benefit of reducing overall groundwater contaminant levels over time; this alternative shall remove source areas to the maximum extent practicable. The DMC Study Area will be suitable for continued use as an industrial/commercial parcel.

An alternate water supply via connection from the City of Middletown Water Distribution System, as well as institutional controls, shall be implemented in the Site-wide Groundwater Study Area such that principal threats in groundwater will no longer present an unacceptable risk to current and future residents via ingestion, dermal contact, or inhalation. As a contingency measure, an alternate water supply, via development of and connection to a new groundwater source, is retained in the event connection to the City of Middletown Water Distribution System cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner. Also included is the interim measure of continued monitoring and filtration, and provision of bottled water as necessary, of impacted private (mostly residential) wells, and any other private wells within the Site-wide Groundwater Study Area that come to be impacted by Site-related contamination, as currently required under state order and state regulations, to ensure continued protectiveness of human health and the environment until construction of the alternate water supply portion of the remedy is complete and operational. A technical impracticability waiver encompasses all areas in the overburden and bedrock aquifers that are currently or conceivably could be impacted by contamination emanating from the Site. In conjunction with the alternate water supply, a monitoring network will be implemented to ensure that contaminated groundwater does not migrate and institutional controls will prevent use of contaminated groundwater; a contingency remedy of groundwater extraction for hydraulic containment will be implemented if it is determined that groundwater is migrating beyond the technical impracticability zone.

Further delineation of areas posing potential unacceptable indoor air risks on and outside of the MMC and DMC Study Areas will occur, and further actions may be taken to address such risks (including, without limitation, sub-slab depressurization systems and institutional controls), such that low level threats detected in shallow groundwater shall not present an unacceptable risk to current and future residents via inhalation.

The major components of this remedy are:

- Soil excavation and off-site disposal, in conjunction with soil vapor extraction, at the MMC Study Area to address risks to human health from contamination in soil and soil vapor. Excavation of a localized area of surface soil contamination on an adjacent residential parcel will also occur.

- Excavation and off-site disposal of soil hot spot areas at the DMC Study Area in order to address risks to human health from contamination in overburden (shallow) groundwater and to address source contamination.

- Connection to the Middletown Water Distribution System to distribute an alternative source of public water to all residences currently affected by groundwater contamination and a buffer zone of residences located near the contaminated area. Development of and connection to a new groundwater source is retained as a contingency measure in the event that a connection to the City of Middletown Water Distribution System cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner. Also included is the interim measure of continued monitoring and filtration, and provision of bottled water as necessary, of impacted private (mostly residential) wells, and any other private wells within the Site-wide Groundwater Study Area that come to be impacted by Site-related contamination, as currently required under state order and state regulations, to ensure continued protectiveness of human health and the environment until construction of the alternate water supply portion of the remedy is complete and operational. This alternative addresses current and future risk to human health from ingestion of contaminated groundwater.

- For the overall area of groundwater contamination, implementation of a monitoring network for the dissolved plume to ensure no migration of groundwater beyond its current general boundary.

- Contingency to implement a groundwater extraction system for hydraulic containment if monitoring indicates that the overall plume or source zone is spreading or migrating beyond its current general boundary.

- Implementation of a technical impracticability waiver of the applicable or relevant and appropriate requirements that would normally require cleanup of the groundwater, since it is not technically practicable to clean up the groundwater to drinking water and other standards in a reasonable amount of time.

- Institutional controls, primarily in the form of Environmental Land Use Restrictions (ELURs) as defined in the Connecticut Remediation Standard Regulations (CT RSRs), and/or by local ordinance, in a variety of areas to prevent unrestricted future use of certain areas of the Site or use of contaminated groundwater.

- Further delineation of areas posing potential indoor air risks on and outside of the MMC and DMC Study Areas by further characterization, including the collection of shallow groundwater data. If there are unacceptable risks, then further actions will be taken to address such risks, including without limitation, sub-slab depressurization systems and institutional controls on vacant properties or portions of properties, in accordance with EPA and Connecticut Department of Environmental Protection (CT DEP) requirements.

- Five-year reviews to ensure that the remedy continues to be protective of human health and the environment.

D. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action with the exception of chemical-specific requirements for overburden and bedrock groundwater which are waived, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Based on the technical infeasibility of restoring both the overburden and bedrock aquifers in a reasonable timeframe, EPA concluded that it was impracticable to clean up all contaminated overburden and bedrock groundwater throughout the Site and at the DMC Study Area in a cost-effective manner. Thus, the selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. Only the combination of alternatives at the MMC Study Area partially satisfy the preference for treatment, by implementing soil vapor extraction to treat volatile organic compounds prior to excavating contaminated soil and disposing of it off-site.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (and groundwater and/or land use restrictions are necessary), a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Five-year reviews will continue as long as waste remains at the Site and unlimited use is restricted.

E. SPECIAL FINDINGS

Issuance of this ROD embodies specific determinations made by the Director of the Office of Site Remediation and Restoration pursuant to CERCLA. Under section 121(d)(4)(C) of CERCLA, the Director of the Office of Site Remediation and Restoration hereby waives compliance with chemical-specific federal and state applicable or relevant and appropriate requirements (ARARs) that would normally require restoration of overburden and bedrock groundwater. Due to the nature of the Durham Meadows Superfund Site, full compliance with these requirements is not technically feasible in a reasonable timeframe.

A portion of the DMC Study Area contains wetlands. Section 404 of the Clean Water Act and Executive Order 11990 (Protection of Wetlands) require a determination that federal actions involving dredging and filling activities or activities in wetlands minimize the destruction, loss or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. EPA has determined that there is no actionable ecological risk at the Site, therefore none of the cleanup alternatives specifically involves actions to cleanup wetlands areas. EPA has determined it is unlikely that any of the remedial alternatives will involve activity that will impact wetlands areas at or around the Site. If, however, as part of future design activities, EPA determines that there is no practical alternative to conducting work in wetlands, EPA will then minimize potential harm or avoid adverse effects to the extent practical. Best management practices will be used to minimize adverse impacts on the wetlands, wildlife and its habitat. Damage to these wetlands would be mitigated through erosion control measures and proper regrading and revegetation of the impacted area with indigenous species. If the loss of wetlands areas occurs, wetlands would be restored or replicated consistent with the requirements of the federal and state wetlands protection laws.

Portions of the Site also are located within the 100-year floodplain. Executive Order 11988 (Protection of Floodplains) requires a determination of whether federal actions will occur in floodplains. If work will occur in floodplains, the federal agency must consider alternatives that avoid adverse impacts to the floodplain. If the only practical alternative requires siting in a floodplain, the agency must then minimize potential harm to the floodplain. EPA has determined it is unlikely that any of the remedial alternatives will involve activity that will impact floodplain areas at or around the Site. If, however, as part of future design activities, EPA determines that there is no practical alternative to conducting work in floodplains, EPA will then minimize potential harm and avoid adverse effects to the extent practical. If the loss of floodplain areas occurs, compensatory flood storage would be provided consistent with the requirements of the federal and state wetlands protection laws.

F. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

1. Chemicals of concern (COCs) and their respective concentrations
2. Baseline risk represented by the COCs
3. Cleanup levels established for COCs and the basis for the levels
4. Current and future land and ground-water use assumptions used in the baseline risk assessment and ROD.
5. Land and groundwater use that will be available at the Site as a result of the selected remedy
6. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
7. Decisive factor(s) that led to selecting the remedy

G. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for the Durham Meadows Superfund Site. This remedy was selected by the EPA with partial concurrence of the Connecticut Department of Environmental Protection.

Concur and recommended for immediate implementation:

U.S. Environmental Protection Agency

By: Susan Studlien Date: 09/30/05

Susan Studlien
Director
Office of Site Remediation and Restoration
Region 1

THE DECISION SUMMARY

A. SITE NAME, LOCATION AND BRIEF DESCRIPTION

Durham Meadows Superfund Site
Durham, Middlesex County, Connecticut
CERCLIS Identification Number CTD001452093
EPA and PRP Lead

The Durham Meadows Superfund Site (Site) is located in the Town of Durham, Middlesex County, Connecticut, and includes an area of groundwater contamination generally centered on Main Street. The Site includes historic Main Street in Durham center, and contains industrial and residential properties. The Site is generally bounded by Talcott Lane to the north; Brick Lane, Ball Brook and Allyn Brook to the East; Allyn Brook to the south; and wetlands west of Maple Avenue to the west.

The Site is centered around the Durham Manufacturing Company (DMC), a currently operating manufacturing facility located at 201 Main Street, and the former location of Merriam Manufacturing Company, Inc. (MMC) at 281 Main Street. Both companies manufactured metal cabinets, boxes and other items. The companies' past disposal of wastewater in lagoons or sludge drying beds, spills at both facilities, and inadequate drum storage practices at MMC, among other things, contributed to the contamination at each facility and in the overall area of groundwater surrounding both facilities. Contamination from volatile organic compounds (VOCs) has been detected in soil and groundwater on both industrial properties, as well as in residential drinking water wells surrounding the MMC and DMC facilities.

A more complete description of the Site can be found in Section 1.0 of the Remedial Investigation Report (Metcalf & Eddy, June 2005).

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

Merriam Manufacturing Company, Inc. (MMC) was established in 1851 at the 281 Main Street location in Durham, Connecticut. MMC manufactured metal products, including displays, boxes and cases, by pressing, breaking and welding sheet metal that was then degreased, painted and assembled. Beginning in 1940, the plant used trichloroethene (also known as trichloroethylene, or TCE) to clean boxes prior to painting. In 1953, the plant installed new equipment including a "water-wash degreaser." In 1974, the plant was using TCE, 1,1,1-trichloroethane (also known as 1,1,1-TCA, or TCA), and methylene chloride in vapor degreasers. A 600-gallon vapor degreaser was used from 1975 to 1986, and a 2,300-gallon vapor degreaser was used from 1978 to 1993.

Floor drains were reportedly located in the vicinity of the degreasers, and various solvents were stored in above-ground storage tanks near the loading dock area. Additionally, MMC used tetrachloroethene (also known as tetrachloroethylene, perchloroethylene, or PCE) as early as the 1940s, and used toluene as a solvent in the painting process.

Beginning in 1953, the wash water from the box cleaning operation drained to an on-site septic system. From 1973 until at least 1978, this wash water was discharged into two wastewater lagoons constructed at the facility. This wastewater contained water mixed with oil.

A liquid, enamel-based paint was applied to degreased metals in paint booths, and excess paint was discharged to on-site lagoons located at the rear of the property. Other solvents were used in the painting process, including toluene as a paint thinner from 1940-1993. Between 1940 and 1973, wastewater from the painting operations drained to the ground along the north side of the building. From 1973 to 1982, paint waste was drained into the two wastewater lagoons constructed at the facility. This wastewater was composed of water and residue from the paint spray operations. After 1982, wastes generated from Merriam's operations were either eliminated or collected and stored in drums. These drums were then disposed of off-site.

In addition, a number of leaks and spills occurred during MMC operations, including at the former drum storage area and the loading dock area. In November of 1981, CT DEP discovered violations of the Resource Conservation and Recovery Act (RCRA) at the MMC facility, including mislabeled, leaking waste drums, and storage of drums without proper containment. One hundred improperly labeled containers were stored on asphalt without a berm or drain. Two drums were leaking, and there was evidence of prior spills.

In March 1998, the bulk of the factory was destroyed by fire, leaving only a small warehouse building towards the rear of the property.

After the fire, an old underground storage tank used for heating oil was discovered at the Merriam property. Merriam hired a contractor to pump out the contents of the tank and, in late 1999 and early 2000, Merriam removed the tank and associated contaminated soil pursuant to a Connecticut Notice of Violation. This work reportedly resulted in the excavation and off-site disposal of approximately 120 to 130 tons of soil contaminated with oil.

The Durham Manufacturing Company (DMC) was established in 1922 at 201 and 203R Main Street in Durham, Connecticut. Three main buildings, including an office building and two manufacturing buildings, are currently located on the property. DMC also manufactures metal boxes and displays, and has used various solvents during its operations, including TCE (from the 1940s through the present), 1,1,1-TCA (from 1973-1976), and methylene chloride (used from 1976 through the present).

In 1951, DMC installed a 750-gallon settling tank to receive wastewater and paint sludge from wet paint spray booths and a caustic stripper tank. Approximately 500 gallons per year of sludge were pumped from the tank. Supernatant in the tank was discharged into an on-site "ditch." Approximately 1,200 gallons of water per week moved through the settling tank to the "ditch" as a result of cleaning operations of the wet paint spray booths. In 1974, DMC replaced the 750-gallon tank with a 5,000-gallon tank, which continued to receive wastewater and sludge from the wet paint spray booths and caustic stripper. Water was eventually drained into an on-site leaching field.

From approximately 1974 through 1978, DMC used unlined sludge drying beds in its wastewater treatment operations. Accumulated paint sludge from the settling tank was directed into one of two drying beds approximately twice a year. The sludge was dug out of the drying beds by hand approximately once a year, drummed, and taken to the Durham/Middlefield landfill for disposal. An on-site aeration pond was constructed in 1960 to receive non-contact cooling water from the degreasing and spot-welding operations, and storm water from drains located around the parking lot and roof. In 1982-1983, an aeration system was installed in the pond.

In 1982, solvent usage was approximately 1,000 gallons per month, and the wastewater stream was approximately 4,000 gallons per month.

Based on analytical data from an extraction well "EX-6" on the DMC property, it appears that a methylene chloride spill may have occurred in the area sometime in the mid-1990's. Analytical data provided in a draft work plan for remedial investigation work by DMC's contractor Leggette, Brashears & Graham (LB&G) indicates that methylene chloride detections in EX-6 increased from 168 parts per billion (ppb, or ug/L) on May 3, 1995, to 2,977,000 ppb on August 15, 1995.

A more detailed description of the Site history can be found in Section 1.0 of the Remedial Investigation Report.

2. History of Federal and State Investigations and Removal and Remedial Actions

In 1970, a drinking water sample taken from the Frank W. Strong Middle School (Strong School), located at 191 Main Street, south of and adjacent to the DMC property, was found to contain PCE and chloroform. Wastewater located in an "open pit" at DMC was observed approximately 550 feet north of the school's well location, and samples collected from the DMC pit and from Ball Brook reportedly contained PCE. Chloroform was also detected in an "open seepage area of discharge" at the rear of MMC and in a ditch leading from the rear of the property toward Ball Brook.

In 1982, in response to complaints of possibly contaminated drinking water, the Connecticut Department of Environmental Protection (CT DEP) began testing drinking water wells of residences near MMC and DMC along Main Street. CT DEP detected VOCs in a number of wells, including TCE, 1,1,1-TCA, PCE and methylene chloride. A number of wells had contaminant levels above the Maximum Contaminant Levels (MCLs) set by the federal Safe Drinking Water Act.

Under CT DEP Water Supply orders, MMC and DMC installed carbon filters on impacted residential wells. Since then, the two companies have monitored and maintained up to 38 filtered wells on at least a quarterly basis. Currently, DMC is responsible for servicing 14 of these wells. MMC was responsible for servicing 24 of these wells, but the company ceased these activities in late 2004; CT DEP has taken over monitoring and maintenance of these locations.

Regional School District #13 was maintaining and monitoring filters at the Strong School at 191 Main Street in Durham until August 2004, when it connected to a well system at the Coginchaug Regional High and Korn Elementary Schools (to the east, and not impacted by the Site). The well located at 191 Main Street has been sealed and can no longer be used.

EPA discovered 1,4-dioxane in 2003-2004 in wells at MMC, DMC, and at a number of residences. Because this compound is not effectively captured by the current carbon filters, CT DEP is supplying bottled water for drinking to several affected homes in the northern portion of the Site, and requires monitoring for this compound at a number of residences throughout the Site.

EPA's contractor prepared a Removal Program Site Investigation in September 1989, and EPA's Removal Program performed assessments in July 1990 and July 1992, however, no removal actions have been conducted at the Site to date.

A brief summary of the federal and state Site investigations and enforcement actions conducted to date under CERCLA and other environmental authorities is provided below.

Date	Event
October 24, 1972	CT DEP Pollution Abatement Orders No. 1082 and 1083 to MMC requiring construction of wastewater lagoons. (Modified on May 22, 1973, and again on August 20, 1973.)
June 30, 1980	CT DEP Hazardous Materials Management Unit Inspection at DMC.
November 30, 1981	CT DEP Site Investigation at MMC.
February 11, 1982	CT DEP Pollution Abatement Order No. 3209 to DMC, requiring DMC to perform investigations and propose remedial action for its own facility.
March 2, 1982	CT DEP Complaint Report received regarding MMC.
Early 1982	CT DEP Groundwater Survey at MMC.
July 12, 1982	CT DEP Pollution Abatement Order No. 3299 to MMC, requiring MMC to perform investigations and propose remedial action for its own facility.
August 24, 1982	EPA and CT DEP follow-up site inspection at MMC.
October 1982	Leggette, Brashears & Graham Groundwater Quality Investigation for

	DMC reports groundwater contamination on the property.
December 10, 1982	CT DEP Water Supply Order No. 3332 to MMC (modified on October 19, 1983), requiring provision of potable water and monitoring of residences.
December 10, 1982	CT DEP Water Supply Order No. 3334 to DMC (modified on June 1, 1983, June 28, 1983, and April 4, 1984), requiring provision of potable water and monitoring of residences.
January 4, 1983	EPA Administrative Compliance Order and Abatement of Penalties to MMC, ordering compliance with a number of RCRA provisions.
January 1983	Roux Associates, Groundwater Investigation for MMC reports soil and groundwater contamination on the property.
March 16, 1983	EPA Perimeter Survey at DMC.
May 12, 1983	CT DEP Water Supply Order No. 3462 to MMC (modified October 19, 1983).
March 8, 1984	CT DEP Water Supply Order No. 3680 to MMC.
March 20, 1984	CT DEP Site Inspection at MMC.
March 20, 1984	CT DEP Preliminary Assessment at MMC.
Midyear, 1984	EPA Site Inspection at MMC.
January 30, 1985	EPA Notice of Violation of Consent Agreement and Order to MMC for delays in constructing site security.
September 25, 1985	EPA Final Site Inspection Report at MMC.
November 13, 1985	EPA Hazard Ranking System Document.
August 10, 1987	Stipulated Judgment entered in Hartford Superior Court requiring MMC to monitor for VOCs and bacteria, and maintain carbon filtration systems at designated locations. Penalties to be imposed for any non-compliance. Docket No. CV83-0285138S.
September 1988	Roux Associates Site Investigation for MMC, includes installation of monitoring wells, and provides additional information on groundwater contamination and potential source areas on the MMC facility.
March 28, 1989	CT DEP Pollution Abatement Order No. 4806 and Water Supply Order No. 4805 to MMC.
October 4, 1989	EPA lists Durham Meadows Superfund Site on the National Priorities List.
November 22, 1989	CT DEP Consent Order No. 4891 with MMC for supply of potable water and monitoring at residences.
December 27, 1989	CT DEP fines MMC for failure to submit plan for maintenance and monitoring carbon filtration systems.
January 22, 1990	Roux Associates Phase II Site Investigation for MMC, includes pumping tests.
June 20, 1990	Roux Associates Addendum to Phase II Site Investigation for MMC.
October 7, 1991	Amendment to August 10, 1987 Stipulated Judgment, Docket No. CV83-0285138S.

October 7, 1991	Stipulated Judgment entered in Hartford Superior Court requiring MMC to comply with Pollution Abatement Orders Nos. 3299 and 4806. Allan Adams fined $150,000 for non-compliance with these Orders. Docket No. CV87-0334095.
September 1992	Haley & Aldrich Soil Gas Survey for MMC, identifies areas impacted by VOCs.
July 1993	EPA's contractor Metcalf & Eddy (M&E) performs surface water & sediment sampling. Under agreement with EPA, U.S. Geological Survey (USGS) performs borehole geophysics.
January 10, 1994	Leggette, Brashears & Graham completes *Summary of Subsurface Investigations, Durham Manufacturing Company, Durham, Connecticut* for DMC, reports on soil, groundwater, and soil vapor sampling.
April 1994	EPA's contractor M&E completes *Data Summary Report for START Initiative.*
April 1995	Agency for Toxic Substances & Disease Registry health consultation addressing private well monitoring.
1995	USGS completes *Geohydrology and Water Quality of the Durham Center Area, Durham, Connecticut.*
July 7, 1997	EPA and DMC enter into an Administrative Order by Consent for a Remedial Investigation/Feasibility Study and Other Work at the Durham Meadows Superfund Site.
September 1997	Leggette, Brashears & Graham submits *Draft Work Plan for Conducting the Remedial Investigation and Feasibility Study, Durham Meadows Superfund Site, Durham, Connecticut* for DMC.
March 1998	The bulk of MMC's facility is destroyed in a fire.
April & October 1998	EPA and DMC contractors and personnel conduct two rounds of sampling of untreated groundwater in a total of approximately 80 private wells.
November 1998	EPA's contractor, Lockheed Martin, conducts additional surface water and sediment sampling, and other field activities to investigate ecological risk at the Site.
December 1998	DMC conducts field investigations on its property.
August 1999	Leggette, Brashears & Graham submits *Draft Data Report, Durham Meadows Superfund Site, Durham, Connecticut* for DMC.
September 1999	Agency for Toxic Substances & Disease Registry health consultation regarding 1998 monitoring results.
May – June 2003	EPA's contractor, M&E, conducts field investigations at the MMC property.
December 2003 – June 2004	EPA conducts additional residential well sampling to investigate the presence of a newly identified contaminant, 1,4-dioxane.
2004	CT DEP requires 1,4-dioxane be added to monitoring for certain homes. Several homes are provided with bottled water for drinking due to 1,4-

	dioxane movement through existing carbon filters.
2004	MMC ceases monitoring and filtration of affected homes surrounding its property. CT DEP takes over this work.
2005	Leggette, Brashears & Graham submits Draft Remedial Investigation Report for DMC.
May 2005	EPA conducts soil vapor and indoor air sampling at a limited number of homes in the area.
June 2005	EPA finalizes RI, FS, and Technical Impracticability Evaluation Reports.

3. History of CERCLA Enforcement Activities

EPA began conducting search work for responsible parties in 1990. In 1993, this work was supplemented with a broader effort to determine if there were other sources of groundwater contamination beyond the MMC and DMC facilities. In December 1993, EPA sent CERCLA Section 104 Information Request letters to DMC and MMC. Both facilities responded with separate submissions in January and February 1994. EPA also sent an Information Request letter to the Town of Durham regarding past activities at the Strong School property at 191 Main Street. EPA notified three parties of their potential liability with respect to the Site: the Durham Manufacturing Company (DMC), Merriam Manufacturing Company (MMC), and Allan E. Adams (Mr. Adams), as president and owner of MMC.

On September 1, 1995, EPA sent Special Notice letters to the three potentially responsible parties (PRPs) to commence negotiations regarding the performance of a Remedial Investigation and Feasibility Study (RI/FS) at the Site. Substantial negotiations occurred with all PRPs, including the development of a specific technical scope of work for the RI/FS for the Site. In October 1996, MMC and Mr. Adams notified EPA of their inability to continue negotiating based on certain conditions, and EPA formally ceased negotiations with these parties. EPA continued negotiating with DMC, and in June 1997, EPA and DMC entered into an Administrative Order by Consent (AOC) for the RI/FS. The AOC became effective on July 7, 1997. Pursuant to the AOC, DMC agreed to perform RI/FS work on its own facility and in the southern portion of the groundwater plume. EPA agreed to perform RI/FS work on the MMC facility and in the northern portion of the groundwater plume.

In February 2005, EPA took over all remaining work to draft the RI/FS for the entire Site, and issued Draft Final Risk Assessment, RI, FS and Technical Impracticability Evaluation Reports on June 30, 2005. During the public comment period, DMC provided comments on the remedy selection for this Site. The written comments are included in the Administrative Record.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, CT DEP has continued to require filtering and monitoring of up to 38 impacted private wells. CT DEP serves as the primary point of contact for these efforts. Until recently, community concern and involvement regarding EPA efforts at the Site has been relatively low. EPA kept the community and other interested parties apprised of Site activities through fact sheets and press releases. Below is a brief chronology of the significant public outreach efforts.

- In March 1994, EPA held an informational meeting with representatives of the Town of Durham to discuss the Site.
- In June 1994, EPA established a local public information repository at the Durham Public Library in Durham.
- In January 1998, EPA released a fact sheet describing the Superfund process and plans for the Durham Meadows Site.
- In May 2003, EPA released a fact sheet describing investigations to be conducted at the former location of MMC.
- In March 2004, EPA released a fact sheet regarding 1,4-Dioxane, a newly identified contaminant discovered in groundwater in certain residential drinking water wells.
- In June 2004, EPA released another fact sheet regarding 1,4-Dioxane, and describing upcoming plans to sample for this contaminant at approximately 80 residential wells in the area.
- In April 2005, EPA released a fact sheet describing upcoming efforts to evaluate soil gas and indoor air at a limited number of locations at the Site.
- On July 1, 2005, EPA sent Draft Final versions of the Remedial Investigation Report, the Feasibility Study Report, and the Technical Impracticability Evaluation Report to the public information repository at the Durham Public Library.
- On July 7, 2005, EPA issued a press release providing a brief analysis of the Proposed Plan, and outlining the public comment period schedule.
- On July 7, 2005, EPA released a one-page mailing inviting the public to attend the public information meeting and public hearing on the Proposed Plan.

- On July 9, 2005, EPA published a public notice and brief analysis of the Proposed Plan in The Middletown Press and announcing the availability of the plan and supporting documents beginning July 13 at public information repositories at the Durham Public Library and at EPA's office in Boston, Massachusetts. The public notice stated that the Proposed Plan included notice of a technical impracticability waiver for federal and state requirements that would normally require cleanup of groundwater to meet drinking water standards. The Proposed Plan also included notice of a potential determination, and solicited comment on the proposed determination, to minimize destruction, loss or degradation of wetlands pursuant to Section 404 of the Clean Water Act and Executive Order 11990 (Protection of Wetlands), should work in wetlands areas be required, as well as the proposed determination to minimize potential harm and avoid adverse effects to the floodplain pursuant to Executive Order 11988 (Protection of Floodplains) should work in floodplain areas be required. Additionally, the Proposed Plan notified the public of the availability of a Draft Reuse Assessment as part of the Site Administrative Record, and solicited comments on this document.

- On July 12, 2005, EPA made the Proposed Plan and administrative record available for public review at EPA's office in Boston and at the Durham Public Library. The Durham Public Library continues to be the primary information repository for local residents and will be kept up to date by EPA.

- On July 12, 2005, EPA held a public meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan to a broad community. At this meeting, representatives from EPA and CT DEP answered questions from the public.

- From July 13, 2005 to August 12, 2005, the Agency held a 30 day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public.

- On July 15, 2005, EPA mailed copies of the Proposed Plan to the entire mailing list (approximately 400 local residents).

- On July 26, 2005, EPA issued a press release regarding the upcoming public hearing to discuss the Proposed Plan and accept any oral comments.

- On July 28, 2005, the Agency held a public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the Agency's response to comments are included in the Responsiveness Summary, Appendix D of this Record of Decision.

D. SCOPE AND ROLE OF RESPONSE ACTION

For purposes of remedial investigations and remedy selection, the Site is divided into three Study Areas: the MMC Study Area, the DMC Study Area, and the Site-wide Groundwater Study Area. The selected remedy was developed by combining components of cleanup for each Study Area to obtain a comprehensive approach for Site remediation.

In summary, for the MMC Study Area, the remedy provides a combination of soil vapor extraction and soil excavation and off-site disposal to prevent exposure to contaminated soil and soil vapor, and institutional controls to prevent any future use of the site that may result in exposure to contaminants. For the DMC Study Area, the remedy provides for soil excavation and off-site disposal to prevent exposure to contaminated overburden groundwater and for source reduction, in conjunction with institutional controls to prevent future exposure by construction workers or future residents. The remedy provides for the provision of an alternate water supply to area residents in order to prevent exposure to contaminated groundwater.

It is not technically practicable to clean up the groundwater in overburden or bedrock in a reasonable timeframe, therefore the remedy provides for monitoring only, with a contingency to implement an alternative of groundwater extraction for hydraulic containment if it is determined that the overall plume or source zone is spreading or migrating beyond its current general boundary. The groundwater portions of the remedy are being implemented in conjunction with a technical impracticability waiver of the applicable or relevant and appropriate environmental requirements (ARARs) that would normally require cleanup of the groundwater to meet drinking water and other standards. Institutional controls are also required to prohibit future use of groundwater in this area.

Based upon the potential future indoor air risks found at both the MMC and DMC Study Areas, there is a potential, at other locations, for current or future exposures through volatilization of organic compounds. During remedial design there will be further delineation of the area posing potential indoor air risks on or outside of the MMC and DMC Study Areas by further characterization, including the collection of shallow groundwater data. If there are unacceptable risks, then further actions will be taken to address such risks, including without limitation, sub-slab depressurization systems and institutional controls on vacant properties or portions of properties, in accordance with EPA and CT DEP requirements.

The principal and low-level threats that this ROD addresses are summarized in Table 1.

E. SITE CHARACTERISTICS

Section 1.0 of the Feasibility Study contains an overview of the Remedial Investigation. The significant findings of the Remedial Investigation are summarized below.

The Conceptual Site Model (CSM) for soil, groundwater, soil vapor, indoor and outdoor air, surface water, and sediment at the Site is provided in Figure 1. The CSM is a three-dimensional "picture" of Site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future Site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response actions for soil, groundwater, and indoor air for the Site are based on this CSM.

1. Site Setting, Geology, and Hydrogeology

The Durham Meadows Superfund Site is located in Durham, Middlesex County, Connecticut (Figure 2). The Site consists of an area of groundwater contamination (approximately 100 acres) generally centered along Main Street in Durham and encompassing the DMC and MMC facilities. The companies' past activities contributed to the contamination at each facility and in the overall area of groundwater surrounding both facilities. Contamination from VOCs has been detected in soil and groundwater on both industrial properties, as well as in residential drinking water wells surrounding the MMC and DMC facilities. The Site is located within a Historic District, established by a Town Ordinance. [Town of Durham, 2003b].

For purposes of remedial investigation and remedy selection, the Site is divided into three Study Areas: the MMC Study Area, the DMC Study Area, and the Site-wide Groundwater Study Area. The MMC Study Area consists of the facility property, and includes the abutting residential property at 275 Main Street. The DMC Study Area consists of the facility property, excluding the portion of the property located east of Ball Brook. The Site-wide Groundwater Study Area consists generally of groundwater in the bedrock aquifer within the limits of the Site, including the MMC and DMC facilities, as well as residential areas impacted by groundwater contamination from the source areas. The Site-wide Groundwater Study Area also includes the Strong School, 168 Main Street, and 174 Main Street, where VOC levels in drinking water wells are generally higher than in other areas.

The Town of Durham, Connecticut lies within the Connecticut Valley Lowland in south central Connecticut. Two glacial advances deposited and reworked the overburden till and outwash deposits found in this region. Bedrock underlying the Study Area is the Jurassic age Portland Formation, which was deposited in a late Triassic, early Jurassic age rift basin [USGS, 1995]. The Portland Formation has a strike slightly west of north and dips gently eastward at approximately 3 degrees at the MMC site and approximately 5 degrees at the DMC site. It is comprised of well-consolidated sandstone, siltstone, shale, and conglomerate with low primary (intergranular) porosity and hydraulic conductivity. Secondary porosity and hydraulic conductivity due to fractures, joints, and separations along bedding planes make the bedrock a viable aquifer.

This ROD is partitioned between the Study Areas. Previous investigations have included components of one or more Study Areas, resulting in some overlap in the discussion of each Study Area. The Study Areas are shown in Figure 2.

MMC Study Area Geology and Hydrogeology

The MMC Study Area includes two parcels, where the former MMC plant was located, and a third parcel on which the residence at 275 Main Street is located. The three parcels measure approximately 3.86 acres in total. The MMC Study Area is depicted in Figure 3, which shows the approximate locations of former and current site features. These site features include the former and remaining portion of the building, former lagoon areas, a former drum storage area, former underground storage tanks (USTs), current propane aboveground storage tanks, and current metal scrap and drum storage areas. Also shown are the locations of former degreasers and former paint booths within the facility buildings, a former water supply well (present but not in use), a former drywell, and a former fuel oil tank within the loading dock area.

The MMC Study Area is relatively level, with a slope to the east that starts approximately 100 feet behind the remaining building and east of Main Street. Overland runoff flows generally to the east off the sloped area at the rear of the property into the floodplain of Ball Brook. Ball Brook flows across the property along the northeast corner. This is the closest Ball Brook passes to the Study Area before flowing further east. The MMC Study Area has no ponds situated within the property boundary, although vernal pools may exist near Ball Brook. There are no wetlands on the MMC Study Area.

The MMC Study Area is underlain by one to two feet of fill and 10 to 25 feet of glacial till. This was determined from soil borings drilled in 2003 by M&E and from borings by Roux Associates from 1988 to 1990. In the area of the building that partially burned down (leaving only the rear section intact), the depth of fill is several feet deeper. Soil borings drilled during May and June of 2003 indicated refusal depths between 11 and 24 feet below ground surface (bgs). Refusal depths were deeper to the west-northwest and shallower to the east-southeast [M&E, 2005a Draft Final RI].

During RI activities in May and June 2003 at MMC Study Area, overburden groundwater was rarely encountered. In several wells, a perched layer of groundwater was observed locally, but a laterally extensive perching layer could not be confirmed [M&E, 2005a]. A discussion of bedrock and bedrock groundwater beneath the MMC Study Area is included within the Site-wide Groundwater Study Area discussion.

DMC Study Area Geology and Hydrogeology

The DMC Study Area mainly consists of buildings and asphalt, with some grassy areas along the northern border and the eastern portion of the property. The DMC Study Area measures approximately 10.5 acres, and is currently occupied by three main buildings, including an office building and two manufacturing buildings. Current major property features include septic system leach fields, a propane tank, a cooling tower, a "burn-off oven," materials towers, degreasers and an associated degreaser tank, paved parking areas, an aeration pond, and wetland areas (Figure 4). For the purposes of remedial investigations, the DMC Study Area does not include a portion of the DMC property located east of Ball Brook. This area has not historically been used for operations or disposal. A portion of the DMC Study Area along Ball Brook is located within the 100-year floodplain. Three production wells are currently used by DMC for withdrawal of bedrock groundwater [USEPA, 2002a; CTDEP, 2001].

The DMC Study Area is underlain by one to two feet of fill and 10 to 20 feet of low permeability till over bedrock, as determined from multiple soil borings and monitoring well installations within the till overburden conducted by Leggette, Brashears, & Graham, Inc (LB&G) [LB&G, 1982; LB&G, 1994]. The DMC Study Area topography slopes somewhat steeply to the east. Surface drainage on the DMC property is from west to east, draining to Ball Brook [LB&G, 1982]. Overall, there appears to be slightly greater saturated thickness on the eastern portion of the site, which is both lower in elevation and closer to wetlands. Information on bedrock and bedrock groundwater beneath the DMC Study Area is included within the Site-wide Groundwater Study Area discussion.

The DMC Study Area contains one man-made surface water pond (referred to as the "aeration pond" or "cooling water pond"). The pond is located on the eastern portion of the property (behind the manufacturing facility). The pond was constructed in 1960 to serve as a holding pond for cooling water. In 1982/1983 an aeration system was added to the pond. The pond may also be connected to trench drains (also called curtain drains) on the property. The pond is currently used to aerate groundwater pumped from DMC Well No. 2. Ball Brook, which lies approximately 60 feet east of the aeration pond, flows south through the Study Area to Hersig Brook [USGS, 1995; LB&G, 1999].

Site-wide Groundwater Study Area Geology and Hydrogeology

The Site-wide Groundwater Study Area is comprised of the groundwater found in the fractured bedrock aquifer throughout the Durham Meadows Superfund Site. The area included in the Site-wide Groundwater Study Area is depicted on Figure 5, which shows residential properties that have historically been sampled as part of investigation efforts by MMC and DMC.

According to Connecticut groundwater classification maps, the Site is located in type GA aquifer. Designated uses of GA-classified groundwater aquifers include existing private and potential public or private supplies of water suitable for drinking without treatment and base flow for hydraulically connected surface water bodies [CTDEP, 2005a]. Residences and commercial and manufacturing facilities throughout the Site have individual water supply wells for potable water and septic systems for waste disposal. There is no public water supply or sanitary sewer system in the Site-wide Groundwater Study Area. Waste fluids disposed to septic systems may migrate into the overburden till and the bedrock aquifer.

Three hydrogeologic units can be found near the Study Area: stratified drift (sands/gravels/ fines), till, and sedimentary bedrock belonging to the Portland Formation. Stratified drift deposits are found in the valleys to the west and east of the Site. These deposits are predominantly fine-grained glaciolacustrine sediments having low permeability. The glacial till is also a low permeability unit, which is found overlying the bedrock throughout the Study Area. The bedrock unit that underlies Durham, Connecticut serves as the main source of water for the Durham area. It has a low primary porosity (approximately 6%) with little or no hydraulic conductivity in the rock matrix. The hydraulic conductivity of the till is low, but it is an important hydrologic unit serving as a conduit between the ground surface and the fractured bedrock aquifer below. Recharge to all three hydrogeologic units is primarily from precipitation, approximately 52 inches yearly from a thirty year average (1971-2000) [NOAA, 2002]. Annual recharge to the three hydrogeologic units has been estimated at approximately 23 inches for stratified drift and 8 inches for the till and bedrock units [USGS, 1995].

The dominant fracture trend in the area strikes northeasterly and the fractures dip steeply toward the northwest and southeast. Less common, secondary fracture sets were identified striking north and also east-northeast. Fracture densities in the bedrock at the MMC and DMC Study Areas were approximately two to four fractures per 100 feet, based upon borehole geophysics conducted by USGS [USGS, 1995]. However, MMC monitoring wells MW-2 and MW-3 averaged approximately eight to ten fractures within the top 100 feet of bedrock.

The Ball Brook fault, a northeast-striking western-dipping normal fault, cuts directly through the Site near DMC. USGS geophysical logs indicate that the Ball Brook fault intersects DMC Well No. 2 at approximately 200 feet bgs [USGS, 1995]. DMC Well No. 2 is capable of 100 gpm pumping rates, probably due to the higher hydraulic conductivity in the fracture zone. However, anecdotal information suggests that nearby wells ran dry when DMC Well No. 2 was pumped at 100 gpm. The well is currently pumped at approximately 20 gpm.

2. Nature and Distribution of Contamination

This section describes the nature and distribution of contamination in surface soil, subsurface soil, soil vapor, overburden groundwater, surface water and sediments, and evidence of a source of Dense Non-aqueous Phase Liquid (DNAPL), as determined by the RI [M&E, 2005a].

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 manner in which 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.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or groundwater, low leachability contaminants or low toxicity source material.

A summary of contaminants and their distribution at the Site is provided in Table 1.

As discussed in Section 4.0 of the RI report [M&E, 2005a], a method based on converging lines of evidence was used to assess whether DNAPL is likely to be present in the subsurface within the MMC, DMC, and Site-wide Groundwater Study Areas. The method of assessment is based primarily upon an approach outlined by Kueper et al. [Kueper et al, 2003], using criteria established in the industry for evaluating the presence of DNAPL. DNAPL has not been directly observed within any of the Study Areas. Soil, soil gas, and groundwater contaminant concentrations generally do not support a conclusive determination that DNAPL may be present, with the exception of overburden groundwater at the DMC Study Area, where historic concentrations are well above the 1% aqueous phase solubility for several chlorinated VOCs. However, given the complex hydrogeologic environment of the site and other factors such as deep open hole monitoring wells that may dilute groundwater within these wells, this criterion has limited applicability. History of solvent usage and plume behavior are more accurate indicators at this site. Past manufacturing activities included the use of chlorinated solvents that were likely released to the environment. If released in a pure phase, these solvents tend to sink into the subsurface as a DNAPL where they spread vertically and horizontally. DNAPL will reside in unsaturated and saturated media as either residual contamination (discontinuous ganglia blobs in porous or fractured media) or as pooled DNAPL above fine-grained layers or fractured media where the entry pressure prevents further migration in the subsurface. Both residual and pooled DNAPL will slowly dissolve causing a persistent source of dissolved phase contamination. Chlorinated solvents including methylene chloride, xylene, (1,1,1-TCA), trichloroethene (TCE), and tetrachloroethene (PCE) were used in the manufacturing processes occurring in the MMC and DMC Study Areas during different periods of operation, and are common sources of DNAPL.

In addition to past solvent use, evidence of the presence of DNAPL within each Study Area includes the detection of dissolved contaminants in bedrock groundwater contamination over many years (greater than 30) coupled with the plumes extending from source areas near both MMC and DMC. The persistence of the bedrock contamination, as well as the continued presence of groundwater contamination at the source areas, is indicative of a stable source of contamination such as DNAPL. Further evidence of DNAPL is discussed in the RI [M&E, 2005a].

Nature and Extent of Contamination at MMC Study Area

Based on historical information, the primary source of contamination is believed to be volatile organic compounds (VOCs) related to chlorinated solvents released or spilled from MMC operations. VOCs have been encountered in soil samples and soil vapor samples from several locations within the MMC Study Area. TCE was detected most frequently and at the highest concentrations. VOCs were not detected in surface soils at the background sampling locations. Based on soil vapor surveys, the estimated extent of VOC concentrations (particularly TCE, PCE, and 1,1,1-TCA) in soil vapor includes the area of the former degreaser, the former loading dock, and the former drum storage area.

Semi-volatile organic compounds (SVOCs) and extractable petroleum hydrocarbons were detected in most surface and subsurface soil samples, with the highest concentrations occurring in the surface soils. SVOCs were also detected in the background surface soil samples. Metal concentrations above background levels were detected in all soil samples. Several metals were also detected in the Synthetic Precipitation Leaching Procedure (SPLP) analysis. Vehicle usage and paving around the former building, including a portion of the adjacent residential property that was used for parking, may have contributed incidental concentrations of petroleum-related compounds. Highly cracked and weathered asphalt is found in the former parking areas. Other sources of petroleum hydrocarbons and metals in soils may include the building fire which destroyed the original section of the MMC building and topsoil placed to cover the remnants of the fire. Residual ash and debris likely related to the building fire and non-native soil fill are located across the surface of the Study Area.

There is no permanent overburden groundwater table in the MMC Study Area. Chlorinated volatiles were detected in overburden groundwater samples from the wet meadow east of the

MMC Study Area in 1988 [Roux, 1990] and likely result from bedrock groundwater discharge. Bedrock groundwater analytical data collected from wells located within the MMC Study Area are discussed under the Site-wide Groundwater Study Area.

In 1993, M&E sampled surface water and sediment locations in the vicinity of the MMC and DMC properties for EPA. Based on these results, EPA developed a supplemental sampling program and collected additional samples during the RI in 1998. Surface water samples collected in Ball Brook adjacent to the MMC Study Area contained no VOCs, SVOCs, pesticides, or polychlorinated biphenyls (PCBs). Metals concentrations were fairly consistent with results for upstream locations in Ball Brook. Also, the upstream locations contained concentrations of some VOCs and SVOCs that were not detected in surface water adjacent to the Study Area. Sediment samples collected in Ball Brook adjacent to the Study Area in 1998 contained several VOCs (mainly chlorinated solvents), SVOCs (mainly polycyclic aromatic hydrocarbons, or PAHs), pesticides, and metals. Sediment samples collected in 1993 showed similar results except that no chlorinated VOCs were detected.

Nature and Extent of Contamination at DMC Study Area

Organic compounds, including PCE and TCE, have been detected in surface and subsurface soil samples around the former solvent storage tank. Soil with non-chlorinated VOC contamination was also discovered to the east of the main building, and these samples are immediately adjacent to a groundwater monitoring location with similar contamination. A surface soil sample contained elevated concentrations of ethylbenzene and total xylene. High concentrations of ethylbenzene, toluene, total xylene, and MTBE were also detected in the subsurface soil at the same location. The presence of MTBE and the absence of benzene are hypothesized to be the presence of degraded gasoline [LB&G, 1999]. However, it has been reported that former tanks that stored ethylbenzene, toluene, and xylene for use as paint solvents may have been maintained near this sample location [LB&G, 2005]. SVOC concentrations detected at numerous sampling locations and are likely due to asphalt mixed into the sample as indicated in the boring logs [LB&G, 1999]. Low concentrations of metals have been measured in soil samples collected throughout the DMC Study Area, with the exception of one sample containing an elevated concentration of arsenic (however the field duplicate sample measured below the detection limit for arsenic). No SPLP laboratory data for metals is available for DMC Study Area soils.

Contaminants of concern in overburden groundwater at the DMC Study Area include chlorinated VOCs and, to a lesser extent, BTEX. Chlorinated VOCs detected in groundwater include TCE; PCE; 1,1,1-TCA; 1,1-DCA; 1,1-dichloroethene (1,1-DCE); 1,2-dichloroethene (1,2-DCE); methylene chloride; and vinyl chloride. The highest single detection of TCE was in the former leach field adjacent to the former industrial waste gallery (170,000 ug/L in August 1984). Overburden groundwater samples from the north driveway area indicate that there may be a source area in the vicinity of the former solvent storage area. An additional contaminant source may be located near the former leach field to the northeast of the main (western) manufacturing building. The extent of groundwater TCE and PCE contamination includes the north driveway and the property east of the main (western) manufacturing building. During the most recent groundwater sampling event (December 1998), the highest concentrations of TCE (66,000 ug/L) were detected at EX-4, near the solvent storage area, and at WS-10 (4,200 ug/L), less than 100 feet northeast of the aeration pond, with concentrations decreasing toward the center of the property from these two areas. Overburden groundwater collected east of the main building (WS-20 in December 1998) contained elevated concentrations of non-chlorinated VOCs, including ethyl benzene, toluene, and total xylenes. Metals and SVOC concentrations in overburden groundwater from the DMC Study Area have been generally low.

A soil vapor survey was performed by LB&G as reported in its 1994 report. The soil vapor survey indicated the presence of VOCs in soil vapors on the DMC property and on two nearby residential properties to the south, 168 and 174 Main Street [LB&G, 1994].

In 1993, M&E sampled surface water and sediment locations in the vicinity of the MMC and DMC properties for EPA. Cis-1,2-dichloroethene (cis-1,2-DCE) was detected in the surface water sample collected from SW/SE-9, a site adjacent to the DMC property. SVOCs, pesticides, and PCBs were not detected above analytical detection limits. Metals detected were comparable between a location upstream of the DMC property location and the location adjacent to the DMC property (i.e., no detection downstream was more than three times the concentration upstream) [M&E, 1994]. VOCs were not detected in sediment samples. The SVOC 4-methylphenol and the pesticide 4,4-DDE were detected in the sediment sample collected from the location adjacent to the DMC property. The SVOC and the pesticide were not detected in the upstream sample. Barium and calcium were detected at location adjacent to the DMC property at concentrations more than three times the concentrations detected in the upstream sample [M&E, 1994].

Based on these results, EPA developed a supplemental sampling program and collected additional samples during the RI in 1998. Surface water and sediment samples have been collected from the aeration pond in 1998 (shown on Figure 4). The TCE concentration in the pond water was 5 ug/L, and low concentrations of VOCs, SVOCs, and metals were detected in a sediment sample.

<u>Nature and Extent of Contamination in Site-wide Groundwater</u>

The primary sources of groundwater contamination in the Site-wide Groundwater Study Area include spills, past waste disposal practices, and other Site activities at the MMC and DMC facilities. The overburden soils impacted by these facilities are another likely source of groundwater contamination in the bedrock aquifer, with potential DNAPL areas in the glacial till overburden at both the MMC and DMC Study Areas.

Two residential properties that may have been former home-based businesses and the Strong School have VOC levels in drinking water wells that are generally higher than in other areas.

The interpretation of contaminant sources and migration near these residences, 168 and 174 Main Street, is unclear. There is some information indicating that both sites were used for home-based businesses, a solvent drum was reportedly discovered with no further supporting information or details, and wells are located southwest of the DMC site coincident with the primary fracture trend and the potential preferential pathway created by Ball Brook. No bedrock monitoring wells currently exist between DMC, these residences, and/or the Strong School. The historical influence of pumping at the Strong School may potentially have drawn contamination and possibly mobilized DNAPL from both the DMC site and the residences at 168 and 174 Main Street. Therefore, it cannot be unequivocally determined whether the historically high levels of contamination near 168 and 174 Main Street originate from past uses of the properties, the DMC site, or a combination of these possibilities.

Anecdotal information gathered by EPA during confidential interviews of former teachers and students regarding the Strong School, located at 191 Main Street, indicates that an industrial arts shop and an automotive repair shop were once operated on the property. A school bus maintenance area was also formerly located at the Strong School property. However, no record of solvent use or spills was found for the Strong School property. Two leaking underground storage tanks (USTs) were identified at the Strong School, including 1,000-gallon and 4,000-gallon USTs formerly used to store petroleum (gasoline) products. The USTs were removed in August 2002, and monitoring wells were installed to assess impacts from the leaking USTs in April, 2004 [AEI, 2005].

The Strong School stopped using its water supply well in August 2004 in favor of a hookup to the District 13 Consolidation well system. This well system consists of two wells located at the Coginchaug High School and one well located at the Korn Elementary School (well system license No. CT0380472).

Groundwater data indicate that VOCs, primarily chlorinated solvents, were detected in the bedrock groundwater within the Site-wide Groundwater Study Area. VOCs detected included solvents used in the industrial processes at the DMC and MMC properties: PCE, TCE, and 1,1,1-TCA. TCE was the most prevalent compound detected in the bedrock groundwater in the Study Area. The highest concentrations were detected at MMC, DMC, the Strong School, and the residences at 168 Main Street and 174 Main Street. Daughter compounds that likely result from the degradation of the primary chlorinated solvents were also detected in bedrock groundwater, including cis-1,2-DCE, trans-1,2-dichloroethene, 1,1-DCE, 1,1,-DCA, and vinyl chloride.

Similar to the parent compounds, the highest concentrations of chlorinated daughter compounds were detected at MMC, DMC, the Strong School, and the residences at 168 Main Street and 174 Main Street. The compound 1,4-dioxane was detected in 21 bedrock wells within the Site-wide Groundwater Study Area. Detections of 1,4-dioxane are generally coincident with detections of 1,1,1-TCA [Zenker et. al. 2003].

Based on Site data, the plumes follow linear distribution trends of a fractured bedrock aquifer that generally appear to follow the dominant north-northeast to south-southwest trending fractures and minor north to south fractures [USGS, 1995]. Two separate plumes are observed in the Site-wide Groundwater Study Area, one extending south-southwest and south from the MMC Study Area and one extending south and southwest from the DMC Study Area (Figure 6). This trend is generally observed for PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, and 1,4-dioxane. TCE was the most widespread contaminant and was detected at the highest concentration levels of the contaminants mapped. The MMC and DMC TCE plumes appear not to overlap during the spring of 1998 but appear to merge and overlap near Maiden Lane during the fall of 1998 (Figure 7). The highest concentrations of 1,1,1-TCA are south of DMC and trend east-northeast to west-southwest from the Strong School toward the residences at 168 Main Street and 174 Main Street. Plume contour maps are presented and discussed in Section 4.0 of the RI [M&E, 2005a].

Concentrations of primary contaminant compounds (PCE, TCE, and 1,1,1-TCA) have been observed to be declining slightly at the three locations downgradient of MMC Study Area [M&E, 2005a]. Daughter compounds resulting from biodegradation of PCE, TCE, and 1,1,1-TCA (cis-1,2-DCE; vinyl chloride; 1,1-DCA; chloroethane) suggest that natural attenuation may be progressing. Contaminant concentrations are relatively persistent at 289 Main Street, directly north of MMC, providing further evidence that a persistent source is located at the MMC Study Area.

Below the DMC property, PCE and TCE concentrations are persistent. Daughter compounds were detected at 205 Main Street, near the northwest corner of the DMC property; however, little historic daughter compound data was available for DMC Well Nos. 1 and 2. Concentrations of 1,1,1-TCA appear to be declining near the DMC property; however, 1,1,1-TCA daughter compound data is sparse for these wells. PCE and TCE concentrations at the Strong School have been relatively elevated and persistent. Degradation may be indicated by the presence of daughter compounds cis-1,2-DCE and vinyl chloride. Septic systems in the area provide bacteria and nutrients that may assist natural attenuation.

SVOC compounds in the bedrock groundwater were generally detected at low concentrations. Elevated concentrations of benzo(a)pyrene were noted at 176 Main Street and 268 Main Street, southwest of MMC. An elevated concentration of pentachlorophenol was noted at 176 Main Street and the Strong School contained bis(2-ethylhexyl)phthalate at an elevated concentration.

Seven metals (aluminum, arsenic, iron, lead, manganese, magnesium and mercury) have been detected in bedrock groundwater at elevated concentrations in at least one sample. Sampling for metals was not conducted comprehensively and samples were collected primarily from residential wells. Metals detected at elevated concentrations in potential source area locations were aluminum, iron, and lead in DMC Well No. 2; arsenic, lead, iron, and manganese in the Strong School well; arsenic in the 168 Main Street well; and arsenic, aluminum, lead, and iron in the 174 Main Street well.

3. Fate and Transport of Contamination

Chemicals released at the MMC and DMC facilities have migrated to some extent into soil, groundwater, sediment and surface water. There are several transport pathways and processes that govern the mobility and fate of these chemicals at the MMC and DMC Study Areas. Potential migration pathways include volatilizing of contaminants into the vapor phase (soil vapor), transport of contaminants through the unsaturated zone (pure-phase DNAPL or dissolved phase in percolating groundwater), transport of contaminants through the saturated zone (pure-phase DNAPL or dissolved phase in groundwater) and surface runoff or discharge of contaminated groundwater to nearby surface water and sediments. Groundwater contaminants in the Site-wide Groundwater Study Area migrate through the Site via volatilization and DNAPL transport through the unsaturated overburden and/or unsaturated bedrock fractures and migration of DNAPL or groundwater transport of dissolved contaminants in the saturated overburden (DMC Study Area only) and into fractures of the saturated bedrock aquifer. At the MMC Study Area, the saturated zone is located primarily within the bedrock.

<u>MMC Fate and Transport of Contamination</u>

Currently, most areas of concern within the MMC Study Area are not covered with impervious materials. The ground surface is relatively flat at the MMC Study Area but slopes gently eastward beginning about 100 feet east of the existing building toward a fresh water wetland that lies between the MMC facility and Ball Brook. Because of the pervious surface and relatively flat ground surface, precipitation will percolate vertically through these areas. Within the unsaturated zone, when percolating water comes into contact with contaminated soils, many of the chemicals will dissolve and migrate with the water in a dissolved phase through the unsaturated zone to the saturated zone.

Chlorinated solvents presumably entered the soil at the MMC Study Area in the source areas described above through spills, leaks, industrial processes, and disposal practices. Chlorinated VOCs are denser than water and can occur as DNAPL. DNAPL released to the ground tends to penetrate through the unsaturated zone into the groundwater leaving a path of residual DNAPL within the fractured till, pooled on top of fine grained till layers, in depressions on the bedrock surface and/or in the bedrock fractures. DNAPL in the till migrates primarily through the interconnected network of fractures and joints. It likely spreads horizontally through the horizontal and near horizontal fractures and vertically downward through the less frequent vertical joints. Variations in grain-size and porosity of the till matrix can cause additional horizontal spreading, diffusion, and/or dissolution of the contaminants as water and DNAPL migrate through the till. Nearly all the wells in the Site-wide Groundwater Study Area, including the facility production wells and the residential wells, are deep open-hole wells. Downward vertical flow of DNAPL is caused by the influence of gravity and the density of the pure phase chlorinated solvents. Downward flow of DNAPL and dissolved phase contaminants into bedrock may have been induced by historic pumping at various residential wells and industrial supply wells through the processes of pool mobilization and/or borehole short-circuiting. (Pool mobilization and borehole short-circuiting are described in Section I.3 of this ROD.)

Adsorption will be the dominant fate mechanism for most PAHs and metals at the Study Area. PAHs have relatively high organic carbon partition coefficient (K_{oc}) values and will adsorb to organic soil particles and organic matter, and therefore will not migrate appreciably as a dissolved phase in the unsaturated zone. Adsorption of metals through various processes will also occur in the unsaturated zone.

The results of soil gas surveys at the MMC Study Area indicate that the high vapor pressure of the chlorinated compounds caused a vapor plume to develop within the till matrix and fractures. Water migrating through the unsaturated zone can be contaminated by the vapor plume and/or residual DNAPL in the fractures, thereby spreading the zone of contamination. The till is generally unsaturated at the MMC Study Area, but contaminants migrating through the till may diffuse into discontinuous or seasonal water zones providing an ongoing source of contamination. Seasonal fluctuations in the water table can sometimes saturate the till immediately above the bedrock surface, thereby providing additional dissolution and dispersion of residual DNAPL.

Overland flow (runoff) and groundwater from the MMC Study Area likely discharges to the wet meadow. The wet meadow then drains into Ball Brook. The data collected in 1993 and 1998 do not indicate that Study Area contaminants have migrated to surface water. Major metal ions and heavy metals occur naturally in surface water and, as indicated above, metals concentrations were similar upstream and adjacent to the Study Area.

Sediment samples were collected upstream of and adjacent to the MMC Study Area in 1993 and 1998. Sediment samples collected in 1998 contained several VOCs (mainly chlorinated solvents), SVOCs (mainly PAHs), pesticides, and metals. The 1993 sediment samples showed similar results except that no chlorinated VOCs were detected. The two VOCs (2-butanone and toluene) that were detected in 1993 were also detected in an upstream sediment sample (SE-1). SVOCs, pesticides, PCBs, and metals were also detected in the upstream sediment locations.

While it appears that many of the detected contaminants could be attributed to upstream sources, the presence of several chlorinated solvents in 1998 sediment samples could likely be attributed to transport from the MMC facility. Sediment transport occurs though overland flow (runoff), scouring, and re-suspension in flowing surface water bodies.

DMC Fate and Transport of Contamination

The DMC Study Area is largely covered with impervious material (building footprints, pavement). The unsaturated zone at the DMC Study Area consists of a layer of porous, disturbed fill that is approximately 3 feet thick. Below the unsaturated zone is a layer of lodgment till that extends to bedrock surface. The water table is contained within this till layer. Transport through the saturated till layer is described below.

Chlorinated VOCs and BTEX compounds are the primary contaminants at the DMC Study Area. Chlorinated VOCs are denser than water and can occur as DNAPL. BTEX compounds are indicative of petroleum-related contamination. .

Chlorinated solvents likely entered the soil at the DMC Study Area in the source areas described above through spills, leaks, industrial processes, and disposal practices. The source and extent of BTEX compounds, identified by LB&G east of the main building (in the vicinity of soil boring B5), have not been identified to date. Since a large portion of the DMC property is covered with impervious material, it is likely that the BTEX contamination will infiltrate the porous media and move downward to the water table with gravity. The contaminants will either dissolve or, if present as LNAPL, may float and move with the rise and fall of the water table.

Below the unsaturated zone is a layer of lodgment till that extends to bedrock surface. The water table is found within this layer and can fluctuate several feet due to seasonal wet and dry cycles. The USGS reports that this till is likely fractured with horizontal to near horizontal fractures connected by less frequent vertical joints. DNAPL migrating through the unsaturated till enters the saturated till. Migration into and through the saturated till is affected by gravity, capillary pressure, interfacial tension, and interconnectivity of the fractures. In order for DNAPL to migrate into fractures and/or pores within the till, it must overcome the entry pressure in the saturated medium. Narrow fractures or smaller pores will generally have higher entry pressures than wide fractures or large pores. DNAPL may pool until the vertical extent exceeds the entry pressure for the fractures, and then migrate downward, or it can spread horizontally until wider fractures or pores are encountered before downward migration occurs.

Dissolution can reduce the volume of the DNAPL as it migrates through the saturated zone. Pooled or residual DNAPL may settle into dead-end fractures or zones where further migration is prevented. This DNAPL can provide an ongoing source of dissolved phase contamination via dissolution which can continue for many years. Dissolved phase contamination can diffuse into the matrix porosity of the till or rock when contaminant levels in the fractures are relatively high, then re-diffuse from the matrix back into the saturated fracture at a later time, prolonging natural attenuation or clean-up attempts.

Downward vertical flow of DNAPL is caused by the influence of gravity and the density of the pure phase chlorinated solvents. Downward flow of DNAPL and dissolved phase contaminants may also be induced by pumping in DMC water supply wells located in the vicinity of suspected source areas through the processes of pool mobilization and/or borehole short-circuiting. Water withdrawal rates of 50 to 60 gpm were historically reported for cooling water supply from DMC Well No. 2. DMC Well No. 1, located near the former solvent storage area, is used as the potable water supply well for the facility. DMC Well No. 3, located near the former waste disposal areas, is reportedly used for quench water to cool the ovens used for baking paint on the metal boxes and other products. Drawdown that is induced during pumping creates a downward hydraulic gradient near these wells and lowers the entry pressure for DNAPL. All three DMC wells are located near contaminant source areas or where significant contaminant concentrations were detected in the overburden.

Shallow groundwater in the saturated till at DMC flows eastward toward the wetlands and Ball Brook. Dissolved phase contaminants are transported downgradient, mainly through the fractures in the till, and eastward toward Ball Brook. Some eastward groundwater flow exists within the till matrix but the intergranular hydraulic conductivity is low. Therefore, the majority of groundwater flow is attributed to near horizontal interconnected fractures. The intergranular porosity of the till reported by USGS was 21 to 32 percent, indicating that significant contaminant diffusion into the till matrix is likely.

In November 1998, fieldwork was conducted at the Durham Meadows Superfund Site as part of an EPA Screening-Level Ecological Risk Assessment (SLERA). Soil, surface water, and sediment samples were collected [USEPA, 2005, Final Screening-Level Ecological Risk Assessment]. Surface water was sampled at four locations in the vicinity of the DMC facility including PND ("cooling water pond", also known as the aeration pond), BB1 (downstream of DMC), BB2 (embayment of Ball Brook) and BB3 (upstream of DMC). The only VOCs detected in sample BB2 consisted of 1,1,1-TCA, 1,2-DCE, and TCE. TCE and 1,2-DCE were also detected in the sample from the cooling water pond (PND). The SVOCs diethylphthalate and dimethylphthalate were detected in the cooling water pond sample. No SVOCs were detected at locations BB1, BB2, or BB3. No pesticides or PCBs were detected in any of the four surface water sample locations. In general, metal concentrations were similar for samples collected in the cooling water pond (PND) and adjacent to the DMC facility (BB2), but noticeably higher than those measured in the samples upstream and downstream of BB2.

It is likely that VOCs (1,1,1-TCA, 1,2-DCE, and TCE) are migrating to surface water at location BB2. This migration could be due either to overland flow (runoff) or from groundwater discharge to the vicinity of location BB2; however, concentrations of these chemicals in overburden groundwater in the vicinity of BB2 are also elevated, indicating that surface water may be impacted by groundwater discharge.

In 1998, sediments were sampled at four locations in the vicinity of the DMC facility including PND ("cooling water pond", also known as the aeration pond), BB1 (downstream of DMC), BB2 (embayment of Ball Brook) and BB3 (upstream of DMC). Analytical results indicated the presence of VOCs in the sample collected from the on-site cooling water pond. VOCs detected in the cooling water pond sample included PCE, TCE, 1,1,1-TCA, 1,1-DCE, and 1,2-DCE. Methylene chloride and trichlorofluoromethane were detected in upstream sample BB3. Vinyl chloride and 1,2-DCE were detected in sample BB2, collected adjacent to the DMC facility. No VOCs were detected in downstream sample BB1 [USEPA, 2005]. Numerous SVOCs were detected in all four samples collected. No pesticides or PCBs were detected in any of the four sediment samples. Metals concentrations in sediment (barium, copper, nickel, magnesium, zinc) tended to be higher at location BB2, adjacent to the DMC facility. It is likely that VOCs (1,2-DCE and vinyl chloride) are migrating to sediments in the vicinity of sample location BB2. It is unknown if the migration is due to overland flow (runoff) and deposition of contaminants or from groundwater discharge and deposition of contaminants.

Site-wide Groundwater Fate and Transport of Contamination

Releases of chemicals to the environment have occurred within the Durham Meadows Superfund Site. These contaminants have migrated into the soil, overburden groundwater, and the bedrock aquifer. There are several transport pathways and processes that govern the mobility and fate of chemicals in Site-wide Groundwater Study Area.

Potential migration pathways include volatilization and transport of free-phase contaminants through the unsaturated overburden and/or unsaturated bedrock fractures and migration of free-phase or groundwater transport of dissolved contaminants in the fractures of the saturated bedrock aquifer. Along these migration pathways, several processes may occur that can affect the extent to which chemicals will migrate. These processes involve physical mechanisms and chemical reactions between the chemical and environmental media that will act to promote or attenuate chemical migration.

Bedrock groundwater in the MMC Study Area within the fractured bedrock aquifer flows through fracture openings, that are generally small in size (tens of microns); and account for less than 1% of the bulk volume of rock. Fractures in most natural settings have preferred orientations. The intersections of the fractures create the geometric network of the fracture system. The direction of groundwater flow and contaminant transport in fracture systems is dependent upon the orientation and connectivity of the network.

Contaminants near MMC migrate through the thin mantle of fractured till into the bedrock fractures. The patterns evident in the contaminant plume maps (Figures 4.3-11 through 4.3-18 in the RI [M&E, 2005a]) indicate that contamination is migrating toward the south-southwest along the primary fracture direction reported by USGS, then southward coincident with one of the minor fracture directions [USGS, 1995].

Concentration versus distance cross-sections and the plume maps indicate that the plume is still attached to the potential source area (Figures 4.3-19 through 4.3-21 and 4.3-11 through 4.3-18 in the RI [M&E, 2005a]). The majority of bedrock water supply wells in the MMC area are located southwest of MMC and there are few wells located toward the east. It appears that dissolved phase contamination may be influenced by pumping of the numerous water supply wells southwest of MMC as well as by the direction of fractures and joints. The diffusion or re-diffusion (called back-diffusion) of dissolved phase contamination into/from the fractures and micro-fractures is possible where matrix porosity and/or microfractures exist along the fracture faces. Operation of the on-site water supply wells likely created a downward vertical gradient in the well's area of influence. This downward gradient could cause the downward migration of DNAPL and/or dissolved phase contaminants faster and to a greater extent than would normally be expected under non-pumping conditions.

The long open-hole sections of bedrock water supply wells and the monitoring wells at MMC may have promoted the vertical migration of contamination in the bedrock aquifer as a result of borehole short-circuiting. Geophysical data reported by the USGS indicates that both downward and upward vertical flow exists within the wells tested. Vertical flow may vary in time, rate, and direction depending upon pumping in nearby water supply wells. This further serves to complicate the interpretation of contaminant migration, promotes mixing of dissolved phase contamination between fracture sets, and allows downward migration of DNAPL where DNAPL is present.

If DNAPL is present above or within fractured bedrock, it has the potential to migrate laterally from the source area as well as downward. The reason for this migration is that little dilution will occur within the fractures. The depth of DNAPL penetration within fractured bedrock will depend upon the fracture aperture width, entry pressure, dip of the fractures, DNAPL volume, and density. Penetration depth is very difficult to predict even in the most characterized bedrock settings [Pankow and Cherry, 1996]. The steeply dipping fractures in bedrock at the Site can serve as migration pathways for DNAPL that enters the bedrock fracture network. Based upon the connection of fractures with long open-hole bedrock sections in the on-site wells near the source areas, it appears that on-site monitoring wells and the on-site water supply well may also provide pathways for the downward migration of DNAPL. Pumping in nearby off-site water supply wells likely lowers entry pressures in connected fractures thus mobilizing DNAPL and allowing it to enter on-site wells near the source areas and allowing it to cascade downward to the bottom of the on-site water supply well and source area monitoring wells. Over time, pooled DNAPL will reach an equilibrium depth and will not continue to be mobile unless pumping rates are increased, thus decreasing the entry pressure even further.

The direction and physical processes of contaminant migration near DMC are similar in most respects to MMC with contaminants migrating through the fractured till into the bedrock fracture network. Extensive areas of overburden contamination at DMC near the former solvent tanks, degreasers, and waste disposal areas provide a persistent source for contaminant migration into the bedrock fractures. Steeply dipping fractures and long open-hole bedrock sections in the local water supply wells contribute to the vertical migration of contamination and mixing within the fracture networks intersected by the wells. These wells are likely a critical factor in the spread of contamination from DMC where DMC Well Nos. 1, 2, and 3 are 750, 400, and 340 feet deep respectively with open-hole sections of 666, 375, and 259 feet. The presence of these open-hole bedrock wells and the high dip angle of the bedrock fractures likely promote the downward migration of DNAPL and mixing of dissolved phase contamination throughout the bedrock aquifer.

The bedrock groundwater plume maps for DMC illustrate south and southwesterly contaminant migration, coincident with the major and minor fracture orientation. However, additional analysis indicates the potential for influence due to pumping and/or other possible contaminant sources that further complicate the interpretation of the data.

The USGS reported that groundwater flow in the DMC Study Area is controlled by bedrock structural features and affected by groundwater withdrawals from wells. The southwestern and southern contaminant trends coincide with reported fracture trends, but there are several water supply wells operating in the DMC area with relatively high capacities compared to the local residential wells. Two of the DMC supply wells and the Strong School well (when it was operating) likely pulled DNAPL and dissolved phase contamination through fractures and joints from different directions than normally would be expected. DMC Well No. 2 operates continuously at approximately 20 gpm for source control, and DMC Well No. 1 is used as a drinking water supply well, after the water is treated [LB&G, 2005].

DMC Well Nos. 1 and 2 are located along the Ball Brook fault. The results of the USGS borehole geophysical program indicate that DMC Well No. 2 intersects the Ball Brook fault at approximately 200 feet below ground surface. It is likely that DMC Well No. 1 also intersects the fault, but the well was not logged or tested. Contaminant levels in DMC Well Nos. 1 and 2 are lower than expected, possibly due to less contaminated groundwater being drawn along the fault zone and through interconnected fractures toward DMC due to the constant pumping of DMC Well No. 2. Aquifer test results indicate that DMC Well No. 2 potentially had an area of influence greater than 700 feet northeast and approximately 500 feet toward the south at pumping rate of 100 gpm for a period of 5 hours [LB&G, 1982].

The persistence of contamination in groundwater samples collected from the residential water supply wells indicates that DNAPL may potentially be present nearby. Although these wells likely pump at low rates (probably 2 gpm or less) drawdown in the wells could be significant, depending upon the hydraulic conductivity of the interconnected fracture network. This could lower the entry pressure for fractures intersecting the well and/or affect the hydraulic pressure gradient thereby mobilizing pooled DNAPL. Mobilized DNAPL could potentially migrate from the DMC source areas toward these residential wells through dipping or plunging fractures. Based upon the anecdotal evidence of solvent stored in a dirt-floor basement, and the results of the soil gas survey conducted by LB&G, it is also possible that chlorinated solvents may have been released and DNAPL may have entered the bedrock near these sites. Potential dissolution of residual DNAPL could have resulted in diffusion of contamination into the bedrock matrix.

Contaminant levels at the Strong School are higher relative to the DMC supply wells which is likely due to dissolved phase contamination being drawn through the north-northeast to south-southwest and north to south trending fractures from DMC by extended periods of pumping. Although records were not available for the Strong School well, groundwater withdrawals were likely more frequent and at a significantly higher pumping rate than nearby residential wells. The Strong School well is 386 feet deep with 259 feet of bedrock open-hole. Pumping at the Strong School also potentially lowered the water levels in nearby fractures, likely resulting in significant drawdown in this fractured bedrock aquifer. Lowering the water levels in fractures could have potentially changed the hydraulic pressure gradient in the area, allowing pooled DNAPL to migrate and/or lower entry pressures for DNAPL to enter bedrock fractures. DNAPL could have migrated along south or southwesterly dipping fractures from DMC toward the Strong School. Potential dissolution of DNAPL and/or residual DNAPL may have resulted in diffusion of dissolved phase contamination into the bedrock matrix via intergranular porosity and/or microfractures. Given the available data, it is possible that contamination detected in the Strong School well is drawn from both the DMC site and the area near 168 and 174 Main Street by extended and relatively high-rate pumping of the Strong School water supply well.

The Strong School stopped using its water supply well (191 Main Street) in August 2004 in favor of a hookup to the District 13 Consolidation well system. This well system consists of two wells located at the Coginchaug High School and one well located at the Korn Elementary School (well system license No. CT0380472).

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The area surrounding the Site is primarily residential, and includes local businesses, school buildings, churches and light industry. The area along Main Street, which includes both the MMC and DMC properties, is zoned for residential use within 150 feet of the street and residential/farm use beyond 150 feet. Permitted uses within the Main Street Residential and Farm Residential districts are specified in the Town of Durham, Connecticut Zoning Regulations (As Amended to June 1, 2003), Section 05.01 [Town of Durham, 2003a]. The schedule shows uses permitted by right, uses permitted as a special exemption, uses permitted by right subject to a site plan review, and uses not permitted.

Neither MMC nor DMC conform to the zoning requirements of the district in which they are located, but are protected in the zoning regulations as long established businesses. The zoning regulations also allow for expansion of non-conforming manufacturing establishments to not over 150% of the area occupied at the time of the enactment of the regulations. The regulations further specify conditions under which non-conforming use can be changed or terminated. Termination of a non-conforming use occurs only upon voluntary discontinuance or abandonment by the property owner as specified in the regulations.

This section focuses mainly on the MMC and DMC Study Areas, where the most significant cleanup activities will occur. It should be noted that the federal government does not have an ownership interest in the MMC and DMC parcels.

DMC Study Area

DMC is located at 201 Main Street and 203R Main Street. DMC currently owns three separate parcels totaling approximately 25 acres. The parcel that fronts on Main Street, which houses the original building, is 3.6 acres. A larger parcel to the east is 14.5 acres, and is bisected by Ball Brook; DMC has expanded operations onto the westerly portion of this second parcel. The most easterly parcel is 7.1 acres and is currently undeveloped. The DMC Study Area, where Superfund investigations and sampling have occurred, measures approximately 10.5 acres.

The parcels are located in an area of mixed use that includes residential, commercial and industrial applications. The surrounding parcels on Main Street are mainly residential homes. The Strong School, at 191 Main Street, and an athletic field are located immediately to the south. The Coginchaug High School and the Korn Elementary School are located to the east of DMC, and are not impacted by the Site.

DMC has been in business at this location since 1922, and has expanded its manufacturing operations several times in the last decade. On June 27, 2003, a newspaper article in the Town Times, reported that DMC considered expansion into undeveloped portions of land at the rear of the property (to the east of the site and across Ball Brook) but that expansion considerations are now on hold. No Superfund sampling or investigations have occurred east of Ball Brook. Superfund interest is focused mainly on the parcels west of Ball Brook.

The property is currently zoned residential within 150 feet of Main Street, and residential/farm beyond 150 feet. The original structure was built prior to the implementation of zoning regulations, and the Town of Durham reports that DMC has maximized all available expansion potential on the Main Street parcel.

A single, one-story brick manufacturing building and paved parking area occupies the majority of the parcel. A large steel-sided warehouse-style building was added to the facility in the early 1990's, between the original building and Ball Brook to the east. There is a portion of this parcel that is subject to wetlands regulation, and identified in the Town of Durham's Plan of Conservation and Development [Town of Durham, 2003b]. Nearly all of the area on this parcel has been covered by the DMC building and associated parking areas. The parking lot ends at a steep slope leading to a small, unlined cooling pond, which is separated from Ball Brook by a low earthen ridge. Access is available from Main Street.

The parcel across Ball Brook was previously used as a tree farm. This parcel is owned by DMC and may be available for expansion.

No significant soil cleanup has occurred yet under the Superfund program or state order. Most areas of soil contamination are located towards the front (western end) of the parcel. Overburden (shallow) groundwater on this parcel is contaminated, and there are a number of monitoring wells on this property. A multiphase extraction system was reported to have been operated in the mid-1990's however, data on the effectiveness of the system was not provided to EPA.

Current Uses: The parcels west of Ball Brook are actively used by DMC for its production operations.

Potential Future Uses: It is expected that the property associated with the Superfund Site will continue being used for its current purpose. Since the company has reportedly maximized its expansion potential on such property, it is reasonable to assume that no further expansion or construction (industrial, commercial, or residential) will occur west of Ball Brook.

It is also assumed that DMC will continue to operate its business at this location. The owner has not indicated any plans to sell or relocate, and the Town has not expressed any interest in acquiring the property. The Town has not reported any delinquency on DMC's property taxes. Further, the current use appears to be compatible with the Town's Master Plan and no zoning changes involving this area are currently anticipated.

Potential Use/Reuse Considerations: DMC is likely to continue its manufacturing use for the foreseeable future. The parcel is zoned in such a way that it could, however, revert back to residential use. Potential future residential use of this property was therefore considered in the RI/FS and the human health risk assessment as a conservative, worst-case scenario with respect to exposure.

MMC Study Area

MMC was located at 281 Main Street until most of the building burned down in 1998. MMC and affiliated businesses have relocated to and continue manufacturing operations at another facility located outside of the Site boundaries in Middletown, Connecticut. A small warehouse-style portion of the original building still stands at the rear of the property, east of Main Street. This building is in fair condition and has been leased to Continental Fabrication, a small-sized manufacturer of metal parts. Most debris from the original building foundation was cleared, although pavement debris was found during soil sampling activities in 2003. Most debris was located in the former loading dock area and near the driveway.

The property is currently zoned residential within 150 feet of Main Street, and residential/farm beyond 150 feet. The original structure was built prior to the implementation of zoning regulations, and the Town of Durham reports that, before the 1998 fire, MMC had maximized all available expansion potential.

The parcels on which MMC were located are owned by the Estate of Mr. Allan Adams, the former owner and president of MMC. The surrounding parcels on Main Street, including immediate neighbors, are residential homes. The residence at 289 Main Street, just to the north of the Merriam property, is located extremely close to the property line and former location of the factory building. The residence at 275 Main Street is located on a separate parcel, also owned by the Estate of Mr. Adams. Throughout its historical operations, the demarcation between the 275 Main Street and 281 Main Street parcels has not always been clear; it appears from historical photos that limited site operations and/or employee parking at MMC may have occurred on the rear portion of the 275 Main Street parcel, behind the existing residential home.

MMC was located on and conducted most operations on two parcels, measuring 1.03 acres and 2.37 acres. The residence at 275 Main Street is located on a parcel measuring 0.46 acres. The MMC Study Area includes all three parcels, measuring approximately 3.86 acres.

East of the remaining building is a downward drop in elevation to a fairly extensive wet meadow that leads to Ball Brook. A drainage swale begins on the southern edge of the property, and turns to the north behind the former lagoon, eventually widening at, and discharging to, the wet meadow. This area appears to be a seasonally saturated wet meadow; standing water has been observed in the wet meadow during the spring.

EPA installed a six-foot high chain-link fence around the front portion of the property in May 2003. The fence is likely to remain in place for the foreseeable future, probably until most cleanup activities have been completed. Continental Fabrication keeps a gate open to the property during business hours.

While MMC has conducted a number of onsite investigations under state order, no significant soil cleanup has occurred under the Superfund program or state order, other than the removal of an underground storage tank for fuel oil and associated contaminated soil in 1999. The tank was discovered during debris removal after the bulk of the building burned in 1998.

Most areas of documented soil contamination are in the former locations of the loading dock, drum storage area, and lagoons. An additional area of soil and soil gas contamination is located centrally on the property, within the former building footprint, on or around the former location of degreasers. Other small areas of soil and/or soil gas contamination are located throughout the front portion of the property, in and around the former building footprint, and at the rear of the 275 Main Street parcel.

Groundwater beneath the parcel is contaminated with VOCs. There are currently five bedrock monitoring wells onsite. MW-4, located east of the private residence at 275 Main Street, was converted to a supply well after the 1998 fire destroyed the original MMC supply well. Underground piping runs between MW-4 and the 275 Main Street residence. Piping also runs between MW-4 and the existing onsite building. Existing monitoring wells must remain in place for ongoing collection of data.

Current Uses: Continental Fabrication is the only active use of the MMC property; the 275 Main Street residence is rented out as two separate apartments, and both apartments have tenants.

Potential Future Uses: There is considerable uncertainty regarding the future reuse of this parcel. With the exception of the Continental Fabrication facility, the remainder of the property has been unused since the main building was destroyed by fire in 1998. In the past, the parcel was privately owned, and the owner did not develop any plans to reuse the property. Town Officials had expressed interest in the past for using this property for potential municipal-related uses, including the possibility of elderly housing or a community/senior center, or maintaining the tax base by allowing rebuilding of another light industry or office/commercial building. While the community had not been extensively surveyed regarding its opinion on these matters, some local residents expressed a preference that the property not be reused for industrial purposes.

Under the existing zoning, residential homes could also be built on the property. If this were to occur, future use of the property would then default to the area's residential and residential/farm existing zoning, and industrial/commercial use would be prohibited.

Given this uncertainty, there was a range of reasonably anticipated future land uses due to current zoning regulations. The Feasibility Study considered this range during the development of remedial action cleanup objectives for the MMC Study Area [M&E, 2005b, Draft Final FS]. Potential future residential use of this property was considered in the FS and the human health risk assessment as the most conservative assumption with respect to exposure, however, and the remedy is tailored for potential future residential use.

Resolution of Site liabilities, and the recent death of the property owner, are major complications for reuse of this property, as described below.

Potential Use/Reuse Considerations: The most significant complicating factor in potential reuse of this parcel comes with the passing of Mr. Allan Adams in October 2004. The Town of Durham received notice from the Probate Court in early July 2005 of a hearing date for the reading of Mr. Adams' will. The will states that Mr. Adams bequeathed the 281 Main Street parcel to the Town of Durham for use as elderly housing. The Town was reportedly required to officially accept the gift or disclaim it by July 19, 2005, nine months from the date of death. Given the late notice, and the Town's resulting inability to fully investigate the property and satisfy the Town Charter requirements for town meeting approval of land acquisitions to be used for town purposes, the Town of Durham elected to disclaim the property.

As of September 2005, the property remains in Probate Court and its disposition is unclear.

In early 2005, EPA noticed the Estate of Mr. Allan Adams of its potential liability at the Site. EPA filed a lien against the MMC factory property at 281 Main Street, Durham, on August 27, 1997; the lien was filed with the Town of Durham at Volume 154, Page 784.

While EPA did file a lien against the MMC property, the federal government does not have an ownership interest in this parcel.

Numerous other factors that may affect potential reuse of the site are related to the need for cleanup of the parcel and the timeframe for any such cleanup activity. The cleanup remedy will include restrictions on groundwater use, and potentially land use. There may be restrictions on areas of the site that could be graded to accommodate reuse. Reuse must accommodate existing and any future monitoring wells, as well as any remaining longer-term cleanup structures (e.g., soil vapor extraction system). The impacts of ongoing cleanup activities (such as truck traffic, noise, dust, etc.) may also affect the timing of reuse, although the legal disposition of the property is likely to play a larger part in determining when this property can be reused. Town Officials had also noted that another limiting factor may be the need to construct a new septic system on the property; the wetland area behind the remaining building onsite may also be a limiting factor in this regard.

Site-wide Groundwater Study Area

The aquifer is currently used as a source of drinking water. In 1982, after contamination was discovered in private drinking water wells, under a CT DEP order, MMC and DMC installed carbon filters on impacted residential wells. Since then, the two companies have monitored and maintained up to 38 filtered wells on at least a quarterly basis. DMC is responsible for servicing 14 of these wells. MMC is responsible for servicing 24 of these wells, but ceased these activities in late 2004; CT DEP has taken over monitoring and maintenance of these locations.

Regional School District #13 was maintaining and monitoring filters at the Strong School at 191 Main Street in Durham until August 2004, when it connected to a well system at the Coginchaug Regional High and Korn Elementary Schools (to the east, and not impacted by the Site). The well located at 191 Main Street has been sealed and can no longer be used.

EPA discovered 1,4-dioxane in 2003-2004 in wells at MMC, DMC, and at a number of residences. Because this compound is not effectively captured by the current carbon filters, CT DEP is supplying bottled water for drinking to several affected homes in the northern portion of the Site, and requires monitoring for this compound at a number of residences throughout the Site.

The groundwater at the Site is currently classified by the State of Connecticut as "GA" (suitable for drinking without treatment) or "GA*" (not currently drinkable without treatment but targeted to be restored to GA standards in the future). The overburden and bedrock aquifers in the study area, however, have limited productivity and are not expected to yield sustainable, significant quantities of water for use as a public drinking water resource.

There is currently no source of public water in the area of the Site. The Durham Center Division of the Durham Public Water System is located to the south of the Site, and serves approximately 35 locations along Cherry Lane, Fowler Avenue and Main Street. The system uses two wells, with a combined estimated yield of 15 gallons per minute. This system was previously owned and operated by the Eastern Connecticut Regional Water Company; the Town of Durham obtained the exclusive water service area and purchased this system in 2002. The Town of Durham is currently making repairs and improvements to the system. As of September 2005, the Town of Durham, in conjunction with the Connecticut Department of Public Health, is investigating the potential use of the Durham Fairgrounds Wells for a future source of water to the Durham Center System. These wells are located southwest of the Site, and have been suggested as another potential source of water to serve affected private wells at the Site.

Preliminary results of a recent 72 hour pump test for simultaneous operation of the two Fairgrounds wells exhibited a capacity of approximately 170 gallons per minute (verbal communication between Martin Beskind of CT DEP and William Milardo, Local Health Officer, Town of Durham, September 8, 2005). The test was conducted for the Town of Durham in July 2005; results are to be confirmed in a report to be provided to the Town of Durham.

There are several other areas surrounding the Superfund Site where chemical contaminants render the groundwater unsuitable for drinking without treatment. To the north of the Site is a smaller area of contaminated groundwater in the vicinity of Main Street and Marina Place where several private wells are contaminated with gasoline constituents released by former service stations located on Main Street. Another area of gasoline-related contamination exists north of the Site on Main Street near the former Dairy Mart. Solvent contamination has impacted approximately six private wells near the intersection of Maple Avenue and Middlefield Road, the source of which is not currently known. An area of groundwater contamination exists near the former landfill that straddles the border of the Towns of Durham and Middlefield. Last, one well along Maiden Lane, east of the Site, is contaminated with gasoline-related substances from a spill on a nearby farm.

No public sewers are located near the Site; area homes and businesses use septic systems.

The current use of surface water at the Site is for recreation only (e.g., wading), although Ball Brook is not of a size to support recreational uses such as boating, or sustenance fishing.

Stakeholder input on current and potential future Site and resource uses were obtained through meetings with representatives of the Town of Durham and the Mid-State Regional Planning Agency. CT DEP issued the Ground Water Use and Value Determination for the Site on July 5, 2005 [CTDEP, 2005b]. CT DEP has classified the aquifer for drinking water purposes; however, the overburden and bedrock aquifers in the study area are not expected to yield sustainable, significant quantities of water for use as a public drinking water resource.

Regarding community input on future land use, EPA published a public notice and brief analysis of the Proposed Plan in The Middletown Press on July 9, 2005, and announced the availability of the plan and supporting documents beginning July 13 at public information repositories at the

Durham Public Library and at EPA's office in Boston, Massachusetts. The Proposed Plan was subsequently mailed to over 400 local residents. The Proposed Plan included a notice to the public of the availability of a Draft Reuse Assessment as part of the Site Administrative Record, and solicited comments on this document. No specific comments on the Reuse Assessment were submitted during the public comment period, although the draft document did not include developments in 2005 regarding the ownership of the Merriam Manufacturing Company parcel.

G. SUMMARY OF SITE RISKS

EPA performed a baseline human health risk assessment and a screening-level ecological risk assessment to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. The assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action.

The baseline human health risk assessment followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the Site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates.

A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below followed by a summary of the environmental risk assessment.

1. Human Health Risk Assessment

Hazard Identification

Forty-five of the more than 100 chemicals detected at the Site were selected for evaluation in the human health risk assessment as chemicals of potential concern. The chemicals of potential concern were selected to represent potential Site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Tables 2.1 through 2.11 of the risk assessment [M&E, 2005d, Draft Final Baseline Human Health Risk Assessment]. From this, a subset of the chemicals were identified in the Feasibility

Study as presenting a significant current or future risk (cancer risk exceeding one in a million or hazard quotient exceeding the threshold level of 1) and are referred to as the chemicals of concern in this ROD and summarized in ROD Tables 2 through 9 for surface soil, indoor air, shallow groundwater, and bedrock groundwater. These tables contain the exposure point concentrations used to evaluate the reasonable maximum exposure (RME) scenario in the baseline risk assessment for the chemicals of concern. Exposure point concentrations for both RME and central tendency exposure scenarios for all chemicals of potential concern can be found in Tables 3.1 through 3.11 of the risk assessment [M&E, 2005d].

Exposure Assessment

Current and potential future Site-specific pathways for exposure to chemicals were determined. The extent, frequency, and duration of current or potential future exposure were estimated for each pathway. From these exposure parameters, a daily intake level of each Site-related chemical was estimated.

The following is a brief summary of just the exposure pathways that were found to present a significant risk. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 3.0 and on Tables 4.1 through 4.12 of the risk assessment [M&E, 2005d].

The following current exposure pathways were found to present a significant risk:

- Adjacent resident (adult and young child) with exposure to surface soil (by ingestion and dermal contact) and indoor air (by inhalation) at the MMC Study Area;[1]
- Commercial worker exposure to untreated groundwater (by ingestion and dermal contact) from the DMC Study Area supply well (DMC #1);[2]
- Residential household water exposure to untreated groundwater (by ingestion, dermal contact, and inhalation) from private bedrock wells.[3]

[1] For current residential soil exposures, ingestion of 100 mg/day for 24 years was presumed for an adult. For a young child (age 1 to 6), ingestion of 200 mg/day for 6 years was presumed. Body weights of 70 kg and 15 kg were used for the adult and child, respectively. Dermal contact was assumed with 5,700 cm^2 of surface area for the adult and 2,800 cm^2 for the child. Soil exposures were assumed to occur 150 days/year. The Johnson & Ettinger Model was used to estimate indoor air concentrations from measured soil gas concentrations. Inhalation of indoor air was assumed to occur 24 hr/day, 350 days/yr, for a combined exposure duration of 30 years.

[2] For current untreated contaminated groundwater, a drinking water ingestion rate of 1 L/day was assumed for commercial workers. An exposure frequency of 250 days/year was used for an exposure duration of 25 years. A body weight of 70 kg was used. Dermal contact was assumed with 2,479 cm^2 of surface area. Washing was assumed to occur 250 days/year for 0.5 hr/day.

[3] For current exposures to untreated groundwater from private wells, drinking water ingestion rates of 2 L/day and 1.5 L/day for the adult and child, respectively, were assumed. An exposure frequency of 350 days/year was used for a combined exposure duration of 30 years. Dermal contact was assumed with 18,000 cm^2 of surface area for the adult, and 6,600 cm^2 for the child. Showers/baths were assumed to occur 350 days/year for 0.58 hr/day for the adult and 1 hr/day for the child. Airborne concentrations of volatile compounds released during showering/bathing were estimated using the Foster and Chrostowski

The following future exposure pathways were found to present a significant risk:

- Resident (adult and young child) with exposure to surface soil (by ingestion and dermal contact) and indoor air (by inhalation) at the MMC Study Area;[4]
- Resident (adult and young child) with exposure to indoor air (by inhalation) at the DMC Study Area;[5]
- Construction worker exposure to shallow groundwater (by dermal contact and inhalation of vapors) at the DMC Study Area;[6] and
- Residential household water exposure to untreated groundwater (by ingestion, dermal contact, and inhalation) from the Site-wide Groundwater Study Area.[7]

Toxicity Assessment

EPA assessed the potential for cancer risk and noncancer health effects.

The potential for carcinogenic effects is evaluated with chemical-specific cancer slope factors (CSFs) and inhalation unit risk values, for oral and inhalation exposures. A weight of evidence classification is available for each chemical. CSFs have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk calculated using the CSFs is unlikely to be greater than the risk predicted. A summary of the cancer toxicity data relevant to the chemicals of concern is presented in ROD Table 10.

The potential for noncancer health effects is quantified by using reference doses (RfDs) for oral exposures and reference concentrations (RfCs) for inhalation exposures. RfDs and RfCs have been developed by EPA and they represent an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure that is likely to be without an appreciable risk of deleterious effects during a lifetime. RfDs and RfCs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not

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shower model.

[4] For future residential soil and indoor air exposures, the same exposure assumptions and methods described for the current exposure scenario were used.

[5] For future residential indoor air exposures, the same exposure assumptions and methods described for the current exposure scenario were used

[6] For future worker exposures to shallow groundwater, an exposure frequency of 66 days/year was used with an exposure duration of 1 year. Dermal contact was assumed with 3,300 cm^2 of surface area. Dermal contact was assumed to occur 1 hr/day. The Johnson & Ettinger Model was used to estimate outdoor air concentrations from measured shallow groundwater concentrations. Inhalation exposures were assumed to occur 8 hrs/day.

[7] For future residential exposures to untreated groundwater, the same assumptions used for the current household water use pathways were used.

occur. A summary of the non-carcinogenic toxicity data relevant to the chemicals of concern is presented in ROD Table 11.

Risk Characterization

This section combines estimates of exposure with toxicity to estimate potential health effects that might occur if no action were taken.

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the daily intake level (see Exposure Assessment) by the CSF or by comparison to the unit risk value. These toxicity values are conservative upper bound estimates, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. Therefore, the true risks are unlikely to be greater than the risks predicted. Cancer risk estimates are expressed as a probability, e.g., one in a million. Scientific notation is used to express probability: one in a million risk (1 in 1,000,000) is indicated by $1x10^{-6}$ or 1E-06. In this example, an individual is not likely to have greater than a one in a million chance of developing cancer over a lifetime as a result of exposure to the concentrations of chemicals at a site. All risks estimated represent an "excess lifetime cancer risk" in addition to the background cancer risk experienced by all individuals over a lifetime. The chance of an individual developing cancer from all other (non-site-related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposure is 10^{-4} to 10^{-6}. Current EPA's practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the RfD or RfC. A HQ $\leq$ 1 indicates that an exposed individual's dose of a single contaminant is less than the RfD or RfC and that a toxic effect is unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI $\leq$ 1 indicates that toxic non-carcinogenic effects are unlikely.

The following is a summary of the media and exposure pathways that were found to present a significant risk exceeding EPA's cancer risk range and noncancer threshold. Only those exposure pathways deemed relevant to the remedy being proposed are presented in this ROD. Readers are referred to Section 5 and Tables 9.1 through 9.77 of the risk assessment [M&E, 2005d] for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern and for estimates of the central tendency risk.

Resident

ROD Tables 12 through 14 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in surface soil and indoor air evaluated to reflect potential current and future residential exposure corresponding to the RME scenario. For the current young child and adult resident at the MMC Study Area, carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6}. The cumulative carcinogenic risk was 5 x 10^{-4}. The exceedance was due primarily to the presence of carcinogenic PAHs and arsenic in surface soil and trichloroethene in indoor air. For the future young child and adult resident at the MMC and DMC Study Areas, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and a target organ HI of 1. For the MMC Study Area, the cumulative carcinogenic risk was 2 x 10^{-4} and the target organ HI was 5. The exceedances were due primarily to the presence of trichloroethene, carcinogenic PAHs, arsenic, and chromium in surface soil and trichloroethene in indoor air at the MMC Study Area. For the DMC Study Area, the cumulative carcinogenic risk was 8 x 10^{-3} and the target organ HI was 4. The exceedances were due primarily to the presence of trichloroethene in indoor air at the DMC Study Area.

Commercial Worker

ROD Tables 15 and 16 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in bedrock groundwater evaluated to reflect potential current/future commercial exposure at the DMC Study Area (well DMC#1) corresponding to the RME scenario. For the current/future commercial worker, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and a target organ HI of 1. The cumulative carcinogenic risk was 2 x 10^{-4} and the target organ HI was 5. The exceedances were due primarily to the presence of tetrachloroethene and trichloroethene in bedrock groundwater.

Construction Worker

ROD Table 17 depicts the non-carcinogenic risk summary for the chemicals of concern in shallow groundwater evaluated to reflect potential future construction worker exposure at the DMC Study Area corresponding to the RME scenario. For the future construction worker, non-carcinogenic risks exceeded the EPA acceptable target organ HI of 1. The target organ HI was 30. The exceedance was due primarily to the presence of trichloroethene in shallow groundwater.

Residential Groundwater Use (Site-wide)

ROD Tables 18 through 21 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in private bedrock groundwater wells and Site-wide bedrock groundwater evaluated to reflect potential current and future potable water exposure corresponding to the RME scenario.

For the current resident using untreated groundwater as household water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1 for 35 of the private wells. The cumulative carcinogenic risks range from 2 x 10^{-4} to 3 x 10^{-2} and the target organ HIs range from 2 to 900. The exceedances were due primarily to the presence of benzene, 1,2-dichloroethene, cis-1,2-dichloroethene, 1,2-dichloroethane, 1,4-dioxane, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, arsenic, and vanadium in bedrock groundwater used for potable purposes.

For the future resident using untreated groundwater as household water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1 for Site-wide bedrock groundwater. The cumulative carcinogenic risk was 4 x 10^{-2} and the target organ HI was 900. The exceedances were due primarily to the presence of benzene, 1,2-dichloroethene, cis-1,2-dichloroethene, 1,2-dichloroethane, 1,4-dioxane, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, arsenic, mercury, and vanadium in bedrock groundwater used for potable purposes.

Uncertainties

Shallow groundwater data for the DMC Study Area were not validated. This shallow groundwater data was used in the risk assessment as reported because no other data of higher quality were available. The data were used to estimate risk for the future construction worker and future resident. Because the quality and, therefore, reliability of these data are unknown, the use of the unvalidated shallow groundwater data results in uncertainty of unknown bias regarding the risk estimates for these media.

Trichloroethene is being re-evaluated for carcinogenic potency by EPA. The high-end of the range of oral slope factors and unit risk values was used for risk estimation. This approach may have resulted in an overestimate of the risk associated with trichloroethene in groundwater and air. This uncertainty will be periodically reviewed to address changes in the toxicity values for this compound.

For the groundwater dermal contact pathway, risk associated with dermal absorption of chlorinated organic compounds may be underestimated. Permeability constants for the chlorinated organic compounds such as 1,1-dichloroethene, 1,2-dichloroethane, 1,2-dichloroethene, methylene chloride, tetrachloroethene, trichloroethene, and vinyl chloride tend to be underestimated by the correlation modeling. This uncertainty may result in an underestimation of risk. In addition, risk associated with dermal absorption could not be quantified for all contaminants. Data needed to predict dermal absorption is insufficient for some compounds including pentachlorophenol and carcinogenic PAHs. This uncertainty may also result in an underestimation of risk. These uncertainties will be periodically reviewed to address changes in the toxicity values and dermal absorption values.

Airborne concentrations of volatile compounds for the indoor air, outdoor air, and showering/bathing scenarios were estimated using accepted EPA exposure models. The use of modeling to estimate airborne concentrations of volatile compounds likely result in an over-estimate of risk since conservative assumptions were employed in the exposure modeling.

2. Ecological Risk Assessment

EPA's Screening-Level Ecological Risk Assessment (SLERA) concluded that no ecological receptors are expected to experience significant, long-term risk from Site-related contaminants present in surface water or sediment, therefore there is no actionable ecological risk associated with the Site.

Section 1: Identifying contaminants of potential concern (COPCs).

EPA performed a SLERA to estimate the probability and magnitude of potential adverse environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken [USEPA, 2005].

In 1993, M&E sampled surface water and sediment locations in the vicinity of the MMC and DMC properties for EPA. Based on these results, EPA developed a supplemental sampling program and collected additional samples during the RI in 1998. These analytical data were compiled and sorted by environmental medium. The media of concern were surface water, sediment, and wetland soil collected in and around Ball Brook, both across from and upstream of the Site. Further details are available in the SLERA [USEPA, 2005].

Metals in surface water collected from Ball Brook were analyzed in both unfiltered and filtered samples. The analytical results from the unfiltered samples represent total metals, which include both the fraction associated with particulate matter and the fraction which is freely dissolved in the water column. The filtered samples represent only the dissolved metals fraction. It is the latter which is responsible for any aquatic toxicity that may be associated with this group of compounds in surface water.

Following EPA Region I practices, COPCs were not selected by comparing Site data to background data. However, background data were used during risk characterization to separate COPCs present in Ball Brook due to natural or upstream anthropogenic sources from those that may have been released from the Site at levels exceeding background.

An arithmetic mean was calculated for each analyte present above its detection limit in at least one surface water, sediment, or wetland soil sample. The maximum concentration was also retained for each of those analytes. A chemical was eliminated from further consideration if it was not present above its detection limit in any of the surface water, sediment, or wetland soil samples.

A chemical was retained as a COPC if its maximum concentration in surface water, sediment, or soil exceeded a conservative ecological benchmark. A chemical was automatically retained as a COPC if no benchmark was available. Calcium, magnesium, potassium, and sodium were removed from further consideration because these compounds are physiological electrolytes.

ROD Table 22, Table 23, and Table 24 provide, for each COPC in surface water, sediment, and wetland soil, respectively, the (a) frequency of detection, (b) minimum detected concentration onsite, (c) arithmetic mean concentration (detects only and detects plus one half the detection limit for non-detects), (d) maximum detected concentration onsite, (e) maximum detected background concentration (if available), (f) benchmark, (g) ecological hazard quotient (HQ), (h) COPC flag, and (i) reason codes.

One SVOC and three metals were retained as surface water COPCs, either because their maximum concentrations exceeded their benchmarks or because no benchmarks were available (see Table 22).

Two VOCs, seventeen SVOCs, two pesticides, and ten metals were retained as sediment COPCs, either because their maximum concentrations exceeded their benchmarks or because no benchmarks were available (see Table 23).

One VOC, seventeen SVOCs, two pesticides, and 12 metals were retained as wetland soil COPCs, either because their maximum concentrations exceeded their benchmarks or because no benchmarks were available (see Table 24).

Section 2: Exposure assessment.

2.1 Ecological setting

Merriam Manufacturing Company (MMC):

The MMC facility operated from a single-story building that was largely destroyed by a fire in 1998. A drainage swale begins on the southern edge of the property, and turns to the north behind a former waste lagoon, eventually widening, and draining into a forested area adjacent to a seasonally-saturated wet meadow, which extends to Ball Brook. The wet meadow has some standing water, but both the wet meadow and Ball Brook may become nearly dry during the summer.

The wet meadow extends for about 150 feet from the base of the slope east of the facility to Ball Brook. It does not appear on the U.S. Fish and Wildlife Service National Wetland Inventory Map, most likely due to its small size. Ball Brook flows from north to south through the wet meadow before passing through a culvert beneath Brick Lane, joining a tributary which flows from the northeast, and flowing south toward the Durham Manufacturing facility. Upstream from MMC, Ball Brook begins at a small pond in a residential area, passes through a mowed field, then flows adjacent to an outfall pipe that appears to be broken and out of service. The brook then flows through a series of meanders before entering the wet meadow. The stream channel becomes poorly defined in the downstream (southern) end of the wet meadow. It is likely that during periods of high water, the brook spreads over the adjacent areas of cattails and sedges.

Durham Manufacturing Company (DMC):

The area behind the DMC facility parking lot is primarily riparian (Ball Brook). A small pond (described as a cooling water basin) is located close to the factory (western) side of the stream, and is bordered to the north by a small wetland dominated by common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea).*

Ball Brook is about eight feet wide and fairly shallow at the DMC facility. The stream bottom contains a mixture of debris (e.g., concrete blocks, bricks, etc.) in the vicinity of the cooling pond, but is sand/silt just upstream, and a rocky/gravelly/sandy substrate downstream from the pond.

2.2 Key species

Given the limited terrestrial habitat on the DMC portion of Ball Brook, the principal ecological receptors of concern would be aquatic organisms inhabiting the brook and terrestrial organisms found in and around the wet meadow.

The benthic invertebrate community was not characterized for this SLERA. However, Ball Brook sediment should support a diverse assemblage of benthic invertebrates. Numerous caddisfly and stonefly larvae were observed in the substrate of Ball Brook during past Site visits.

The local fish community in Ball brook was not characterized for this SLERA. Small fish have been observed in portions of Ball Brook upstream and downstream from the MMC facility. However, the section that passes through the wet meadow has a maximum depth of only a few inches, and is less than one inch deep in portions of the southern end of the wet meadow. This area is unlikely to support fish. Dace and fingerling-sized trout have been observed along the reach of Ball Brook downstream from the DMC site up to its confluence with Hersig Brook.

The local amphibian community in and around Ball Brook, the wet meadow, and the adjoining riparian areas was not characterized for this SLERA. It is expected to include several species of frogs (e.g., green frog, spring peeper, northern leopard frog, and tree frog) and salamanders (e.g., northern two-lined salamander and northern dusky salamander).

The local reptile community in and around Ball Brook, the wet meadow, and the adjoining riparian areas also was not characterized for this SLERA. It is expected to include several species of snakes (e.g., eastern ribbon snake, eastern garter snake, northern water snake, and northern brown snake) and aquatic turtles (e.g., eastern painted turtle and spotted turtle).

The following bird species were observed directly or indirectly during past Site visits: song sparrows, a mallard with a brood, northern cardinal, American robin, red-winged blackbird, red-tailed hawk, blue jay, gray catbird, common grackle, and common yellow throat.

The following mammal species were observed directly or indirectly during past Site visits: the hairytail mole, whitetail deer, muskrat, raccoon and domestic cattle. Additional mammals expected to frequent the riparian areas at the Site may include the short-tailed shrew, mink, cottontail rabbit, muskrat, white-footed mouse, eastern gray squirrel, meadow vole, eastern chipmunk, and woodchuck.

2.3 Calculating exposures

Table 25 summarizes the ecological exposure pathways of concern and the various endpoints evaluated in the SLERA.

For non-wildlife receptors (i.e., fish, benthic invertebrates, soil invertebrates, and terrestrial plants), the arithmetic mean (calculated as the average of the detects and ½ the detection limit for non-detects) of each COPC identified in surface water, sediment, and soil were used as exposure point concentrations.

For the target wildlife receptor (i.e., the short-tailed shrew feeding in the wet meadow), food chain modeling was used to calculate mean and maximum COPC-specific estimated daily intakes (EDIs). The generic equation used in these calculations was as follows:

$$EDI_{total} = EDI_{soil} + EDI_{food}$$

Where: EDI_{total} = the total estimated daily intake (mean and maximum) of a COPC from all applicable exposure routes

EDI_{soil} = the estimated daily intake (mean and maximum) of a COPC from the incidental ingestion of soil during foraging activity

EDI_{food} = the estimated daily intake (mean and maximum) of a COPC via food ingestion

A food chain model was developed to calculate a mean and maximum EDI for the short-tailed shrew, assuming that this receptor obtained all of its food from the wet meadow entirely in the form of earthworms. The tissue residue levels in earthworms were estimated based on measured concentrations in the soil samples from the wet meadow and using (1) an equilibrium partitioning model for organic COPCs, and (2) regression equations and uptake factors (UFs) for metal COPCs. It was assumed that the daily intake of COPCs from drinking Ball Brook surface water was negligible.

Section 3: Ecological effects assessment.

3.1 Measures of ecological effect for non-wildlife receptors

Aquatic receptors

The chronic surface water benchmarks used to select COPCs were retained as measures of ecological effects for use in risk characterization. Those values were (in order of preference): (1) the chronic national ambient water quality criteria [USEPA, 2002b]; (2) the secondary chronic values [Suter and Tsao, 1996]; or (3) the lowest chronic value for fish, aquatic invertebrates, or aquatic plants [Suter and Tsao, 1996].

The "no effect" sediment benchmarks used for selecting COPCs were also retained as measures of ecological effects for use in risk characterization. Those values were (in order of preference): (1) the threshold effects concentrations [Ingersoll et al., 2000]; (2) the sediment ecotox thresholds [USEPA, 1996]; (3) the lowest effect levels [Jaagumagi et al., 1995]; (4.a) for organic compounds, the Equilibrium Partitioning-derived secondary chronic value or lowest chronic value sediment quality benchmarks [Jones et al., 1997]; and (4.b) for metals, the EPA Region IV sediment benchmarks [Jones et al., 1997].

In addition, "effects" sediment benchmarks were included as measures of ecological effect to better characterize risk. Those values were (in order of preference): (1) the probable effects concentrations [MacDonald et al., 2000], the effects range - medians [Long et al., 1995], and the severe effect levels [Persaud et al., 1993].

Terrestrial receptors

The conservative soil benchmarks used to select COPCs in the wet meadow were retained as measures of ecological effects to evaluate risk to terrestrial non-wildlife receptors. Those values were (in order of preference): the U.S. EPA ecological soil screening levels [USEPA, 2003], (2) the Oak Ridge National Laboratory (ORNL) wildlife benchmarks [Sample et al., 1996]; (3) the ORNL terrestrial plants benchmarks [Efroymson et al., 1997], and (4) the ORNL soil, litter invertebrates and heterotrophic processes benchmarks [Efroymson et al., 1997b].

3.2 Measures of effect for wildlife receptors

Wildlife receptor exposures were estimated using food chain modeling to calculate an EDI for each COPC. The EDIs were then compared to published no effect toxicity reference values (TRVs) for mammals, which represent daily contaminant intakes not believed to result in harmful impacts under long-term exposures.

Section 4: Ecological risk characterization.

The hazard quotient method (HQ = mean exposure concentration ÷ toxicity value) was used to identify the potential for ecological risk in the medium of concern. If a HQ was below 1.0, then it was assumed unlikely that the COPC would result in an adverse effect to a target receptor group. Conversely, a HQ above 1.0 indicated the possibility of risk to the target receptor group.

The risk calculated for onsite samples was compared with risk in upstream reference samples. Also, the mean concentrations for surface water, sediment, and soil were used instead of the maximum concentrations in order to provide a more realistic evaluation of risk. This refinement of the SLERA focused the assessment on those contaminants more likely to be associated with past Site discharges.

4.1 Risk estimates

4.1.1 Potential risk to surface water receptors

ROD Table 26 summarizes the surface water risk for those contaminants identified as COPCs in ROD Table 22, and compares concentrations in Site samples to upstream reference samples. Chronic risk based on mean Site concentrations was present for aluminum and barium in unfiltered surface water, but only for barium in filtered surface water. The ratio of the Site maximum over the reference maximum concentrations indicates that there is some incremental exposure onsite for barium and copper. However, the concentrations of these metals were noticeably higher than background in only one station on Ball Brook (BB2). Immediately downstream of this sampling location, in station BB1, concentrations were similar to background. This pattern suggested that the contamination was localized to the immediate vicinity of the cooling water pond outfall, and would be unlikely to have a noticeable effect on surface water receptors in Ball Brook downstream of the Site.

Taken together, this information suggested that aquatic receptors were not expected to experience significant, long-term risk from Site-related contaminants present in the surface water from Ball Brook.

4.1.2 Potential risk to sediment receptors

ROD Table 27 summarizes the sediment risk for those contaminants identified as COPCs in ROD Table 23 , and compares concentrations in Site samples to upstream reference samples. The assessment indicated that 14 PAHs and three metals exceeded a HQ of 1.0 when their mean concentrations were compared to their corresponding "no effect" benchmarks. Only five of those PAHs, but no metals, exceeded a HQ of 1.0 when their mean concentrations were compared to their corresponding "effect" benchmarks. However, none of the five PAHs exceeded the concentrations found at the upstream reference location, suggesting that the source of PAH contamination was located upgradient from the MMC facility. It was concluded that any risk to the benthic invertebrate community that might be associated with PAHs would not be due to past Site releases.

4.1.3 Potential risk to soil receptors

No additional soil benchmarks were available to further refine the soil assessment. The available evidence indicated that the VOCs identified as COPCs were unlikely to present risk to soil receptors (see ROD Table 24). Not enough benchmarks were available to further evaluate the potential risk of PAHs to soil receptors. Twelve metals did exceed their conservative soil benchmarks but no additional information was available to determine if those exceedances had the potential to result in significant risk to soil receptors. Five-year reviews will be conducted at this Site to ensure that the remedy continues to be protective of human health and the environment. Such reviews consider newly developed risk information, such as new or revised ecological benchmarks.

4.1.4 Potential risk to terrestrial wildlife receptors

ROD Tables 28 and 29 show the HQs for the short-tailed shrew under maximum and mean exposure scenarios, respectively.

Under the maximum exposure scenario, six PAHs and seven metals had HQs above 1.0. Under the mean exposure scenario, five PAH and four metals showed HQs exceeding 1.0. The HQs decreased on average by a factor of two between the two exposure scenarios.

The maximum exposure scenario provided a "worst-case" risk estimate which is unlikely to occur in the field. Under mean exposure, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene had HQs equal to 3.4 and 2.3, respectively. The HQs of the remaining PAHs fell between 1.0 and 2.0. Given the conservative assumptions built into the exposure assessment and the fact that the TRVs represented daily intakes not expected to result in long-term toxicity response, it was considered highly unlikely that actual risk to the shrew would be associated with the levels of PAHs measured in the wet meadow.

The aluminum concentrations in wetland soil are difficult to interpret using the available information. The U.S. EPA Ecological Soil Screening Level for Aluminum directive, dated 2003, notes the difficulty of modeling risk from aluminum in soil based on total aluminum analysis, and suggests using a generic rule that aluminum is seldom a problem for terrestrial receptors in soils above pH 5.5. In this instance the soil pH is not known, so this rule cannot be applied.

A review of the aluminum concentrations across the two transects suggested that aluminum was not associated with any known point source on the MMC property, because concentrations did not appear to decrease with greater distance from the site. On the basis of distribution, it did not appear that aluminum had moved from the MMC property into the wet meadow through the flow paths evaluated in this SLERA. It was therefore concluded that aluminum did not represent a Site-related risk to wildlife receptors.

4.2 Uncertainty analysis

Conservative exposure and toxicity assumptions were used in this SLERA to ensure that risk was not missed if it was in fact present and to serve as substitutes for the lack of Site-specific data.

The major uncertainties of the SLERA and their potential impacts on the results of the SLERA are summarized below.

Non-wildlife aquatic and soil receptors

The risk analysis indicated the presence of potential risk to benthic invertebrates and soil receptors in some areas of Ball Brook and the wet meadow. The biggest impact on the overall risk to those two receptor groups was that some of the metal COPCs in sediment and the majority of soil COPCs lacked benchmarks. Hence, the potential impact of these chemicals could not be fully assessed using the HQ methodology. Five-year reviews will be conducted at this Site to ensure that the remedy continues to be protective of human health and the environment. Such reviews consider newly developed risk information, such as new or revised ecological benchmarks.

Terrestrial wildlife receptors

Several conservative assumptions were required to calculate daily exposures to the short-tailed shrew using simplified food chain modeling. The major assumptions are discussed below:

(1) Soil-to-biota Uptake Factors (UFs) represent crude estimates of contaminant transfers through the food chain. Even though several metal UFs were based on empirical data, most UFs in the literature were derived using simple assumptions and calculations. Also, conservative UFs of 1.0 were used if published UFs were unavailable.

(2) For a SLERA, EPA guidelines recommend assuming that COPCs in food, soil, and sediment are 100% bioavailable and thus become part of the daily dose. Also, no provision was made for detoxification by metabolism and excretion in the wildlife receptors. This represents a conservative assumption.

(3) For a SLERA, EPA guidelines recommend assuming that the diet is composed of the most contaminated food. For this study, the shrew was assumed to consume earthworms for 100% of its daily food intake. This was quite conservative, because shrews in the field would consume only around half of their food in the form of earthworms.

(4) Conservative "no effect" toxicity reference values (TRVs) were used in the risk characterization.

(5) The health effects of benzo(a)pyrene on mammals are well documented due to the high toxicity of this chemical. Wildlife TRVs were unavailable for most of the other, but less toxic, PAHs. It was assumed conservatively that their toxicities were equal to that of benzo(a)pyrene.

(6) Finally, COPCs without TRVs were excluded from the HQs, even though their concentrations were modeled into prey items. It is reasonable to assume that some of those COPCs could be present in prey items at concentrations harmful to one or more of the wildlife receptors. The risk associated with those COPCs cannot be quantified.

3. Basis for Response Action

Because the baseline human health risk assessment revealed that **current and future residents, commercial workers and construction workers** potentially exposed to compounds of concern in various media by a variety of exposure pathways may present an unacceptable human health risk, actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

- For current and future residents potentially exposed to compounds of concern in untreated groundwater via ingestion, dermal contact, and inhalation, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1. A similar unacceptable risk is posed by ingestion and dermal contact from the DMC supply well (DMC #1) to current and future commercial workers.

- For current and future residents adjacent to the MMC Study Area potentially exposed to compounds of concern in surface soil and soil vapor via ingestion, dermal contact, and inhalation, carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6}.

- For future residents that may come to be located at the MMC Study Area and potentially exposed to compounds of concern in surface soil and soil vapor via ingestion, dermal contact and inhalation, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and a target organ HI of 1.

- For future residents that may come to be located at the DMC Study Area and potentially exposed to compounds of concern in indoor air via inhalation following vapor migration from overburden (shallow) groundwater, carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and a target organ HI of 1.

- For future construction workers at the DMC Study Area potentially exposed to contaminants of concern in overburden (shallow) groundwater by dermal contact, non-carcinogenic risks exceeded the EPA acceptable target organ HI of 1.

Media which are to be the focus of remedial actions based on the human health risk assessment therefore include groundwater at the Site-wide Groundwater Study Area, overburden (shallow) groundwater at the DMC Study Area, and surface soil and soil vapor at the MMC Study Area.

EPA's new *Cancer Guidelines and Supplemental Guidance* (March 2005) will be used as the basis for EPA's analysis of all new carcinogenicity risk assessments. If updated carcinogenicity risk assessments become available, EPA will determine whether an evaluation should be conducted as part of the remedial design to assess whether adjustments to the target cleanup levels for this remedial action are needed in order for this remedy to remain protective of human health.

Because the Screening-Level Ecological Risk Assessment concluded that no ecological receptors are expected to experience significant, long-term risk from Site-related contaminants present in surface water or sediment, there is no actionable ecological risk associated with the Site, and there are no cleanup alternatives specifically tailored to ecological risk mitigation.

H. REMEDIATION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment.

RAOs are based on numeric cleanup goals and regulatory requirements called Applicable or Relevant and Appropriate Requirements (ARARs). ARARs include federal and state environmental statutes, regulations and requirements, such as federal drinking water quality standards (Maximum Contaminant Levels, or MCLs), state drinking water quality standards, and Connecticut Remediation Standard Regulations (CT RSRs). Risk-based goals (RBGs) are identified by EPA where no ARARs for particular contaminants exist.

Chemical-specific, location-specific, and action-specific ARARs are included in Tables F-1, F-2, and F-3 in Appendix F.

The RAOs for the Site are listed below. For informational purposes, RAOs are included for media where cleanup goals will be waived.

The RAOs for the MMC Study Area are:

- To reduce the potential exposure of current adjacent residents at the MMC Study Area to benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and arsenic in surface soil via ingestion and dermal contact that may present a human health risk in excess of 10^{-4} such that the cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and complies with CT RSR residential direct exposure criteria (DECs) for the protection of human health.

- To reduce the potential exposure of future residents at the MMC Study Area to trichloroethene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic and chromium in surface soil via ingestion and dermal contact that may present a human health risk in excess of 10^{-4} and target organ HI>1 such that the cancer and non-cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and a HI which does not exceed one and complies with CT RSR residential DECs for the protection of human health.

- To reduce direct contact exposures to Extractable Total Petroleum Hydrocarbons (ETPH), chromium, lead, and mercury in surface soil at the MMC Study Area by complying with the CT RSR residential DECs.

- To limit migration of tetrachloroethene, trichloroethene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, ETPH, arsenic, cadmium, chromium, copper, and lead in surface soil and 1,2,4-trimethylbenzene, trichloroethene, xylene, and lead in subsurface soil at the MMC Study Area to groundwater by complying with the CT RSR GA/GAA pollutant mobility criteria (PMC).

- To reduce the potential exposure of current adjacent residents at the MMC Study Area to trichloroethene in soil gas via inhalation that may present a human health risk in excess of 10^{-4} such that the cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and complies with proposed CT RSR residential volatilization criteria (VC) for the protection of human health.

- To reduce the potential exposure of future residents at the MMC Study Area to trichloroethene in soil gas via inhalation that may present a human health risk in excess of 10^{-4} and target organ HI>1 such that the cancer and non-cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and a HI which does not exceed one and complies with proposed CT RSR residential VC for the protection of human health.

The RAOs for the DMC Study Area are:

- To reduce the potential exposure of future construction workers at the DMC Study Area to trichloroethene in shallow (overburden) groundwater via dermal contact that may present a human health target organ HI>1 such that the non-cancer risk attributable to this medium is a HI which does not exceed one for the protection of human health.

- To reduce direct contact and inhalation exposures to 1,1,1-trichloroethane, tetrachloroethene, and toluene in overburden groundwater at the DMC Study Area by complying with the ARARs (MCLs and CT RSR GWPC and GWVC). (These groundwater ARARs are waived pursuant to the technical impracticability discussion in Section I of this ROD).

- If it is determined, after further investigation, there are areas posing an unacceptable risk, actions will be taken to reduce the potential for ethylbenzene, trichloroethene, vinyl chloride, and xylene present in shallow groundwater at the DMC Study Area to volatilize into buildings.

The RAOs that apply Site-wide are:

- To protect surface water quality by complying with the CT RSR surface water protection criteria (SWPC) for the protection of the environment for groundwater contaminants that discharge to surface water. (These criteria are waived pursuant to the technical impracticability discussion in Section I of this ROD.)

- To remove or contain DNAPL present in subsurface soil at the MMC Study Area, soil and overburden groundwater at the DMC Study Area, and bedrock groundwater at the Site-wide Groundwater Study Area to the extent practicable.

- To reduce the potential exposure of residents and DMC commercial workers at the Site-wide Groundwater Study Area to 1,2-dichloroethane, 1,2-dichloroethene, 1,4-dioxane, benzene, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, arsenic, mercury, and vanadium in bedrock groundwater via ingestion, dermal contact, and inhalation that may present a human health risk in excess of 10^{-4} and target organ HI>1 such that the cancer and non-cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and a HI which does not exceed one and complies with ARARs (MCLs and CT

RSR GWPC and GWVC) for the protection of human health. (These groundwater ARARs and risk-based goals are waived pursuant to the technical impracticability discussion in Section I of this ROD.)

- To reduce 1,1-dichloroethane, 1,1-dichloroethene, benzo(k)flouranthene, phenanthrene, copper, lead, and zinc in bedrock groundwater by complying with the ARARs (MCLs and CT RSR GWPC and GWVC). (These groundwater ARARs are waived pursuant to the technical impracticability discussion in Section I of this ROD.)

- If it is determined, after further investigation, there are areas posing an unacceptable risk for the vapor intrusion pathway, actions will be taken to reduce potential indoor air inhalation exposures to volatile compounds in groundwater at the Site-wide Groundwater Study Area.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the Site.

With respect to source control at the MMC Study Area and the DMC Study Area, the RI/FS developed a range of alternatives in which hazardous substances are treated or removed to the maximum extent feasible, minimizing to the degree possible the need for long term management.

This range also included alternatives that treat certain of the principal threats posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative for each Study Area.

With respect to the Site-wide Groundwater Study Area, the RI/FS developed two sets of remedial alternatives, one set that addresses potential response to the source zone and dissolved plume portions of contaminated groundwater, and another set that specifically addresses the provision of an alternate water supply.

Remedial alternatives related to provision of an alternate water supply focused only on the range of options available to ensure provision of potable water to area residents and businesses; a no action alternative is also provided.

With respect to the source zone and dissolved plume portions of contaminated groundwater, a limited number of remedial alternatives are presented that attain Site specific remediation levels for the dissolved plume within different timeframes; a no action alternative is also provided. The RI/FS determined that no remedial alternative was available to achieve cleanup of the source zone within a reasonable timeframe, and therefore the only alternatives presented are for containment and for no action.

As discussed in Section 3.0 of the FS, soil and groundwater treatment technology options were identified, assessed and screened based on implementability, effectiveness, and general cost. Section 4.0 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 6.0 of the FS.

3. Technical Impracticability Evaluation

Restoration of contaminated groundwater, especially in a designated drinking water aquifer, is one of the primary objectives of the Superfund program. The National Contingency Plan, which provides the regulatory framework for the Superfund program, states that: "EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site" (NCP section 300.430(a)(1)(iii)(F)). Generally, restoration cleanup levels are established by applicable or relevant and appropriate requirements (ARARs), such as the use of federal or state standards for drinking water quality [USEPA, 1993].

ARARs may be waived for six reasons, including where compliance with the requirements is technically impracticable from an engineering perspective. Where groundwater ARARs are waived at a Superfund site due to technical impracticability, EPA's general expectations are to prevent further migration of the contaminated groundwater plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction measures as appropriate. (NCP section 300.430(a)(1)(iii)(F)).

Experience has shown, however, that restoration to drinking water quality may not always be achievable due to the limitations of available remediation technologies. EPA, therefore, must evaluate whether groundwater restoration at Superfund sites is attainable from an engineering perspective. Factors that can inhibit groundwater restoration include hydrogeologic factors and contaminant-related factors, such as the presence of dissolved non-aqueous phase liquids (DNAPL).

EPA conducted an evaluation to determine whether it was technically practicable to clean up the groundwater in the area of the Site within a reasonable timeframe. This evaluation is further discussed in the Technical Impracticability Evaluation Report [M&E, 2005c Draft Final Technical Impracticability Evaluation]. The evaluation concluded that restoration of both the overburden and bedrock aquifers in a reasonable timeframe is not practical for the following reasons:

- The presence of contaminants in residential wells demonstrates that there was a pathway of chlorinated solvent contamination from MMC and DMC and potentially other source areas to the bedrock aquifer.

- Historically, deep, open-hole production wells within the potential DNAPL source area likely mobilized and spread aqueous phase contamination and DNAPL laterally and vertically, effectively expanding the size of the source area and aqueous plume. The mechanisms that cause this contamination are borehole short-circuiting and pool mobilization through change in DNAPL entry pressures caused by pumping in the vicinity of release areas. Borehole short-circuiting can occur when DNAPL that is pooled at shallower locations in bedrock enters a borehole (e.g., bedrock supply or drinking water well), and cascades down to the bottom of wells and potentially invades deeper fractures. Pool mobilization can occur when pumping near solvent release locations causes DNAPL pools to mobilize and spread vertically and laterally over a larger area than would have occurred under natural gradients and entry pressures. These mechanisms are described conceptually in Figures 3.2-1 and 3.2-2 of the Technical Impracticability Evaluation Report [M&E, 2005c].

- The presence of chlorinated solvent contamination in residential areas located several hundred feet from the release areas demonstrates widespread bedrock contamination.

- Most of the residential wells are deep, open-hole bedrock wells. Although contaminants may originally have migrated in discrete fractures, significant cross-contamination through borehole short-circuiting and mixing has likely occurred as a result of pumping these wells over time.

- Little is known regarding the depth of contamination. A significant and costly investigation would be required to characterize the vertical extent of contamination. Even with installation of several monitoring wells, the characterization of the source zone and extent of dissolved-phase contamination would likely not be conclusive due to the heterogeneous nature of fractured bedrock. Therefore, it would be difficult to design an optimal remediation system to restore bedrock groundwater.

- The bedrock is sedimentary in nature and is known to be fractured. Once DNAPL reaches the bedrock, it will migrate downward until it cannot overcome the entry pressure of the fracture due either to the small aperture width or decrease in pool height. The DNAPL may also enter dead-end fractures and cause diffusion of aqueous contaminants into the rock matrix. Removal of DNAPL from fractured bedrock and restoration of groundwater to background concentrations in DNAPL zones within a reasonable time-frame is extremely difficult, if not impossible, due to limited natural or induced flushing within bedrock fractures, particularly dead-end fractures. Also, back diffusion from the matrix could cause concentrations to persist above groundwater standards for years. Current remedial technologies are not effective in restoring DNAPL zones in porous and fractured media, particularly in complex settings.

- The overburden aquifer is a low permeability, porous, fractured glacial till formation. It is likely that DNAPL exists in the till at MMC and DMC based on current data. DNAPL may be pooled in dead-end fractures or remain as residual in the till fractures where diffusive losses to the porous matrix may dissipate DNAPL over time. These characteristics limit the hydraulic accessibility of DNAPL and, coupled with the low permeability of the till, make removal of DNAPL and restoration of groundwater to background levels within a reasonable timeframe unlikely.

- There are currently no available technologies that are known to be effective in restoring DNAPL zones in complex heterogeneous geologic environments to drinking water quality in a reasonable timeframe.

- Restoration of the dissolved-phase plume in a reasonable timeframe is unlikely due to the complex and heterogeneous nature of fractured bedrock.

For these reasons, a technical impracticability waiver of ARARs is warranted under NCP Section 300.430(f)(1)(ii)(C)(3) and EPA's Technical Impracticability Guidance for groundwater. The groundwater zone over which the technical impracticability zone applies encompasses all areas in the overburden and bedrock aquifers that are currently or conceivably could be impacted by contamination emanating from the Site, as outlined on ROD Figure 8. The lateral boundaries of the TI waiver zone extend to groundwater discharge areas to the east, south, and west of the contaminant plumes, including Ball Brook and Hersig Brook to the east of the Site, and Allyn Brook to the south of the Site. To the west of the Site, the TI waiver boundary coincides with the wetland area in the vicinity of the ground elevation contour of 150 feet. This is a potential groundwater discharge area to the west of the estimated western extent of contamination and Maple Avenue. To the north, the TI boundary extends to encompass all residential wells that are in the vicinity of the Superfund Site. The depth of the technical impracticability waiver zone is considered to be at least the depth of the conceptual maximum extent of DNAPL, as depicted on Figures 3.3-15 through 3.3-18 and on Figure 3.6-2 in the Technical Impracticability Evaluation Report, or the depth of the deepest impacted well within the TI waiver zone.

Chemical-specific ARARs for groundwater at the Site include Connecticut Remediation Standard Regulation (CT RSR) standards, including the Groundwater Protection Criteria applicable to the GA groundwater underlying the Site, Surface Water Protection Criteria, and the current and proposed Residential and Industrial/Commercial Volatilization Criteria (which have not yet been promulgated and are "to be considered"). These criteria establish remediation standards for groundwater, include numeric criteria for many contaminants, and provide separate criteria for threats to human health and environmental receptors based on direct contact, as well as migration via groundwater or volatilization. Chemical-specific ARARs also include federal Maximum Contaminant Levels (MCLs) which govern the quality of drinking water provided by a public water supply, and are relevant and appropriate requirements in establishing groundwater remediation goals for private wells.

The compounds and their respective ARARs for which a technical impracticability waiver will apply are presented in ROD Table 30. For compounds where no ARARs exist, risk-based goals are presented. Human health risk-based goals are presented in Section 2 of the FS [M&E, 2005b]. The compounds include all chlorinated solvents released at the Site and related compounds, such as breakdown products and additives (i.e., 1,4-dioxane) as well as other co-located compounds dissolved in groundwater such as PAHs, BTEX compounds, and several metals (arsenic, copper, lead, mercury, vanadium, and zinc). The chlorinated compounds are the most widespread and recalcitrant, the most likely to restrict the ability to restore groundwater, and the primary risk drivers. There is little benefit to attempting to remediate co-located compounds, therefore the TI waiver will apply to all dissolved contaminants found at the Site.

No waiver of location-specific or action-specific ARARs is required for the Site.

J. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each remedial alternative evaluated for the Site. Alternatives were evaluated to address each contaminated medium or potential migration pathway at each Study Area. A more complete, detailed presentation of each alternative is found in Section 6.0 of the FS.

EPA evaluated remedial alternatives separately for the soil and soil vapor at the MMC Study Area.

MMC Study Area – Soil

<u>Alternative MMC S-1: No Action.</u> The No Action alternative is developed as a baseline to which other alternatives can be compared. No remedial action would be performed at the MMC Study Area under the No Action Alternative, and only naturally occurring processes would be acting to reduce contamination. This alternative is not protective of human health or the environment and does not reduce on-site risk or contaminant mobility. The time to achieve response action objectives (RAOs) for MMC Study Area soil under the No Action alternative would likely exceed 100 years since some of the contaminants do not degrade and are not very mobile in soil (PAHs and metals).

Estimated Period of Operation: None
Estimated Total Present Worth: None

<u>Alternative MMC S-2: Containment.</u> The major components of this alternative include:

- Pre-remedial study;
- Soil excavation and consolidation (scenario S-2B);
- Construction of a geomembrane cap;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a containment alternative (contain waste on site while reducing exposure) consisting of covering contaminated areas with a low permeability, geomembrane cap to limit water infiltration and subsequent migration of contaminants above the water table and eliminate the direct exposure pathway to soil. Environmental monitoring would be included to assess the impact on contaminant migration in groundwater and five-year Site reviews would be conducted to evaluate the remedy per EPA guidance. Institutional controls would be implemented to avoid site uses that would obstruct the usefulness of the cap. Under this scenario, institutional controls would include obtaining an Environmental Land Use Restriction (ELUR) as defined in the CT RSRs, to restrict activities that may disturb the engineered control.

Two scenarios for the containment option were considered for the detailed evaluation: capping the entire Study Area assuming that most of the area contains soil with exceedances of the PMC (Scenario S-2A, approximately 3.3 acres) and capping the soil exceeding RBGs and direct exposure criteria (Scenario S-2B, approximately 1 acre).

Estimated Period of Operation:	Containment activities, <1 year; monitoring, 50 years
Estimated Total Present Worth:	$1.3 million to $2.7 million

Alternative MMC S-3: Excavation and Off-site Disposal. The major components of this alternative include:

- Pre-remedial study;
- Excavation support activities;
- Soil excavation and off-site disposal;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

Under this alternative, designated soil would be excavated and transported for off-site disposal. Four variations of this alternative were evaluated in order to provide a range of cleanup levels for comparison purposes:

- Scenario S-3A: Address current residential risk by excavating and removing soil from the back of the adjacent residential property at 275 Main Street only (approximately 0.1 acres). No excavation would be performed on the MMC facility property.
- Scenario S-3B: Address current and future residential risk by excavating all areas of concern with exceedances of RBGs and those that also exceed CT RSR direct exposure criteria (residential and industrial/commercial) (approximately 0.50 acres).
- Scenario S-3C: Address all risk, direct exposure concerns, and PMC by excavating all areas of concern and sample locations indicating an exceedance of pollutant mobility criteria in addition to areas described in S-3A and S-3B above (approximately 0.75 acres).
- Scenario S-3D: Excavate the entire Study Area to address the possibility that all surface

soils across the Study Area exceed one or more of the RAOs (RBGs and CT RSRs). (approximately 3.3 acres)

Due to the uncertainty of depth of contamination in soils, cost for these options included intervals of 0 to 2 feet and 2 to 4 feet deep. Depending on the depth to which excavation occurs, institutional controls would include obtaining an ELUR as defined in the CT RSRs, to restrict future activities that may result in exposure to Site-related contaminants. Environmental monitoring may also be required for the implementation of each of these variations.

Estimated Period of Operation: Excavation and disposal, <1 year; monitoring, 50 years
Estimated Total Present Worth: $332,000 (S-3A 2' deep) to $7.6 million (S-3D to 4' deep)

Alternative MMC S-4: Soil Vapor Extraction. The major components of this alternative include:

- Pre-remedial study;
- Site preparation;
- Installation and operation of the SVE system;
- Treatment of off-gas;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a treatment option for soils containing VOCs and possibly DNAPL. Under this soil vapor extraction (SVE) alternative, a vapor extraction system would be installed to increase volatilization of VOCs from the soil, reducing the concentrations of VOCs in soils and potentially reducing the mass of DNAPL over time. This alternative is also proposed for addressing soil vapor. The SVE system would consist of a network of extraction wells connected to aboveground piping and a vacuum blower with an appropriate technology for the treatment of collected VOCs. It should be noted that surface soils with metals and PAHs requiring remediation cannot be addressed by SVE alone, and may require excavation and disposal or capping to achieve all RAOs. Environmental monitoring and five-year Site reviews would be required to evaluate the progress of this remedy.

Estimated Period of Operation: SVE, 7 years; monitoring, 50 years
Estimated Total Present Worth: $505,000

MMC Study Area – Soil Vapor

Alternative MMC SV-1: No Action. The No Action alternative is developed as a baseline to which other alternatives can be compared. No remedial action would be performed at the MMC

Study Area under the No Action Alternative, and only naturally occurring processes would be acting to reduce contamination. This alternative is not protective of human health or the environment and does not reduce on-site risk or contaminant mobility. The time to achieve RAOs for MMC Study Area soil under the No Action alternative would likely exceed 100 years.

Estimated Period of Operation: None
Estimated Total Present Worth: None

Alternative MMC SV-2: Excavation and Off-site Disposal. The major components of this alternative include:

- Pre-remedial study;
- Excavation support activities;
- Soil excavation and off-site disposal;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a source control remedy. Under this alternative, all accessible VOC-impacted source area materials (soil exceeding PRGs) will be excavated to a depth of four or eight feet and transported for off-site disposal, thereby eliminating the source of the soil vapor concerns. The soil vapor source is likely from VOCs and potential DNAPL located in soils below the former loading dock and degreasers. Institutional controls and environmental monitoring may be required for the implementation of each of these variations.

Estimated Period of Operation: Excavation and disposal, <1 year; monitoring, 50 years
Estimated Total Present Worth: $2.1 million to $3.8 million

Alternative MMC SV-3: Soil Vapor Extraction. The major components of this alternative include:

- Pre-remedial study;
- Site preparation;
- Installation and operation of the SVE system;
- Treatment of off-gas;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a treatment option for soil vapor that reduces concentrations of VOCs in soil over time. SVE technology can also reduce the mass of DNAPL residing in subsurface soils, as described under MMC Alternative S-4.

Estimated Period of Operation: 7 years
Estimated Total Present Worth: $494,000

DMC Study Area – Overburden Groundwater

Alternative DMC GW-1: No Action. The No Action alternative is developed as a baseline to which other alternatives can be compared. No remedial action would be performed at the DMC Study Area under the No Action Alternative, and only naturally occurring processes would be acting to reduce contamination. This alternative is not protective of human health or the environment and does not reduce on-site risk or contaminant mobility. The time to achieve RAOs for DMC Study Area groundwater under natural conditions would likely exceed 100 years.

Estimated Period of Operation: None
Estimated Total Present Worth: None

Alternative DMC GW-2: Groundwater Extraction – Hydraulic Containment. The major components of this alternative include:

- Pre-remedial study and treatability test;
- Groundwater extraction;
- Ex-situ groundwater treatment;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative consists of extracting groundwater within or just downgradient from the hot spot areas (high concentrations of VOCs, and possible DNAPL areas) by utilizing pumping methods from extraction wells and/or a collection trench. Such action will manage the migration of contaminated groundwater from the overburden laterally and vertically to the bedrock. Collected groundwater would be treated in an on-site treatment system. Environmental monitoring would be included to assess contaminant migration and five-year Site reviews would be conducted to evaluate the remedy per EPA guidance. Institutional controls, in the form of ELURs, would prevent the use of overburden groundwater as drinking water or for other domestic purposes, prevent construction of buildings without the necessary controls to minimize potential inhalation risks, prohibit residential activities, and prohibit soil disturbance and exposure to groundwater via intrusive activities without a plan to protect against groundwater contact in uncontrolled conditions. As a hydraulic containment alternative, it is anticipated that this alternative would take at least 100 years to meet all RAOs, including the restoration of overburden groundwater to background concentrations based on Natural Attenuation Modeling.

Estimated Period of Operation: 100 years
Estimated Total Present Worth: $4.9 million

Alternative DMC GW-3: Multi-Phase Extraction. The major components of this alternative include:

- Pre-remedial study and treatability test;
- Multi-phase extraction;
- Ex-situ groundwater treatment;
- Collection and treatment of off-gas;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a more aggressive treatment option for the groundwater plume containing VOCs than hydraulic containment. Under this alternative, an extraction system would be installed (or the existing system modified) to increase volatilization of VOCs from the saturated and unsaturated zone, and extract groundwater for treatment. Collected groundwater and vapor released from the groundwater (and soils) would be collected and treated, thus managing the migration of contaminants and improving the time for restoration. Environmental monitoring would be implemented to assess the progress and success of this remedy. Five-year reviews would be required to assess the remedy in accordance with EPA guidance. Institutional controls, in the form of ELURs, would prevent the use of overburden groundwater as drinking water or for other domestic purposes, prevent construction of buildings without the necessary controls to minimize potential inhalation risks, prohibit residential activities, and prohibit soil disturbance and exposure to groundwater via intrusive activities without a plan to protect against groundwater contact in uncontrolled conditions. This alternative uses a more aggressive extraction strategy than Alternative GW-2, and it is assumed that the time to meet all RAOs will be shorter than that anticipated for the hydraulic containment alternative. A relative period of time for treatment was assumed to be 50 years.

Estimated Period of Operation: 50 years
Estimated Total Present Worth: $4.9 million

Alternative DMC GW-4: In-situ Chemical Oxidation. The major components of this alternative include:

- Pre-remedial study and treatability test;
- Installation of injection wells;
- Injection of oxidant;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as an in-situ treatment option for groundwater containing VOCs and possibly DNAPL. Multiple injections of oxidation chemicals into the VOC hot spots would be conducted, using materials that break down contaminants to nonhazardous byproducts such as salt, water, and carbon dioxide and deplete the source zone mass. Environmental monitoring would be implemented to assess the progress and success of this remedy, including the restoration of the groundwater plume. Five-year reviews would be required to assess the remedy in accordance with EPA guidance. Institutional controls, in the form of ELURs, would prevent the use of overburden groundwater as drinking water or for other domestic purposes, prevent construction of buildings without the necessary controls to minimize potential inhalation risks, prohibit residential activities, and prohibit soil disturbance and exposure to groundwater via intrusive activities without a plan to protect against groundwater contact in uncontrolled conditions. This alternative uses a more aggressive remediation strategy than Alternative GW-2, and it is assumed that the time to meet all RAOs will be shorter than that anticipated for the hydraulic containment alternative. A relative period of time for treatment was assumed to be 50 years.

Estimated Period of Operation:	Oxidant injection, 5 years; monitoring 50 years
Estimated Total Present Worth:	$1.8 million

Alternative DMC GW-5: Soil Excavation. The major components of this alternative include:

- Pre-remedial study;
- Excavation support activities;
- Soil excavation and off-site disposal;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a source control, or removal, remedy. The removal of sources of contamination will likely reduce the concentrations in groundwater, as well as significantly reduce the risk posed to construction workers through direct contact of contaminants in groundwater. Under this alternative, all accessible hot spot areas (including DNAPL if encountered) will be excavated and transported for off-site disposal. A particular challenge to excavating soil from this Study Area is that it is likely that contamination (DNAPL) has penetrated the unsaturated soil (vadose zone), thus, a deep excavation would be required to remove all possible source materials (up to 20 feet deep in some locations with an area of between 0.10 – 0.20 acres for hot spot excavation, with a worst-case estimate of 0.55 acres to excavate all contaminated soils within the 1,000 ppb TCE contour). The presence of buildings and utilities present challenges as well, and it is possible that contaminated soils exist under the buildings.

The elimination of hot spot areas through excavation and off-site disposal of contaminated soils is the alternative that provides the greatest degree of overall protection of human health that is technically practicable at this study area. This alternative is the most reliable option if all contaminated soils are removed, and provides for a shorter timeframe for remedial action, which is desired to reduce the potential for human exposure. Excavation is expected to significantly reduce the risk posed to construction workers through direct contact of contaminated groundwater immediately upon completion. Long-term monitoring of groundwater would be implemented upon removal of source materials to demonstrate the effectiveness and protectiveness of the remedy; complete reduction of contaminants in overburden groundwater is expected to take up to 50 years. Five-year reviews would be required to assess the remedy in accordance with EPA guidance. Institutional controls, in the form of ELURs, would prevent the use of overburden groundwater as drinking water or for other domestic purposes, prevent construction of buildings without the necessary controls to minimize potential inhalation risks, prohibit residential activities, and prohibit soil disturbance and exposure to groundwater via intrusive activities without a plan to protect against groundwater contact in uncontrolled conditions.

Estimated Period of Operation:	Excavation and disposal, <1 year; monitoring, 50 years
Estimated Total Present Worth:	\$1.9 - \$3.2 million for hot spot; \$8.1 million worst case

Site-wide Groundwater Study Area – Source Zone

Alternative SZ-1: No Action. The No Action alternative is developed as a baseline to which other alternatives can be compared. Under this alternative, no remedial action is taken, and as a result only naturally occurring processes would act to reduce contamination. The time to achieve RAOs for groundwater under the No Action alternative is equivalent to projected attenuation of contamination under natural conditions, which is likely to be much greater than 100 years.

Estimated Period of Operation: None
Estimated Total Present Worth: None

Alternative SZ-2: Groundwater Extraction – Hydraulic Containment. The major components of this alternative include:

- Groundwater extraction;
- Ex-situ groundwater treatment;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a containment alternative to manage the migration of contaminated groundwater. The alternative consists of extracting groundwater from the source zones (high concentrations of VOCs and possibly DNAPL, if encountered) using new or existing extraction wells. Such action will limit the migration of contaminated bedrock groundwater. Extracted groundwater would be piped to a centralized treatment system. Groundwater would be treated and discharged to surface waters. Five-year Site reviews would be conducted to evaluate the remedy per EPA guidance. Institutional controls would also be implemented to avoid Site uses of contaminated groundwater until all RAOs are met. Under this scenario, institutional controls would include obtaining an ELUR, as defined in the CT RSRs, to restrict use of groundwater for drinking or domestic purposes.

Estimated Period of Operation: 100 years
Estimated Total Present Worth: $8.7 million

Site-wide Groundwater Study Area – Dissolved Plume

Alternative DP-1: No Action. The No Action alternative is developed as a baseline to which other alternatives can be compared. Under this alternative, no remedial action is taken. The time to achieve RAOs for groundwater under the No Action alternative is equivalent to projected attenuation of contamination under natural conditions, which is likely to be greater than 100 years.

Estimated Period of Operation: None
Estimated Total Present Worth: None

Alternative DP-2: Monitored Natural Attenuation. The major components of this alternative include:

- Installation of bedrock groundwater monitoring wells;
- Environmental monitoring;
- Institutional controls;
- Five-year reviews.

This alternative was developed as a treatment option for dissolved phase contaminated groundwater. It includes monitoring the dissolved phase groundwater plumes for attenuation and five-year Site reviews to evaluate the effectiveness of the remedy. Institutional controls in the form of ELURs or a local ordinance would be implemented to avoid Site uses of contaminated groundwater.

Estimated Period of Operation:	> 100 years
Estimated Total Present Worth:	$1.9 million

Alternative DP-3: Groundwater Extraction – Restoration. The major components of this alternative include:

- Groundwater extraction;
- Ex-situ groundwater treatment;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a pump and treat option. Extracted groundwater would be piped to a centralized treatment system. Groundwater would be treated and discharged to surface waters. Five-year Site reviews would be required to evaluate the remedy in accordance with EPA guidance. Institutional controls in the form of ELURs or a local ordinance would also be implemented to avoid Site uses of contaminated groundwater.

Estimated Period of Operation:	50 years
Estimated Total Present Worth:	$8.5 million

Alternative DP-6: Monitoring. The major components of this alternative include:

- Installation of bedrock groundwater monitoring wells;
- Environmental monitoring;
- Institutional controls;

- Five-year reviews.

This alternative was developed as a limited action alternative. No remedial actions are proposed. It consists of monitoring the Site-wide Groundwater Study Area for a period of up to ten years, including source zone and dissolved plume groundwater to determine whether the plume is migrating or attenuating. Institutional controls in the form of ELURs or a local ordinance would be implemented to avoid Site uses of contaminated groundwater. It is also assumed that an alternate water supply alternative would be implemented in conjunction with this action.

Estimated Period of Operation: 10 years
Estimated Total Present Worth: $434,000

Site-wide Groundwater Study Area – Alternate Water Supply

Alternative AWS-1: No Action. The No Action alternative is developed as a baseline to which other alternatives can be compared. Under this alternative, no alternate water supply is provided. The time to achieve RAOs for groundwater under the No Action alternative is equivalent to projected attenuation of contamination under natural conditions, which is likely to be greater than 100 years.

Estimated Period of Operation: None
Estimated Total Present Worth: None

Alternative AWS-2: Connection to Middletown Water Distribution System. The major components of this alternative include:

- Extend the existing Middletown water system;
- Construct water distribution system within Study Area;
- Connect residences to new distribution system;
- Institutional controls; and
- Five-year reviews.

Under this alternative, the existing Middletown Water Distribution System would be extended along Route 17 south to residences within the Study Area providing potable water to all impacted constituents. It is assumed 85 service connections would be made to the water mains. The proposed distribution system is looped within the Study Area in order to service all impacted constituents as well as to address water quality and pressure considerations. This alternative, combined with institutional controls on existing groundwater use, will prevent exposure to contaminated groundwater. Five-year Site reviews would be required to evaluate the remedy in accordance with EPA guidance. Implementation of this alternative will require the development of administrative and operation and maintenance functions. Administrative responsibilities will include billing, customer service, and regulatory compliance. Operation and maintenance of the water supply and distribution components, including regulatory compliance, will be necessary.

Estimated Period of Operation: Construction <1 year; operation and maintenance, 50 years
Estimated Total Present Worth: $7.0 million

Alternative AWS-3: Development of New Groundwater Source and Water Distribution System. The major components of this alternative include:

- Develop new potable groundwater source;
- Construct water distribution system within Study Area;
- Connect residences to new distribution system;
- Institutional controls; and
- Five-year reviews.

A new groundwater source would be developed in close proximity to the Study Area and a distribution system would be installed within the Study Area under this alternative. This new source and distribution system would provide potable water to all impacted constituents. It is assumed 85 service connections would be made to the water mains. This alternative, combined with institutional controls on existing groundwater use, will prevent exposure to contaminated groundwater. Five-year Site reviews would be required to evaluate the remedy in accordance with EPA guidance. Implementation of this alternative will also require the development of administrative and operation and maintenance functions. Administrative responsibilities will include billing, customer service, and regulatory compliance. Operation and maintenance of the water supply and distribution components, including regulatory compliance, will also be necessary.

When EPA evaluated this alternative in the Feasibility Study, adequate data was not available to determine a definitive well source in proximity to the Study Area, therefore the Feasibility Study presents this alternative to include installation and development of a new groundwater supply, assumed to be upgradient to the north and east of the Study Area, although a specific supply location was not investigated. As outlined in the Proposed Plan, there are a variety of existing well locations that could possibly be further investigated as potential sources, including but not limited to the Durham Fairgrounds wells, the DMC cooling water well, a well at the Parsons Manufacturing Company, or other potential well locations within the Town of Durham. The Durham Fairgrounds wells to the south west of the Study Area are currently being investigated by the Town of Durham as a potential source for the Durham Center water system. Preliminary results of a 72-hour pump test conducted in July 2005 indicated a maximum capacity of 170 gallons per minute for simultaneous pumping of the two Fairgrounds wells. The DMC cooling water well (well #2) may have capacity to provide an adequate source of water for the Study Area, although there is no information available to confirm this. A well located at the Parsons Manufacturing Company may reportedly have enough capacity as well. The Parsons and DMC wells are both currently contaminated, however, and would require treatment prior to distribution for drinking water purposes. The need for treatment would increase the cost estimate for this alternative. Federal and state agencies may also prefer clean water supply options over contaminated sources.

Estimated Period of Operation: Construction <1 year; operation and maintenance, 50 years
Estimated Total Present Worth: $6.6 million

Alternative AWS-4: Point of Use Treatment. The major components of this alternative include:

- Continued operation of residential groundwater pumps
- Ex-situ treatment at each impacted residence;
- Long-term monitoring;
- Five-year reviews.

Under this alternative, ex-situ point of use treatment systems would be installed at each impacted location. Systems would be designed to address specific contaminants of concern at each location. Treatment of the dissolved phase contaminated groundwater at each impacted location would provide some level of restoration of the groundwater as well as provide an alternate water supply. Long-term groundwater monitoring would be required to both evaluate the effectiveness of groundwater restoration as well as ensure the federal and state regulatory requirements related to drinking water supply are met. Five-year Site reviews would be required to evaluate the remedy in accordance with EPA guidance.

Estimated Period of Operation: Implementation <1 year; operation & maintenance, 50 years
Estimated Total Present Worth: $7.2 million

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria. The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy will meet all federal environmental and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria. The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. Short term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. Cost includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria. The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/FS and Proposed Plan:

8. State acceptance addresses the state's position and key concerns related to the preferred alternative and other alternatives, and the state's comments on ARARs or the proposed use of waivers.

9. Community acceptance addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Tables 7.1-1 through 7.6-1 of the FS.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. Evaluation for each criteria is done by Study Area. Only those alternatives which satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria.

1. Overall Protection of Human Health and the Environment.

Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

MMC Study Area: The no action alternatives for soil and soil vapor (S-1 and SV-1) would be the least protective of human health and the environment because there would be no cleanup of the site and unacceptable risks to human health would remain.

The Containment Alternative (S-2), would provide overall protection of human health and the environment by preventing direct exposure to materials that present an unacceptable risk with the use of an impermeable cap and institutional controls; ongoing maintenance of the cap would be required to ensure continued protectiveness. The Excavation and Off-site Disposal Alternative for soil (S-3), would also provide overall protection of human health risks by preventing direct exposure to materials by removing contaminated soil. Both of these alternatives would provide some measure of protection, but may not fully address inhalation risks from soil vapor contamination. Institutional controls would be required to restrict use. The Excavation Alternative for soil vapor (SV-2), provides for deeper excavation, just in the areas with soil vapor contamination, to specifically address this issue. The Soil Vapor Extraction Alternatives for soil and soil vapor respectively (S-4 and SV-3), would effectively eliminate risks to human health from direct contact with TCE in soil and inhalation of TCE in soil vapor. SVE alone, however, cannot address current and future risks due to PAHs and metals in soil.

Combinations of the above alternatives were contemplated to address unacceptable risks from contaminants in both soil and soil vapor. Combining the Containment (S-2) and Soil Vapor Extraction (SV-3) alternatives would prevent direct exposure to human health and address inhalation risk, although the cap would require ongoing maintenance to ensure continued protectiveness. Combining Excavation alternatives for both soil and soil vapor (S-3 and SV-2), would address all contaminants. By combining Excavation for soil (S-3) and Soil Vapor Extraction (SV-3), SVE would be implemented prior to excavation to reduce the volume and depth of VOC contamination requiring excavation. The latter two combinations (S-3 with SV-2, and S-3 with SV-3) provide the greatest degree of overall protection.

DMC Study Area: The No Action Alternative (GW-1) would be the least protective of human health and the environment because there would be no cleanup of the site and unacceptable risks to human health would remain.

For all of the other alternatives contemplated for this Study Area, the possible presence of DNAPL and possible contamination under buildings and utilities increases the expected timeframe for reduction in concentrations. All alternatives are expected to leave some residual DNAPL in overburden, as it is not technically practicable to clean up this DNAPL. Institutional controls are required in conjunction with these alternatives to prevent construction workers from coming into contact with contaminated groundwater, and to prevent future site uses that do not address volatilization issues.

The Hydraulic Containment Alternative (GW-2) would protect human health by extracting and treating overburden groundwater to mitigate the risk posed to construction workers through direct contact and to a future resident through volatilization of contaminants from groundwater. However, reduction of contaminants is expected to occur over a long period of time (at least 100 years). The Multi Phase Extraction Alternative (GW-3) is expected to have similar results as GW-2, except that with the addition of a vapor extraction component, potential contaminant sources in the saturated zone are also reduced, and the timeframe for reduction of contaminants may be reduced to 50 years. The In-situ Chemical Oxidation Alternative (GW-4) is expected to reduce contaminant mass, volume and concentration through injection of an oxidizing agent into wells to treat overburden groundwater; however, the timeframe for reduction of contaminants is assumed to be 50 years due to low permeability of overburden.

The Excavation and Off-site Disposal Alternative (GW-5) would protect human health by excavating contaminated soil in hot spot areas to significantly reduce the risk posed to construction workers through direct contact to contaminants from groundwater. Elimination of hot spot areas provides the greatest degree of overall protection that is technically practicable at this study area, and provides for a shorter timeframe for remedial action, which is desired to reduce the potential for human exposure. Excavation is expected to significantly reduce the risk posed to construction workers through direct contact of trichloroethene in overburden groundwater immediately upon completion, although long-term monitoring is still required as reduction of contaminants in overburden groundwater is expected to take up to 50 years. As stated above, the excavation of hot spot areas will also remove a source of contamination to groundwater.

Site-wide Groundwater Study Area – Alternate Water Supply: The No Action Alternative (AWS-1) would be the least protective of human health and the environment because unacceptable risks to human health would not be addressed. The Connection to Middletown Water Distribution System Alternative (AWS-2), and Development of New Groundwater Source and Water Distribution System Alternative (AWS-3), would both protect human health by providing an alternate water supply for all impacted constituents. These alternatives provide the greatest protection of human health by eliminating all current and future risk. The Point of Use Treatment Alternative (AWS-4), protects human health by filtering and/or otherwise treating well water prior to use, and providing contingencies for bottled water should point of use treatment fail. Institutional controls are required for alternatives AWS-2, AWS-3 and AWS-4 to ensure continued protectiveness by preventing use of contaminated groundwater.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): No Action Alternatives (SZ-1 and DP-1), implemented on their own, would be the least protective of human health and the environment because unacceptable risks to human health would not be addressed.

For the source zone, Groundwater Extraction - Hydraulic Containment Alternative (SZ-2), would increase human health protection by reducing the concentration of contaminants in the associated plume area, although no active cleanup of groundwater is contemplated (containment is the only goal). There is no alternative that can fully achieve cleanup goals in the source zone in a reasonable timeframe.

For the dissolved plume, Monitored Natural Attenuation Alternative (DP-2), no reduction in risk occurs if implemented on its own. Implemented in conjunction with provision of an alternate water supply and institutional controls, human health protection is increased. Groundwater Extraction – Restoration Alternative (DP-3), would increase human health protection, but is not likely to achieve cleanup goals for 50 years. This alternative is not protective if implemented alone, but increases human health protection if implemented in conjunction with provision of an alternate water supply and institutional controls. Monitoring of the Dissolved Plume Alternative (DP-6) uses a monitoring network to ensure that the plume does not migrate to areas not affected by groundwater contamination. Again, implemented alone, no reduction of risk occurs.

Alternatives were combined to include Monitoring of the Dissolved Plume (DP-6), No Action for the Source Zone (SZ-1), and Groundwater Extraction for Hydraulic Containment Alternative (SZ-2) specifically provided as a contingency, in the event that groundwater plume migration does occur. In conjunction with the provision of an alternative water supply as described in alternatives AWS-2 or AWS-3, this combination is protective of human health.

2. Compliance with Applicable or Relevant and Appropriate Requirements.

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address hazardous substances, the remedial action to be implemented at the Site, the location of the Site or other circumstances present at the Site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law which, while not applicable to the hazardous materials found at the Site, the remedial action itself, the Site location or other circumstances at the Site, nevertheless address problems or situations sufficiently similar to those encountered at the Site that their use is well-suited to the Site.

MMC Study Area: Alternatives S-1 and SV-1, No Action for soil and soil vapor, would not comply with chemical-specific ARARs applicable to the Site. Soil vapor extraction alternatives alone, S-4 and SV-3, would not meet all chemical-specific ARARs. The excavation alternatives, S-3 for soil and SV-2 for soil vapor, if implemented separately, may not meet all chemical specific ARARs for the entire depth of soil.

Alternatives S-2, Containment, and all three combinations of alternatives (S-3 and SV-2, Excavation for both Soil and Soil Vapor; S-3 Soil Excavation and SV-3 Soil Vapor Extraction; S-2 Containment and SV-3 Soil Vapor Extraction) would meet all chemical, location, and action-specific ARARs if properly implemented.

DMC Study Area: Alternative GW-1, No Action, would not comply with chemical-specific ARARs applicable to the Site. All other alternatives, GW-2, GW-3, GW-4 and GW-5, will all meet RAOs over time, ranging from up to 50 years for GW-3, GW-4, and GW-5, to 100 years for GW-2. Excavation pursuant to alternative GW-5 is expected to significantly reduce the risk posed to construction workers through direct contact of contaminated groundwater immediately upon completion, although long-term monitoring is still required as reduction of contaminants in overburden groundwater is expected to take up to 50 years. None of the alternatives for the DMC Study Area are expected to meet chemical-specific ARARs relating to groundwater restoration. A technical impracticability waiver is proposed for ARARs that would normally require cleanup of the groundwater. These alternatives will all meet location and action-specific ARARs if properly implemented.

Site-wide Groundwater Study Area – Alternate Water Supply: Alternative AWS 1, No Action, would not comply with chemical-specific ARARs. Alternatives AWS-2, AWS-3 and AWS-4 will all achieve RAOs and chemical-specific ARARs as they relate to water supply only (no actual cleanup of Site-wide groundwater occurs with any of these alternatives). These alternatives will comply with location and action-specific ARARs if properly implemented.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): No action alternatives SZ-1 and DP-1 do not comply with chemical-specific ARARs. Alternative SZ-2 would comply with chemical-specific ARARs, but only as they relate to treatment of extracted groundwater and not for groundwater restoration; this alternative does not meet RAOs or chemical-specific ARARs within the source zone. Alternative DP-2 may achieve chemical-specific ARARs in the dissolved plume, but likely in a timeframe greater than 100 years; this alternative would not achieve RAOs or chemical-specific ARARs within the source zone. Alternative DP-3 may achieve chemical-specific ARARs in a timeframe greater than 50 years in the dissolved plume, however, this alternative would not achieve RAOs or chemical-specific ARARs within the source zone. Alternative DP-6, implemented alone, does not comply with chemical-specific ARARs.

Alternatives were combined to include DP-6, Monitoring of the Dissolved Plume, Alternative SZ-1, No Action for the Source Zone, and Alternative SZ-2, Groundwater Extraction for Hydraulic Containment (SZ-2 is specifically provided as a contingency, in the event that groundwater plume migration does occur). In conjunction with the provision of an alternative water supply as described in alternatives AWS-2 or AWS-3, this combination achieves RAOs and chemical-specific ARARs as they apply to water supply only. A technical impracticability waiver is proposed for ARARs that would normally require cleanup of the groundwater.

3. Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

MMC Study Area: Alternatives S-1 and SV-1, No Action for soil and soil vapor, do not provide any long-term effectiveness or permanence. Soil vapor extraction alternatives alone, S-4 and SV-3, would not remove risks posed by chemicals other than VOCs, and would not address all human health risks. The excavation alternatives, S-3 for soil and SV-2 for soil vapor, if implemented separately, would provide long-term effectiveness and permanence, but only for specific contaminants; residual risks for other contaminants may remain. Alternative S-2 Containment would provide long-term effectiveness and permanence, provided the cap was regularly maintained.

Combining S-2 Containment and SV-3 Soil Vapor Extraction would provide long-term effectiveness and permanence, provided the cap was regularly maintained. The remaining combinations of alternatives (S-3 and SV-2, Excavation for both Soil and Soil Vapor, and S-3 Soil Excavation and SV-3 Soil Vapor Extraction) would provide the most permanence and long-term effectiveness.

DMC Study Area: Alternative GW-1, No Action, does not provide any long-term effectiveness or permanence. Alternatives GW-2, GW-3, GW-4 and GW-5, will all provide some measure of long-term effectiveness by reducing concentrations of VOCs in both the hot spot areas and the associated plume. However, the likely presence of DNAPL, including residual DNAPL within till fractures, creates the possibility of residual contamination being available for dissolution many years into the future. The alternatives are expected to provide adequate and reliable controls. The possible exception is alternative GW-4, in-situ chemical oxidation, due to the potential for mobilization of metals with certain oxidant and soil types. Alternative GW-5 is the most reliable option if all contaminated soils are removed.

Site-wide Groundwater Study Area – Alternate Water Supply: Alternative AWS-1, No Action, does not provide any long-term effectiveness or permanence. Under alternatives AWS-2, AWS-3 and AWS-4, residual risks will remain at the Site due to contaminated groundwater. AWS-2 and AWS-3 provide a permanent hookup to an alternate water supply, which would remove the risk to human health from contaminated groundwater.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): No action alternatives SZ-1 and DP-1 do not provide any long-term effectiveness or permanence. Alternative SZ-2 would reduce concentrations of VOCs in both the source zone and indirectly in the dissolved plume, but residual risk from DNAPL will remain at the Site for many years into the future. This alternative may effectively manage migration and would require a long term monitoring program, regular maintenance, and institutional controls. Under alternative DP-2, residual risk remains due to contaminated groundwater for a timeframe likely greater than 100 years. Alternative DP-3 may minimize migration of contaminated water and reduce the size of the dissolved plume, but residual risk remains for a timeframe likely greater than 50 years.

Alternative DP-6, implemented alone, includes no controls to reduce contaminant levels.

Alternatives were combined to include DP-6, Monitoring of the Dissolved Plume, Alternative SZ-1, No Action for the Source Zone, and Alternative SZ-2, Groundwater Extraction for Hydraulic Containment, specifically provided as a contingency, in the event that groundwater plume migration does occur. In conjunction with the provision of an alternative water supply as described in alternatives AWS-2 or AWS-3, as well as a technical impracticability waiver for both the source zone and dissolved plume areas, this combination achieves long-term effectiveness and permanence for protection of human health and the environment.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

MMC Study Area: The no action alternatives, S-1 and SV-1, do not reduce toxicity, mobility, or volume through treatment. Containment alternative S-2 may reduce mobility, although not through treatment. This alternative would reduce the mobility of the chemical contaminants that are placed beneath the cap by preventing water from coming into contact with contaminants. Excavation alternatives S-3 and SV-2 will reduce toxicity, as contaminants above cleanup levels will be removed from the site; this will greatly reduce mobility and volume, but not through treatment (although some materials shipped off-site may require treatment prior to disposal). Soil vapor extraction alternatives, S-4 and SV-3, will reduce toxicity and the overall mass of VOCs in soil through treatment. SVE is an irreversible treatment process for VOCs, by which extracted VOCs are collected on carbon and destroyed during carbon regeneration. Similarly, any alternative combination that includes SVE will satisfy this criteria.

DMC Study Area: Alternative GW-1, No Action, does not reduce toxicity, mobility, or volume through treatment. Alternatives GW-2, GW-3, and GW-4, will all provide some reduction of toxicity, mobility and volume through treatment, however, residual contamination in groundwater will likely be available as DNAPL. Alternative GW-2 will treat extracted groundwater to remove potential DNAPL in a separation process, remove VOCs with air stripping and adsorption, and remove metals by precipitation. For Alternative GW-2, a treatability study would determine if advanced oxidation would be necessary for treatment of 1,4-dioxane or other contaminants that are resistant to stripping. Alternative GW-3 is similar to GW-2, but adds vapor phase extraction. Alternative GW-4 would involve installation of wells throughout the area for injection of an oxidizing agent into the ground; the oxidizing agent would permanently break down contaminants to non-hazardous products. Excavation alternative GW-5 will reduce toxicity, as hot spot contaminants will be removed from the site; this will additionally greatly reduce mobility and volume, but not through treatment (although some materials shipped off-site may require treatment prior to disposal).

Site-wide Groundwater Study Area – Alternate Water Supply: None of the alternatives reduce toxicity, mobility, or volume through treatment. Natural attenuation may eventually reduce the toxicity and volume of contaminants in groundwater. AWS-4 provides some treatment of contaminated groundwater through the use of filters; however, this treatment is incidental and for water supply purposes only; this alternative does not provide active remediation of contaminated groundwater.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): No action alternatives SZ-1 and DP-1 do not reduce toxicity, mobility, or volume through treatment. Alternative SZ-2 would reduce toxicity, mobility and volume through treatment of VOCs, SVOCs and metals in both the source zone and indirectly in the dissolved plume; extracted groundwater would be treated to remove DNAPL in separation process, and treated via precipitation and air stripping processes. Advanced oxidation would be required to remove 1,4-dioxane. However, residual contamination in groundwater is expected to persist. Under Alternative DP-2, natural attenuation would eventually reduce concentrations of contaminants in groundwater, but no active treatment is contemplated and residual contamination is expected for a timeframe likely greater than 100 years. Alternative DP-3 would reduce toxicity, mobility and volume through treatment of VOCs, SVOCs and metals in the dissolved plume via groundwater extraction and treatment, although residual contamination is expected to remains for a timeframe likely greater than 50 years. Alternative DP-6, implemented alone, provides no active treatment, although natural attenuation would eventually reduce concentrations of contaminants in groundwater.

Alternatives were combined to include DP-6, Monitoring of the Dissolved Plume, Alternative SZ-1, No Action for the Source Zone, and Alternative SZ-2, Groundwater Extraction for Hydraulic Containment, specifically provided as a contingency, in the event that groundwater plume migration does occur. These alternatives would be implemented in conjunction with the provision of an alternative water supply as described in alternatives AWS-2 or AWS-3, as well as a technical impracticability waiver for both the source zone and dissolved plume areas. No active treatment is contemplated, unless the contingency of SZ-2 for containment is implemented.

5. Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

MMC Study Area: Because the no action alternatives, S-1 and SV-1, would not require any activities to be conducted, there would be no short-term impacts to the community or on-site workers. The no action alternatives do not reduce risks to human health. Containment alternative S-2 would have some short-term impacts to the community from the construction activities, and dust control measures and air monitoring would be required. Installation of a cap would take less than one year for construction. Excavation alternatives S-3 and SV-2 would also have some short-term impacts to the community from the construction activities, and similar dust control measures and air monitoring would be required. Construction activities related to excavation and off-site disposal would take less than one year. In soil vapor extraction alternatives S-4 and SV-3, air emissions would be monitored to ensure there are no impacts to the community, and monitoring would be required during construction for worker protection. SVE alone would meet response action objectives within 5 to 7 years for VOCs alone, but would not address risks from other chemicals.

Combining S-2 Containment and SV-3 Soil Vapor Extraction may increase the efficiency of VOC removal and therefore short-term effectiveness. No additional short term impacts to the community or construction workers are contemplated for the remaining combinations of alternatives.

DMC Study Area: The no action alternative GW-1 doesn't require any activities to be conducted, therefore there would be no short-term impacts to the community or on-site workers; this alternative does not reduce risks to human health. Impacts to the community by alternatives GW-2 and GW-3 will be limited to the construction of a treatment facility. Risks may not be adequately addressed for 100 years for GW-2 and 50 years for GW-3. Minimal risk is posed to the community by alternative GW-4; risks may not be adequately addressed for 50 years. The short-term impacts to the community with alternative GW-5 include a high volume of truck traffic during excavation activities. Dust control may be required and construction workers would be required to have appropriate health and safety training; risks may not be adequately addressed for 50 years. Alternative GW-5, however, does provide the shortest timeframe for remedial action, which reduces the potential for human exposure. If excavation is required to a depth of 20 feet, there will be more material handling activities with concurrent additional short-term risks.

Site-wide Groundwater Study Area – Alternate Water Supply: The no action alternative AWS-1 doesn't require any activities to be conducted, therefore there would be no short-term impacts to the community or on-site workers; this alternative does not reduce risks to human health. Under alternatives AWS-2 and AWS-3, construction of water mains and service connections are not expected to have a significant impact on the local community or construction workers, with respect to exposure to contamination. Normal construction hazards associated with this type of activity will be mitigated through implementation of safe work practices and compliance with OSHA requirements. Significant environmental impacts are not expected from water supply infrastructure installation. Under alternative AWS-4, installation and monitoring of treatment systems is expected to pose a mild disturbance to the community at large. Although no active cleanup of groundwater is contemplated by alternatives AWS-2, AWS-3 and AWS-4, risks to human health would be addressed immediately upon hookup to an alternate water supply or provision of point of use treatment.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): The no action alternatives SZ-1 and DP-1 don't require any activities to be conducted, therefore there would be no short-term impacts to the community or on-site workers; this alternative does not reduce risks to human health.

Impacts to the community from alternative SZ-2 would be limited to construction of a treatment facility and associated piping. Construction workers would be required to have appropriate training. Alternative DP-3 has similar impacts, although the lateral extent of piping is greater, and therefore would increase impacts to the community due to installation of extraction wells and piping. Under both alternative SZ-2 and DP-3, no short-term reduction to human health risk would be realized.

Alternatives DP-2 and DP-6 do not propose active remediation beyond monitoring, therefore no significant adverse impacts to the community or workers occur. Minimal impacts occur from the installation of additional monitoring wells if necessary and from monitoring activity. Also, there is no short-term reduction to human health risk.

Alternatives were combined to include DP-6, Monitoring of the Dissolved Plume, Alternative SZ-1, No Action for the Source Zone, and Alternative SZ-2, Groundwater Extraction for Hydraulic Containment, specifically provided as a contingency, in the event that groundwater plume migration does occur. These alternatives would be implemented in conjunction with the provision of an alternative water supply as described in alternatives AWS-2 or AWS-3, as well as a technical impracticability waiver for both the source zone and dissolved plume areas. Unless the contingency of SZ-2 for containment is implemented, no impact to the community or workers is contemplated and no short-term reduction in human health risk occurs. (See alternatives AWS-2 and AWS-3 for relevant discussion on short-term effectiveness.)

6. Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of materials and services, administrative feasibility, and coordination with other government entities are also considered.

MMC Study Area: Alternatives S-1 and SV-1 are the easiest to implement because no remedial actions are required. All other alternatives and combinations of alternatives are easily implemented because they all involve reliable technologies with proven histories of success. The personnel, equipment and materials required to implement each of these technologies are readily available. Alternatives involving excavation and containment would require access to an adjacent residential property, as well as potential institutional controls. Also, excavation alternatives would not be implemented underneath the existing building, if contaminants are found in that area.

DMC Study Area: Alternative GW-1 is the easiest to implement because no remedial actions are required. Alternatives GW-2 and GW-3 are relatively easily implemented, involving reliable technologies that have been implemented at many other such sites. The personnel, equipment and materials required to implement each of these technologies are readily available. Alternative GW-4 can be readily implemented, and has been demonstrated to be technically feasible at similar sites; however, the reliability of oxidation of all potential DNAPL in a fractured till is uncertain. Alternative GW-5, excavation, is a common remediation action. Challenges facing this alternative are the proximity to a building that is actively used and subsurface utilities.

Alternatives GW-2, GW-3, GW-4 and GW-5 may all involve access to an adjacent residential property, as well as potential institutional controls. Also, excavation alternatives would not be implemented underneath the existing building, if contaminants are found in that area.

Site-wide Groundwater Study Area – Alternate Water Supply: AWS-1 is the easiest to implement because no remedial actions are required. Alternatives AWS-2, AWS-3 and AWS-4 are relatively easily implemented because they all involve reliable and common technologies. The personnel, equipment and materials required to implement each of these technologies are readily available. Alternatives AWS-2 and AWS-3 would require extensive coordination with property owners, state and local agencies, and municipalities. Alternative AWS-4 would require similar coordination. The effectiveness of treatment for 1,4-dioxane at individual wells is questionable, and has not yet been proven to be entirely effective.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): The no action alternatives SZ-1 and DP-1 don't require any remedial actions and are therefore the easiest to implement. Alternative SZ-2 is relatively easily implemented in that the technology is reliable and common, and personnel, equipment and materials required to implement each of these technologies are readily available. Placement of extraction wells, however, may be difficult due to the complex hydrogeology found at the source zones, and frequent monitoring would be required. Alternative DP-3 is similarly easily implemented due to readily available technology;

however, placement of extraction wells may be difficult due to the complex hydrogeology in the dissolved plume area.

Alternatives DP-2 and DP-6 do not propose active remediation or construction beyond installation of monitoring wells, therefore these alternatives are much easier to implement.

Alternatives were combined to include DP-6, Monitoring of the Dissolved Plume, Alternative SZ-1, No Action for the Source Zone, and Alternative SZ-2, Groundwater Extraction for Hydraulic Containment, specifically provided as a contingency, in the event that groundwater plume migration does occur. These alternatives would be implemented in conjunction with the provision of an alternative water supply as described in alternatives AWS-2 or AWS-3, as well as a technical impracticability waiver for both the source zone and dissolved plume areas. Implementation of alternatives DP-6 and SZ-1 is easy, but implementing the contingency of SZ-2 for containment would be more difficult as previously described.

7. Cost

MMC Study Area: No action alternatives S-1 and SV-1 have no associated costs. Soil vapor extraction alternatives S-4 and SV-3 are generally the least expensive alternative, with cost estimates ranging from $494,000 to $505,000 if implemented alone. Containment alternative S-2 has a cost estimate of $2.7 million. The excavation alternatives, S-3 and SV-2, have cost estimates ranging from $2.6 to $3.8 million, depending on the lateral extent and depth to which excavation is required.

The combination of the two excavation alternatives for soil and soil vapor, S-3 and SV-2, achieves some overlap in volumes of soil requiring excavation, which saves some shared costs for a total of $4.9 million. The combination of excavation alternative S-3 and soil vapor extraction alternative SV-3 achieves cost savings by implementing SVE first in order to reduce VOC contaminants and the extent to which excavation is required; the total for this combination is $2.2 million. Combining containment alternative S-2 and soil vapor extraction SV-3 results in some cost savings by increasing the effectiveness of the SVE; the total for this combination is $3.0 million.

DMC Study Area: No action alternative GW-1 has no associated cost. The In-situ Chemical Oxidation alternative, GW-4, is the least expensive alternative at $1.8 million. Excavation alternative GW-5 has a cost estimate of $3.2 million. The containment alternative, GW-2, and multi-phase extraction alternative, GW-3, are both priced at an estimate of $4.9 million. The cost for taking action for potential vapor intrusion, if found, has not been included in the cost estimates.

Site-wide Groundwater Study Area – Alternate Water Supply: No action alternative AWS-1 has no associated cost. Alternative AWS-3, Development of New Groundwater Source and Water Distribution System, has an estimated cost of $6.6 million. This cost could change if area wells are determined to have adequate supply, and/or if treatment of water from such wells is necessary prior to distribution. Alternative AWS-2, Connection to Middletown Water Distribution System, has a cost estimate of $7.0 million. Alternative AWS-4, Point of Use Treatment is the most expensive alternative, with a cost estimate of $7.2 million.

Site-wide Groundwater – Source Zone (SZ) and Dissolved Plume (DP): No action alternatives SZ-1 and DP-1 have no associated cost. Alternative DP-6, Monitoring of the Dissolved Plume, has a cost estimate of $434,000. Alternative DP-2, Monitored Natural Attenuation for the Dissolved Plume, has an estimated cost of $1.9 million. Alternative DP-3, Groundwater Extraction – Restoration for the Dissolved Plume, has an estimated cost of $8.5 million, while alternative SZ-2, Groundwater Extraction - Hydraulic Containment for Source Zone, has a cost estimate of $8.7 million. The cost for investigating and taking action for potential vapor intrusion risks beyond the MMC and DMC Study Areas, if found, has not been included in the cost estimates.

8. State Acceptance

CT DEP submitted comments on August 11, 2005, during the public comment period for the Site, generally supporting the preferred alternative. CT DEP specifically concurred with the proposals for the MMC Study Area (combination of Alternatives S-3 and SV-3), the DMC Study Area (DMC Alternative GW-5), the Site-wide Groundwater Study Area alternative water supply proposal (Alternative AWS-2, connection to the Middletown Water Distribution System), and the Site-wide Groundwater Study Area source zone and dissolved plume proposals (Alternative SZ-1 and Alternative DP-6, with a contingency to implement a groundwater extraction system, SZ-2). CT DEP also concurred with the implementation of a waiver of federal and state requirements that would normally require cleanup of the groundwater to meet drinking water standards due to technical impracticability.

CT DEP commented that the institutional control component of the remedies should specifically utilize Environmental Land Use Restrictions (ELURs) pursuant to Section 22a-133q-1 of the Regulations of Connecticut State Agencies. This comment has been incorporated into this ROD.

CT DEP concurred with the need for further characterization to assess the potential for VOCs in shallow groundwater to migrate and pose a potential indoor air risk to areas beyond the MMC and DMC Study Areas. CT DEP disagrees with EPA's determination that further actions will be taken to address such risks only after a determination that there is an unacceptable risk, instead proposing that actions be taken if there are any exceedances of CT RSRs, without the need for further risk assessment. EPA and CT DEP do not agree on this matter, and as a result, CT DEP is not concurring on this specific portion of the remedy. CT DEP is concurring on all other components of the remedy.

EPA responds to these comments in the Responsiveness Summary attached to this ROD as Appendix D.

A copy of the state's partial concurrence letter is included as Appendix C of this ROD.

9. Community Acceptance

During the public comment period, the community and State agencies expressed their support for an alternate water supply. Opinions were mixed regarding the source of water, with a number of comments supporting Alternative AWS-2, Connection to Middletown Water Distribution System, and a lesser number of comments supporting Alternative AWS-3 in which a new groundwater source would be developed in close proximity to the Study Area. No comments were received that explicitly expressed non-support for an alternate water supply.

Only one comment was received (from the Durham Manufacturing Company) regarding non-support of the remediation proposed for the DMC Study Area. DMC comments further indicated that the DMC Study Area should not be included in this Record of Decision. EPA does not agree with this comment.

All comments received during the public comment period and EPA's response to comments are included in the Responsiveness Summary, Appendix D of this Record of Decision.

L. THE SELECTED REMEDY

1. Summary of the Rationale for the Selected Remedy

The selected remedy is a comprehensive remedy which addresses principal Site risks by mitigating potential human health risks at the MMC Study Area, the DMC Study Area, and the Site-wide Groundwater Study Area. The selected remedy is the proposed preferred alternative that was identified in the Proposed Plan and is presented in more detail in the FS.

The **major** components of the selected remedy include:

- Soil excavation and off-site disposal, in conjunction with soil vapor extraction, at the MMC Study Area to address risks to human health from contamination in soil and soil vapor. Excavation of a localized area of surface soil contamination on an adjacent residential parcel will also occur.

- Soil excavation and off-site disposal of hot spot areas at the DMC Study Area in order to address risks to human health from contamination in overburden (shallow) groundwater and to address source contamination.

- Connection to the Middletown Water Distribution System to distribute an alternative source of public water to all residences currently affected by groundwater contamination and a buffer zone of residences located near the contaminated area. Development of and connection to a new groundwater source is retained as a contingency measure in the event that a connection to the City of Middletown Water Distribution System cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner. Also included is the interim measure of continued monitoring and filtration, and provision of bottled water as necessary, of impacted residential wells, and any other residential wells within the Site-wide Groundwater Study Area that come to be impacted by Site-related contamination, as currently required under state order and state regulations, to ensure continued protectiveness of human health and the environment until construction of the alternate water supply portion of the remedy is complete and operational. This alternative addresses current and future risk to human health from ingestion of groundwater.

- For the overall area of groundwater contamination, implementing a monitoring network for the dissolved plume to ensure no migration of groundwater occurs beyond its current general boundary.

- Contingency to implement a groundwater extraction system for hydraulic containment if the overall plume or source zone is spreading or migrating beyond its current general boundary.

- Implementation of a technical impracticability waiver of the applicable or relevant and appropriate requirements that would normally require cleanup of the groundwater, since it is not technically practicable to clean up the groundwater to drinking water and other standards in a reasonable amount of time.

- Institutional controls, primarily in the form of Environmental Land Use Restrictions (ELURs) as defined in the CT RSRs, and/or by local ordinance, in a variety of areas to prevent unrestricted future use of certain areas of the Site or use of contaminated groundwater.

- Further delineation of areas posing potential indoor air risks on and outside of the MMC and DMC Study Areas by further characterization, including the collection of shallow groundwater data. If there are unacceptable risks, then further actions will be taken to address such risks, including without limitation, sub-slab depressurization systems and institutional controls on vacant properties or portions of properties, in accordance with EPA and CT DEP requirements.

- Five-year reviews to ensure the remedy continues to be protective of human health and the environment.

A detailed description of the remedial components of the selected remedy follows.

2. Description of Remedial Components

Specific remedial components are presented for each Study Area.

MMC Study Area. Soil and soil vapor contamination on the property will be addressed using a combination of two alternatives: Alternative MMC S-3C Excavation and Off-site Disposal, and Alternative MMC SV-3 Soil Vapor Extraction (SVE).

The major components of Alternative MMC S-3C Excavation and Off-site Disposal include:

- Pre-remedial study;
- Excavation support activities;
- Soil excavation and off-site disposal;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

The major components of Alternative MMC SV-3C Soil Vapor Extraction include:

- Pre-remedial study;
- Site preparation;
- Installation and operation of the SVE system;
- Treatment of off-gas;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative requires that VOCs in soil vapor be treated via SVE first in order to reduce concentrations of VOCs in soil over time and minimize the volume and depth of required excavation needed to address all contaminants on site. SVE may also reduce the mass of any DNAPL residing in subsurface soils. Remaining soil that exceeds cleanup levels shall be excavated and shipped off-site to an approved disposal facility. Scenario S-3C addresses current and future residential risk by excavating and removing soil that exceeds RBGs, CT RSR residential and industrial/commercial Direct Exposure Criteria (DECs), and CT RSR Pollutant Mobility Criteria (PMCs). The estimated lateral extent of contaminated soil to be addressed is approximately 0.75 acres, and the estimated depth ranges to 4 feet, although soils deeper than 4 feet shall be remediated in accordance with ARARs.

While SVE will treat soil vapor prior to excavation on the bulk of the MMC property, excavation of a localized area of PAH contamination in surface soils primarily located on the 275 Main Street parcel shall occur more immediately, to address potential dermal contact risks to the adjacent resident.

Confirmatory sampling during soil excavation will determine how the soil must be disposed. For cost estimating purposes, it was assumed that all excavated soil would be characterized as non-hazardous under RCRA, since soil vapor extraction is expected to reduce the levels of RCRA listed waste in soil.

Institutional controls in the form of an Environmental Land Use Restriction (ELUR) pursuant to CT RSRs shall be required for the MMC parcels. The significant restrictions of the ELUR will be to (i) ensure that any new structures on the property will be constructed to minimize potential inhalation risks from any remaining contamination, and (ii) prevent the future use of groundwater for drinking water. The status of the parcels owned by the Estate of Mr. Allan Adams is currently in transition; in the absence of an identifiable owner of the MMC or other parcels, other forms of an institutional control shall be investigated (e.g., local ordinance, by-law, deed notice) and implemented to the extent possible. After remedy completion, the restrictions on future use are expected to be minimal, compared to other alternatives considered for the MMC Study Area.

After the cleanup levels have been met and the remedy is determined to be protective, an environmental monitoring program shall be required to ensure continued protectiveness of human health and the environment. The environmental monitoring program will include soil vapor monitoring, for an estimated duration of 7 years, and groundwater monitoring, estimated for 50 years, to ensure that the cleanup levels continue to be met and the remedy remains protective.

<u>DMC Study Area.</u> Contamination in overburden (shallow) groundwater on the property will be addressed through Alternative DMC GW-5 Soil Excavation and Off-site Disposal. The major

components of this alternative include:

- Pre-remedial study;
- Excavation support activities;
- Soil excavation and off-site disposal;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a source control, or removal, remedy. The removal of sources of contamination is expected to reduce the concentrations in groundwater, as well as significantly reduce the risk posed to construction workers through direct contact of contaminants in groundwater immediately upon completion of the excavation. Under this alternative, all accessible hot spot areas (including DNAPL if encountered) shall be excavated and transported for off-site disposal. It is expected that DNAPL has penetrated the unsaturated zone, requiring a deep excavation to remove all possible source materials, up to 20 feet deep in some locations. The presence of buildings and utilities presents challenges, and it is possible that contaminated soils exist under the buildings.

This alternative requires excavation of the most contaminated areas on the property which are providing a risk to human health and appear to be providing an ongoing groundwater contamination source. The hot spot areas to be excavated have a total area of 0.20 acres. Of the alternatives contemplated for the DMC Study Area, excavation and off-site disposal is the only alternative expected to reduce the risk in a relatively short timeframe (less than the 50-100 year estimates associated with other alternatives). This alternative is also the most reliable option if all contaminated soils are removed, and provides for a shorter timeframe for remedial action, which is desired to reduce the potential for human exposure. Excavated soil will be shipped off-site to an approved disposal facility. Confirmatory sampling during soil excavation will determine how the soil must be disposed, but for cost estimating purposes, it was assumed that all excavated soil would be characterized as a hazardous waste under RCRA.

Soil removal may also have the additional benefit of reducing contaminant mass loading to groundwater, and consequently reducing overall groundwater contaminant levels over time. Consistent with EPA's Technical Impracticability Guidance for the Site-wide groundwater, this alternative will also remove source areas to the maximum extent practicable and remove soils exceeding CT RSR Pollutant Mobility Criteria (PMC).

Further delineation of VOCs in soils and VOCs in overburden groundwater beneath the DMC facility building will occur during pre-design and/or remedial activities. If it is determined that contaminated soils or contaminants in overburden groundwater under the DMC facility building are posing an unacceptable risk to current workers inside the facility, additional measures shall be taken to address this exposure pathway. The inhalation risk to a future resident from contaminants in overburden groundwater shall be addressed by institutional controls as described below.

Institutional controls in the form of an Environmental Land Use Restriction (ELUR) pursuant to CT RSRs shall be required for the DMC parcel. The significant restrictions of the ELUR will be as follows:

(i) to prevent construction of a building over groundwater that exceeds CT RSR VC unless the Commissioner of CT DEP grants a release based on the stipulation that any new structures will be constructed to minimize potential inhalation risks from any remaining contamination,

(ii) to prevent the use of overburden groundwater as drinking water or for other domestic purposes,

(iii) to prohibit residential activities at the DMC Study Area, unless the Commissioner of CT DEP grants a release from the ELUR, and

(iv) to prohibit soil disturbance at the DMC Study Area and exposure to groundwater by activities such as construction, grading, digging, drilling, excavation and other intrusive activities unless the Commissioner grants a release from the ELUR. Such release would be based on a plan which includes controls to protect the health of construction workers by preventing contact with groundwater in uncontrolled conditions.

Long-term monitoring of groundwater would be implemented upon removal of source materials to demonstrate the effectiveness and protectiveness of the remedy. Groundwater monitoring shall continue for an estimated duration of 50 years.

Site-wide Groundwater Study Area – Alternative Water Supply. Contamination in Site-wide bedrock groundwater will be addressed through Alternative AWS-2: Connection to Middletown Water Distribution System. The major components of this alternative include:

- Extend the existing Middletown water system;
- Construct water distribution system within Study Area;
- Connect residences to new distribution system;
- Institutional controls; and
- Five-year reviews.

Under this alternative, the existing Middletown Water Distribution System shall be extended from the City of Middletown south along Route 17 to residences within the Study Area providing potable water to all impacted residents and eliminating all current and future risk to human health from ingestion of groundwater. This alternative will provide a permanent source of drinking water to all residences currently affected by groundwater contamination and a buffer zone of residences located near the contaminated area. It is assumed 85 service connections would be made to the water mains. The proposed distribution system is looped within the Study Area in order to service all impacted constituents as well as to address water quality and pressure considerations. This alternative, combined with institutional controls on existing groundwater use, will prevent exposure to contaminated groundwater.

A connection to the Middletown Water System has the advantage of providing flexibility for the Town to address other contaminated areas in the Town of Durham north of the Site and avoiding locating a source well in or near contaminated areas.

While the Middletown Water System may also have adequate capacity to provide water service to other portions of town, as well as fire protection, the alternative analyzed in the Feasibility Study was limited to providing water service only to the Superfund Site for drinking water purposes. With respect to fire protection, the Feasibility Study does provide a breakout of additional costs that would be required to provide fire protection, including greater capacity piping as well as the added cost for hydrants should the Town of Durham decide to expand the use of the water service.

Institutional controls in the form of an Environmental Land Use Restriction (ELUR) pursuant to CT RSRs, or in some other form (e.g., local ordinance) shall be implemented to the extent possible in order to prevent the use of groundwater for drinking water purposes, and to prevent other uses that may pose a potential risk to human health or that may have an adverse impact on the remedy.

Implementation of this alternative shall also require the development of administrative and operation and maintenance functions. Administrative responsibilities will include billing, customer service, and regulatory compliance. Operation and maintenance of the water supply and distribution components, including regulatory compliance, will also be necessary. Administrative agreements between the City of Middletown and the Town of Durham shall be required to formally assign these responsibilities.

Currently, 38 impacted wells have carbon filters and are monitored on at least a quarterly basis. DMC is responsible for servicing 14 of these wells under a CT DEP order. MMC is responsible for servicing 24 of these wells, but ceased these activities in late 2004; CT DEP has taken over monitoring and maintenance of these locations. As an interim measure, monitoring and filtration, and provision of bottled water as necessary, of these residential wells, and any other residential wells within the Site-wide Groundwater Study Area that come to be impacted by Site-related contamination, shall continue as currently required under state order and state regulations, to ensure continued protectiveness of human health and the environment until construction of the alternate water supply portion of the remedy is complete and operational.

As a contingency measure, Alternative AWS-3, Development of a New Groundwater Source and Distribution System, shall be retained in the event that AWS-2, Connection to Middletown Water Distribution System, cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner. Alternative AWS-3 is very similar to AWS-2, with the exception of the source of potable water to be distributed. Under contingency remedy AWS-3, a new groundwater source would be developed in close proximity to the Study Area. All other components of the remedy are similar with respect to construction of a distribution system within the Study Area, the scope of the distribution system, and the number of service connections to the water mains.

The institutional control and five-year review components of the remedy remain the same regardless of whether AWS-3 or AWS-2 is implemented, with the possible exception of requiring institutional controls on and around the new groundwater source to prevent other groundwater use or other land use activities that may interfere with the new source of water. The interim measure of continued monitoring and filtration, and provision of bottled water as necessary, of affected wells under state order also remains the same, regardless of whether AWS-3 or AWS-2 is implemented.

<u>Site-wide Groundwater Study Area – Source Zone and Dissolved Plume.</u> Contamination in the source zone and the dissolved plume in Site-wide bedrock groundwater will be addressed through a combination of Alternatives SZ-1 No Action, and Alternative DP-6 Monitoring. The major components of this combination of alternatives include:

- Installation of bedrock groundwater monitoring wells;
- Environmental monitoring;
- Institutional controls;
- Five-year reviews.

For the overall area of Site-wide groundwater contamination, alternatives to fully restore the groundwater were screened out. It is not technically practicable to clean up the groundwater to drinking water and other standards in a reasonable amount of time. As outlined in Section I of this ROD, EPA is implementing a technical impracticability waiver of chemical-specific ARARs that would normally require cleanup of groundwater to drinking water and other standards.

This combination of alternatives provides limited action. No remedial actions are proposed.

Monitoring of the Site-wide Groundwater Study Area, including the source zone and the dissolved plume, shall occur for a period of up to ten years after the construction of an alternate water supply in order to determine whether the plume is migrating or attenuating; however, further monitoring may be conducted pursuant to five-year reviews. The monitoring well network shall be implemented within and outside of the current known boundaries of the overall groundwater plume in order to monitor plume migration, and ensure the plume does not migrate beyond the limits of the Technical Impracticability zone.

In conjunction with the water supply alternative, institutional controls in the form of ELURs or some other control such as a local ordinance shall be implemented within the Technical Impracticability zone to avoid Site uses of contaminated groundwater.

<u>Site-wide Groundwater Study Area – Contingency SZ-2 Groundwater Extraction for Hydraulic Containment.</u> If monitoring results indicate that contaminants are likely to spread beyond the limits of the Technical Impracticability zone, as defined through the monitoring network implemented in Alternative DP-6, Alternative SZ-2 shall be implemented as a contingency. The major components of this contingency alternative include:

- Groundwater extraction;
- Ex-situ groundwater treatment;
- Environmental monitoring;
- Institutional controls; and
- Five-year reviews.

This alternative was developed as a containment alternative to manage the migration of contaminated groundwater. Under this contingency alternative, groundwater shall be extracted from the source zones (VOCs and possibly DNAPL, if encountered) using new extraction wells, or by converting existing monitoring wells to extraction wells. Such action shall be undertaken with the specific goal to prevent the migration of contaminated bedrock groundwater into areas beyond the Technical Impracticability zone. Extracted groundwater would be piped to a centralized treatment system.

If necessary in areas surrounding the existing Technical Impracticability zone, institutional controls shall be implemented to avoid Site uses of contaminated groundwater.

<u>Additional Areas Requiring Investigation.</u> Based upon the potential future indoor air risks found at both the MMC and DMC Study Areas, there is a potential, at other locations, for current or future exposures through volatilization of organic compounds. Prior to or during remedial design there shall be further delineation of the area posing potential indoor air risks on or outside of the MMC and DMC Study Areas by further characterization, including the collection of

shallow groundwater data. If there are unacceptable risks, then further actions will be taken to address such risks, including without limitation, sub-slab depressurization systems, and institutional controls, such as ELURs, on vacant properties or portions of properties, in accordance with EPA and CT DEP requirements.

To the extent required by law, EPA will review the Site at least once every five years after the initiation of remedial action at the Site if any hazardous substances, pollutants or contaminants remain at the Site to assure that the remedial action continues to protect human health and the environment. EPA will also conduct a review of the Site prior to completion of the remedial action, and prior to any future deletion of this Site from the National Priorities List.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an Explanation of Significant Differences or a Record of Decision Amendment, as appropriate.

A portion of the DMC Study Area contains wetlands, and portions of the Site are located within the 100-year floodplain. EPA has determined it is unlikely that the remedial alternatives will involve activity that will impact wetlands or floodplain areas at or around the Site. If, however, as part of future design activities, EPA determines that there is no practical alternative to conducting work in wetlands or in floodplains, EPA will then minimize potential harm and avoid adverse effects to the extent practical, and comply with all wetlands and floodplains ARARs identified for this Site.

3. Summary of the Estimated Remedy Costs

Remedy costs were estimated separately for each of the study areas as follows:

- MMC Study Area estimated cost: $2.2 million. Combination of Alternative MMC S-3C Excavation and Off-site Disposal, and Alternative MMC SV-3 Soil Vapor Extraction.
- DMC Study Area estimated cost: $3.2 million. Alternative DMC GW-5 Soil Excavation and Off-site Disposal.
- Site-wide Groundwater Study Area, Alternate Water Supply estimated cost: $7.0 million. Alternative AWS-2 Connection to Middletown Water Distribution System. Contingency of AWS-3 Development of a New Groundwater Source and Distribution System (estimated cost $6.6 million).
- Site-wide Groundwater Study Area, Source Zone and Dissolved Plume estimated cost: $434,000. Combination of Alternatives SZ-1 No Action and Alternative DP-6

Monitoring.

- Site-wide Groundwater Study Area, Contingency Remedy for Groundwater Containment estimated cost: $8.7 million.

The estimated total of the remedy is $12,834,000 without the contingency for groundwater containment, or action for any vapor intrusion beyond the DMC and MMC Study Areas. For the Alternate Water Supply component of the Site-wide Groundwater Study Area, if the contingency of AWS-3 Development of a New Groundwater Source and Distribution System is implemented instead of AWS-2 Connection to Middletown Water Distribution System, some cost savings may be achieved, however, any need for treatment would increase the cost estimate. (The cost estimate for AWS-3 of $6.6 million does not include treatment.)

Cost tables (ROD Tables 31 through 40) provide a summary of the major capital and annual O&M cost elements for the Selected Remedy for each Study Area, and present the major construction and O&M activities required to implement each remedy component along with their associated unit and total costs. For long term operation and maintenance (O&M) activities, the cost summary generally provides estimates based on a 50 year timeframe, although in some instances, the O&M activities are expected to exceed 50 years. The cost estimate for Alternative DP-6, Monitoring, assumes an O&M timeframe of 10 years. Data obtained from remedial action and five-year reviews will be utilized to refine long-term O&M cost estimates as necessary.

Regarding the cost summary for AWS-2, Connection to the Middletown Water Distribution System, this estimate includes bringing the water main into the Town of Durham and into the Superfund Site area. Cost estimates include all costs associated with hookup of individual homes, including abandonment of on-site private drinking water wells and implementation of institutional controls to prevent drilling and use of future wells in the area. EPA's authority does not include providing funding of the actual supply of water to individual homeowners; this cost would be borne by the homeowners, either by a direct agreement with the City of Middletown, or to the Town of Durham through a broader agreement between the City of Middletown and the Town of Durham.

While the Middletown Water Distribution System may also have adequate capacity to provide water service to other portions of town, as well as fire protection, the alternative analyzed in the Feasibility Study was limited to providing water service only to the Superfund Site for drinking water purposes. With respect to fire protection, Appendix I of the Feasibility Study [M&E, 2005b] does provide a breakout of additional costs that would be required to provide fire protection, including greater capacity piping as well as the added cost for hydrants. An additional cost estimate of $70,000 is provided for including the Strong School, located at 191 Main Street, to the water line. While the Strong School was previously using an on-site well, filtered to remove groundwater contamination, as of August 2004, it is now using a clean source of water from the District 13 Consolidation well system. This system uses wells at the Coginchaug Regional High School and the Korn Elementary School that are not impacted by the Durham Meadows Site. The additional capital costs to provide all additional costs necessary to provide pipe capacity for fire protection, range from approximately $200,000 to $600,000. This range is a function of the potential fire flow demands.

Also, as noted, Alternative AWS-3, Development of a New Groundwater Source and Distribution System, is retained as a contingency measure in the event that AWS-2, Connection to Middletown Water Distribution System, cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner. Alternative AWS-3 is very similar to AWS-2, with the exception of the source of potable water to be distributed. While Alternative AWS-3 is slightly less costly than Alternative AWS-2, any need for treatment would increase the cost estimate for AWS-3.

The information in the cost estimate summary tables is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

4. Expected Outcomes of the Selected Remedy

The expected outcomes of the selected remedy include:

- To mitigate human health risks associated with potable and domestic use of groundwater within the Site-wide Groundwater Study Area by the connection of residences to an alternate water distribution system. This goal will be achieved as soon as the alternate distribution system is installed, likely to be within three years.
- To prevent unacceptable risks to potential receptors who may come in contact with soil and to reduce the leaching of soil contaminants to groundwater at the MMC Study Area. Remedial goals consistent with residential and industrial/commercial use of the MMC Study Area and protective of leaching to groundwater will be achieved upon the removal of volatile compounds and soils, essentially at the close of construction activities.
- To reduce the potential for exposures via the vapor intrusion pathway at the MMC Study Area. Remedial goals for the vapor intrusion pathway will be achieved upon the removal of vapors and soils, or upon the installation of engineering controls that limit the potential migration of volatile compounds present in the subsurface to volatilize into current or future buildings.

- To reduce the potential for direct contact and inhalation exposures associated with shallow groundwater at the DMC Study Area. Remedial goals for these pathways will be achieved after the removal of soil containing chemicals of concern with the potential to migrate to groundwater, and by the implementation of institutional controls for worker safety and land use controls. Mass contaminant removal may also have the additional benefit of reducing overall contaminant levels over time; this alternative shall remove source areas to the maximum extent practicable.
- To address the potential for vapor intrusion impacts beyond the boundaries of the MMC and DMC Study Areas by further delineation of volatile groundwater contaminants outside the MMC/DMC boundaries.

Required monitoring at all of the Study Areas is expected to last for a minimum of 50 years. However, if the contingency remedy of groundwater extraction for hydraulic containment is implemented, the estimated operation time may be in excess of 100 years.

Once the institutional controls have been implemented, compliance with the restrictions will be monitored and enforced to ensure that the institutional controls are effective. Over time, EPA and CT DEP will also evaluate whether restrictions can be removed because the restrictions are no longer needed to protect public health and the environment.

While Site-wide groundwater will not present an unacceptable risk to human health once the remedy is implemented, the remedy does not provide for groundwater cleanup. A technical impracticability waiver encompasses all areas in the overburden and bedrock aquifers that are currently or conceivably could be impacted by contamination emanating from the Site. The overburden and bedrock aquifers are not expected to ever be suitable for drinking water use.

The selected remedy will also provide environmental benefits such as mass removal of contaminants and the potential reduction of DNAPL present in subsurface soil at the MMC Study Area, and soil and overburden groundwater at the DMC Study Area. It is anticipated that the selected remedy may also provide socio-economic and community revitalization impacts such as potential increased property values due to the implementation of a permanent and safe source of drinking water to affected residences, and the anticipated eventual reuse of the MMC Study Area for industrial/commercial, residential, or other municipal purposes.

a. Cleanup Levels By Study Area

1. MMC Study Area

Based on the results of the Baseline Risk Assessment, surface soil, subsurface soil, and soil vapor were identified as media requiring the development of cleanup levels at the MMC Study Area.

While the surrounding area is currently zoned for residential and residential/farm use, industrial use on the parcels previously occupied by MMC is and would be allowed at the MMC Study Area. A tenant is currently using the warehouse in the rear portion of the property for industrial/commercial purposes, but the remainder of these parcels have been unused since the main building was destroyed by fire in 1998. A third parcel is currently zoned and being used for residential purposes; the 275 Main Street residence is rented out as two separate apartments, and both apartments have tenants.

There is considerable uncertainty regarding the future reuse of the MMC Study Area parcels. Under the existing zoning, residential homes could also be built on the property. If this were to occur, future use of the property would then default to the area's residential and residential/farm existing zoning, and industrial/commercial use would be prohibited. Additional uncertainties exist due to the need to resolve Site liabilities, and the unknown ownership status of the property as described in Section F of this ROD. Given these uncertainties, and the range of reasonably anticipated future land uses, potential future residential use of this property was considered in the FS and the human health risk assessment as the most conservative assumption with respect to exposure, and the remedy is tailored for potential future residential use.

For soil, promulgated State standards have been established for both direct contact exposures (i.e., CT RSR DEC) and for pollutant mobility (i.e., CT RSR PMC). The lower of the available CT RSRs, based on either direct contact or pollutant mobility, for each soil chemical of concern was used as the cleanup level. Each of the identified CT RSRs were less than EPA calculated risk-based values, consistent with residential and commercial use, except for arsenic, benzo(a)pyrene, and dibenz(a,h)anthracene. However, because the risk-based values were below background values for these three compounds, the soil cleanup goal for each of these compounds was set at the CT RSR DEC standard. For lead, the CT RSR DEC for residential receptors, including children, was selected as the soil cleanup goal.

For soil vapor, promulgated State standards have been established for the vapor intrusion pathway (i.e., CT RSR VC). The CT RSR VC for trichloroethene, protective of residential inhalation exposures of impacted indoor air, was used as the cleanup level.

Table 41 summarizes the soil and soil vapor cleanup levels for carcinogenic and non-carcinogenic chemicals of concern in soils and soil vapor established to protect public health. Soil cleanup levels are also provided for contaminants that have the potential to leach to groundwater.

These cleanup levels in soils and soil vapor are consistent with ARARs, attain EPA's risk management goal for remedial actions, and have been determined by EPA to be protective. The cleanup levels apply to surface soil, subsurface soil, and soil vapor at the MMC Study Area only. For areas targeted for soil vapor extraction or soil excavation, the soil cleanup levels must be met at the completion of the remedial action. Compliance with the soil cleanup levels will be demonstrated by confirmatory sampling in remediated areas. Compliance with the soil vapor cleanup levels will be achieved upon the removal of vapors or soil, or upon the installation of engineering controls that limit the potential migration of volatile compounds present in the subsurface to volatilize into buildings.

2. DMC Study Area

Based on the results of the Baseline Risk Assessment, overburden (shallow) groundwater was identified as the medium requiring the development of cleanup levels at the DMC Study Area.

Interim cleanup levels have been established in shallow groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to public health, by direct contact or inhalation, or which were found to exceed an ARAR. Interim cleanup levels have been set based on the ARARs (e.g., non-zero Drinking Water Maximum Contaminant Level Goals (MCLGs), MCLs, and more stringent CT RSR GA/GAA GWPC or GWVC) as available. The remedy includes excavation of soil containing contaminants with the potential to adversely impact shallow groundwater. Periodic assessments of the protection afforded by the remedial action will be made as the remedy is being implemented and following the completion of the remedial action.

Table 42 summarizes the Interim Cleanup Levels for carcinogenic and non-carcinogenic chemicals of concern identified in shallow groundwater at the DMC Study Area. Interim Cleanup Levels are applicable to the contaminated shallow groundwater plume located on the 10.5-acre parcel between Main Street and Ball Brook, where Superfund investigations and sampling have occurred. The Interim Cleanup Levels are consistent with ARARs, attain EPA's risk management goals for remedial actions, and have been determined by EPA to be protective. However, the Interim Groundwater Cleanup Levels will not be fully achieved because restoration of groundwater to ARARs is technically impracticable in a reasonable timeframe.

While groundwater cleanup ARARs cannot be met, the unacceptable risk to public health must still be addressed. Excavation and off-site disposal is selected in order to meet risk-based goals calculated to reduce the potential exposure of future construction workers at the DMC Study Area to trichloroethene via direct contact to overburden groundwater. The elimination of hot spot areas through excavation and off-site disposal of contaminated soils is the alternative that provides the greatest degree of overall protection of human health that is technically practicable at this study area, and also provides for a shorter remediation timeframe. Excavation will remove source areas to the maximum extent practicable and also remove any soils exceeding PMCs pursuant to CT RSRs, which may have the additional benefit of reducing overall contaminant levels over time. The implementation of institutional controls to protect workers during shallow groundwater exposures and to control the potential for exposures via the vapor intrusion pathway provides an added measure of long-term protectiveness.

3. Site-wide Groundwater Study Area

Based on the results of the Baseline Risk Assessment, bedrock groundwater was identified as the medium requiring the development of cleanup levels at the Site-wide Groundwater Study Area.

Interim cleanup levels have been established in bedrock groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to public health or which were found to exceed an ARAR. Interim cleanup levels have been set based on the ARARs (e.g., non-zero Drinking Water MCLGs, MCLs, and more stringent CT RSR GA/GAA GWPC, GWVC, or SWPC) as available.

Because the aquifer under the Site is classified as a GA/GAA aquifer, which is a potential source of drinking water, MCLs and non-zero MCLGs established under the Safe Drinking Water Act and any more stringent State cleanup levels are ARARs. In the absence of an MCLG, an MCL, a proposed MCLG, proposed MCL, a more stringent State standard, or other suitable criteria to be considered (i.e., health advisory, state guideline), interim cleanup levels were derived for 1,4-dioxane, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene having carcinogenic potential (Classes A, B, and C compounds) based on a 10^{-6} excess cancer risk level per compound considering the current or future ingestion of groundwater during domestic water usage. In the absence of the above standards and criteria, an interim cleanup level for 1,2-dichloroethene (Class D) was established based on a level that represent an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1) considering the current or future ingestion of groundwater during domestic water usage.

Table 43 summarizes the Interim Cleanup Levels for carcinogenic and non-carcinogenic chemicals of concern identified in groundwater. Interim Cleanup Levels are potentially applicable to the contaminated bedrock groundwater plume located within the boundaries of the Site-wide Groundwater Study Area. However, the Interim Groundwater Cleanup Levels will not be achieved because restoration of groundwater to ARARs and risk-based goals is technically impracticable in a reasonable timeframe. Instead, the bedrock groundwater remedy is viewed as having long-term protectiveness by the provision of an alternate water supply and institutional controls to prevent the use of groundwater for drinking water purposes. Periodic assessments of the protection afforded by this remedial action will be made as this portion of the remedy is being implemented and at the completion of the remedial action, as well as during five-year reviews.

There exists a potential for groundwater volatile contaminants to impact indoor air outside the boundaries of MMC and DMC Study Area boundaries. To address the potential for vapor intrusion impacts beyond the boundaries of the MMC and DMC Study Areas, EPA will conduct further studies to delineate volatile groundwater contaminants outside the MMC/DMC boundaries and take actions, as necessary.

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Durham Meadows Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs, with the exception of chemical-specific ARARs for overburden and bedrock groundwater which are waived, and is cost effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable. The remedy does not satisfy the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

1. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors. For the MMC Study Area, implementing soil vapor extraction in combination with excavation and off-site disposal will eliminate unacceptable risk to adjacent and potential future onsite residents via ingestion, dermal contact or inhalation of contaminated surface soil and soil vapors. Institutional controls in the form of an ELUR or other mechanism (e.g., local ordinance, by-law, deed notice), shall ensure that any new structures on the property be constructed to minimize potential inhalation risks from any remaining contamination and will prevent use of groundwater as drinking water.

For the DMC Study Area, implementing soil excavation and off-site disposal and institutional controls will reduce the mass transfer of soil contaminants to shallow groundwater, and mitigate unacceptable risks to future construction workers via dermal contact and inhalation to contaminated groundwater, or risks to future onsite residents via inhalation. Institutional controls in the form of an ELUR shall ensure (i) that any new structures will be constructed to minimize potential inhalation risks from any remaining contamination; (ii) that groundwater will not be used for drinking water or other domestic purposes; (iii) that residential activities are prohibited unless the Commissioner of CT DEP grants a release from the ELUR; and (iv) that soil disturbance and exposure to groundwater is prohibited unless the Commissioner of CT DEP grants a release from the ELUR based on a plan which includes controls to protect the health of construction workers.

For the Site-wide Groundwater Study Area, the alternate water supply will eliminate unacceptable risk to current and future residents via ingestion, dermal contact, or inhalation of contaminated groundwater. The interim measure of continued monitoring and filtration, and provision of bottled water as necessary, of impacted residential wells, and any other residential wells within the Site-wide Groundwater Study Area that come to be impacted by Site-related contamination, as currently required under state order and state regulations, ensures continued protectiveness of human health and the environment until construction of the alternate water supply portion of the remedy is complete and operational. A technical impracticability waiver is invoked for chemical-specific ARARs in groundwater. Implementing a monitoring well network within and outside of the current known boundaries of the overall groundwater plume shall ensure the plume does not migrate beyond the limits of the Technical Impracticability zone. If groundwater contamination does migrate at a rate that will eventually approach the limits of the Technical Impracticability zone, a contingency alternative shall be implemented to hydraulically contain contaminated groundwater through groundwater extraction. Institutional controls in the form of ELURs or some other control such as a local ordinance shall be implemented within the Technical Impracticability zone to avoid Site uses of contaminated groundwater.

Further delineation of the area posing potential indoor air risks on or outside of the MMC and DMC Study Areas by further characterization, including the collection of shallow groundwater data, shall control potential vapor intrusion risks in those areas. If there are unacceptable risks, then further actions will be taken to address such risks, including without limitation, sub-slab depressurization systems, and institutional controls, such as ELURs, on vacant properties or portions of properties, in accordance with EPA and CT DEP requirements.

The selected remedy will reduce potential human health risk levels such that they do not exceed EPA's acceptable risk range of 10^{-4} to 10^{-6} for incremental carcinogenic risk and such that the non-carcinogenic hazard will not exceed one. It will reduce potential human health risk levels to protective ARARs levels, i.e., the remedy will comply with ARARs and To Be Considered criteria, with the exception of chemical-specific ARARs in Site-wide groundwater for which a waiver is invoked. The Screening-Level Ecological Risk Assessment concluded that no ecological receptors are expected to experience significant, long-term risk from Site-related contaminants present in surface water or sediment, and there is no actionable ecological risk associated with the Site. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

2. The Selected Remedy Waives Chemical-Specific ARARs in Site-wide Groundwater and Complies with All Other ARARs

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site, with the exception of chemical-specific ARARs in Site-wide groundwater for which a waiver is invoked. A discussion of the requirements that are applicable or relevant and appropriate to the selected remedy is provided in detail in Section 2 of the FS [M&E, 2005b]. Tables of federal and state ARARs and "To Be Considereds" (policies, advisories, criteria, and guidance also considered for the selected remedy) are included in Appendix F; a discussion of why these requirements are applicable or relevant and appropriate is also provided in the tables in Appendix F, as well as in Section 2 of the FS.

As discussed in the Technical Impracticability Evaluation Report [M&E, 2005c], EPA conducted an evaluation to determine whether it was technically practicable to clean up the groundwater in the area of the Site within a reasonable timeframe. The evaluation concluded that restoration of both the overburden and bedrock aquifers in a reasonable timeframe is not practical for the reasons discussed in Section I of this ROD.

A technical impracticability waiver of ARARs is warranted under NCP Section 300.430(f)(1)(ii)(C)(3) and EPA's Technical Impracticability Guidance for groundwater. The groundwater zone over which the technical impracticability zone applies encompasses all areas in the overburden and bedrock aquifers that are currently or conceivably could be impacted by contamination emanating from the Site, as outlined on Figure 8.

The waiver applies to chemical-specific ARARs for groundwater at the Site, which include Connecticut Remediation Standard Regulation (CT RSR) standards, including the Groundwater Protection Criteria applicable to the GA groundwater underlying the Site, Surface Water Protection Criteria, and the current and proposed Residential and Industrial/Commercial Volatilization Criteria (which have not yet been promulgated and are "to be considered"). Chemical-specific ARARs also include federal Maximum Contaminant Levels (MCLs) which govern the quality of drinking water provided by a public water supply, and are relevant and appropriate requirements in establishing groundwater remediation goals for private wells. The compounds and their respective ARARs for which a technical impracticability waiver will apply are presented in Table 30. For compounds where no ARARs exist, risk-based goals are presented. Human health risk-based goals are presented in Section 2 of the FS [M&E, 2005b]. The compounds include all chlorinated solvents released at the Site and related compounds, such as breakdown products and additives (i.e., 1,4-dioxane) as well as other co-located compounds dissolved in groundwater such as PAHs, BTEX compounds, and several metals (arsenic, copper, lead, mercury, vanadium, and zinc). The chlorinated compounds are the most widespread and recalcitrant, the most likely to restrict the ability to restore groundwater, and the primary risk drivers. There is little benefit to attempting to remediate co-located compounds, therefore the TI waiver will apply to all dissolved contaminants found at the Site.

No waiver of location-specific or action-specific ARARs is required for the Site.

3. The Selected Remedy is Cost-Effective

In EPA's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

Remedy costs were estimated separately for each of the study areas as follows:

- MMC Study Area estimated cost: $2.2 million. Combination of Alternative MMC S-3C Excavation and Off-site Disposal, and Alternative MMC SV-3 Soil Vapor Extraction.
- DMC Study Area estimated cost: $3.2 million. Alternative DMC GW-5 Soil Excavation and Off-site Disposal.
- Site-wide Groundwater Study Area, Alternate Water Supply estimated cost: $7.0 million. Alternative AWS-2 Connection to Middletown Water Distribution System.
- Site-wide Groundwater Study Area, Source Zone and Dissolved Plume estimated cost: $434,000. Combination of Alternatives SZ-1 No Action and Alternative DP-6 Monitoring.
- Site-wide Groundwater Study Area, Contingency Remedy for Groundwater Containment estimated cost: $8.7 million.

The estimated total of the remedy is $12,834,000 without the contingency for groundwater containment, or action for any vapor intrusion beyond the DMC and MMC Study Areas. For the Alternate Water Supply component of the Site-wide Groundwater Study Area, if the contingency of AWS-3 Development of a New Groundwater Source and Distribution System is implemented instead of AWS-2 Connection to Middletown Water Distribution System, some cost savings may be achieved, however, any need for treatment would increase the cost estimate. (The cost estimate for AWS-3 of $6.6 million does not include treatment.)

For the MMC Study Area, EPA determined that the combination of Alternative MMC S-3C Excavation and Off-site Disposal, and Alternative MMC SV-3 Soil Vapor Extraction was the most cost effective of the three remedial alternatives as it meets both threshold criteria and provides the best balance of the five balancing criteria. This and two other combinations provided the greatest degree of overall protection of human health, and were very similar in all other comparisons. The selected combination, however, relies on a phased approach of soil vapor extraction followed by excavation, which may reduce the volume and extent of soil requiring excavation. This results in a monetary savings that places this combination at the least expensive alternative that meets threshold criteria and allows for the least restrictive future use of the MMC Study Area.

For the DMC Study Area, EPA determined that Alternative DMC GW-5 Soil Excavation and Off-site Disposal was the most cost effective of the remedial alternatives as it meets both threshold criteria and provides the best balance of the five balancing criteria. For all of the other alternatives contemplated for this Study Area, the possible presence of DNAPL and possible contamination under buildings and utilities increases the expected timeframe for reduction in concentrations. All alternatives are expected to leave some residual DNAPL in overburden, and it is not technically practicable to clean up this DNAPL, thus requiring institutional controls to ensure protection of human health. Of all the remedial alternatives for this Study Area, the selected alternative of excavation and off-site disposal is only the second least expensive, however, it provides the greatest degree of overall protection of human health that is technically practicable at this Study Area. (The least expensive alternative would meet RAOs after an estimated treatment period of 50 years.)

Remedial alternatives for the Site-Wide Groundwater Study Area were divided into two categories, provision of an alternate water supply, and treatment of the source zone and dissolved plume. For the alternate water supply, the three alternatives were very similar in price, ranging from $6.6 to $7.2 million. EPA determined that Alternative AWS-2 Connection to Middletown Water Distribution System was the most cost effective of the remedial alternatives as it meets the threshold criteria and provides the best balance of the five balancing criteria. Alternative AWS-3, Development of a New Groundwater Source and Distribution System, is retained as a contingency measure in the event that AWS-2, Connection to Middletown Water Distribution System, cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner.

For the source zone and dissolved plume, EPA determined that Alternatives SZ-1 No Action and DP-6 Monitoring of the Dissolved Plume, in conjunction with implementation of an alternate water supply and a technical impracticability waiver of chemical-specific ARARs, was the most cost effective of the remedial alternatives as it meets both threshold criteria and provides the best balance of the five balancing criteria. Alternative SZ-2 Groundwater Extraction for Hydraulic Containment is also incorporated into the remedy as a contingency in the event that monitoring results indicate that contaminated groundwater is likely to migrate beyond the limits of the Technical Impracticability zone.

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain or, as appropriate, waive ARARs and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

At the MMC Study Area, most of the alternatives proposed for soil or soil vapor, if assessed individually, would not provide long-term effectiveness or permanence. Combinations of the alternatives for the two media significantly improved long-term effectiveness and permanence, and EPA determined that the combination of Alternative MMC S-3C Excavation and Off-site Disposal, and Alternative MMC SV-3 Soil Vapor Extraction best satisfied this criteria. This combination only partially satisfies the preference for treatment as a principal element; soil vapor extraction will provide treatment and removal of VOCs, however, remaining contaminated soil will be excavated and disposed off-site. No alternatives retained after the initial screening were able to treat the combination of VOCs in soil and soil vapor, and PAHs and metals in soil due to various reasons. Other alternatives were less technically or cost effective, or would pose an unacceptable risk to residents located adjacent to the study area and at one residential property located on-site.

At the DMC Study Area, all of the alternatives provide some measure of long-term effectiveness by reducing concentrations of VOCs in both the hot spot areas and the associated plume. However, the likely presence of DNAPL, including residual DNAPL within till fractures, creates the possibility of residual contamination being available for dissolution many years into the future. All alternatives provide adequate and reliable controls, with the possible exception of alternative GW-4, in-situ chemical oxidation, due to the potential for mobilization of metals with certain oxidant and soil types. EPA determined that Alternative DMC GW-5 Soil Excavation and Off-site Disposal best satisfied this criteria, as it provides the greatest degree of overall protection and is the most effective in the short term. This alternative does not satisfy the preference for treatment as a principal element; instead, untreated waste will be primarily disposed off-site (although some materials shipped off site may require treatment prior to disposal).

At the Site-wide Groundwater Study Area, the alternate water supply alternatives all provide some measure of long-term effectiveness by reducing or eliminating potential risk to human health via ingestion of contaminated groundwater. The alternatives that provide water from the City of Middletown or from an unspecified off-site well would provide the most long-term effectiveness and permanence. None of the alternatives reduce toxicity, mobility, or volume through treatment. Natural attenuation may eventually reduce the toxicity and volume of contaminants in groundwater but will take many decades. AWS-4 provides some treatment of contaminated groundwater through the use of filters, however this treatment is incidental and for water supply purposes only; this alternative does not provide active remediation of contaminated groundwater. Based on the lack of information to support the viability of an available nearby supply well, EPA determined that AWS-2 Connection to Middletown Water Distribution System best satisfied the criteria for long-term effectiveness and permanence. However, AWS-3, Development of a New Groundwater Source and Distribution System, is retained as a contingency measure in the event that AWS-2, Connection to Middletown Water Distribution System, cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner.

For the source zone and dissolved plume, while some of the alternatives satisfy the preference for treatment, none of the alternatives provide certain long-term effectiveness and permanence. Alternative SZ-2, groundwater extraction for hydraulic containment, would reduce concentrations of VOCs in both the source zone and indirectly in the dissolved plume, but residual risk from DNAPL will remain at the Site for many years into the future. Under alternative DP-2, monitored natural attenuation for the dissolved plume, residual risk remains due to contaminated groundwater for a timeframe likely greater than 100 years. Alternative DP-3, groundwater extraction for restoration of the dissolved plume, may minimize migration of contaminated water and reduce the size of the dissolved plume, but residual risk remains for a timeframe likely greater than 50 years. Alternative DP-6, monitoring, includes no controls to reduce contaminant levels.

Alternatives were combined to include DP-6 Monitoring of the Dissolved Plume, Alternative SZ-1 No Action for the Source Zone, and Alternative SZ-2 Groundwater Extraction for Hydraulic Containment (SZ-2 is specifically provided as a contingency, in the event that groundwater plume migration does occur). In conjunction with the provision of an alternative water supply, as well as a technical impracticability waiver for both the source zone and dissolved plume areas, this combination achieves long-term effectiveness and permanence for protection of human health and the environment.

5. The Selected Remedy Does Not Satisfy the Preference for Treatment as a Principal Element

The selected remedy does not satisfy the statutory preference for treatment as a principal element, primarily due to a determination that it is not technically practicable to clean up contaminated overburden and bedrock groundwater throughout the Site and at the DMC Study Area in a reasonable timeframe. As described in Section I of this ROD, a technical impracticability waiver of chemical-specific ARARs is warranted for groundwater at the Site.

Only the combination of alternatives at the MMC Study Area partially satisfies the preference for treatment, by implementing soil vapor extraction to treat VOCs prior to excavating contaminated soil and disposing of it off-site.

6. Five-Year Reviews of the Selected Remedy are Required.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (and groundwater and/or land use restrictions are necessary), a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Five-year reviews will continue as long as waste remains at the Site and unlimited use is restricted.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a Proposed Plan for remediation of the Site on July 12, 2005. The preferred alternative included:

- Excavation and off-site disposal, in conjunction with soil vapor extraction, at the MMC Study Area.
- Excavation and off-site disposal of hot spot areas at the DMC Study Area.
- Connection to the Middletown Water Distribution System to distribute an alternative source of public water to all residences currently affected by groundwater contamination and a buffer zone of residences located near the contaminated area.
- Implementing a monitoring network for the overall area of groundwater contamination to ensure no migration of groundwater beyond its current general boundary.

- Contingency to implement a groundwater extraction system for hydraulic containment if the overall plume or source zone migrates beyond its current general boundary.
- Implementation of a technical impracticability waiver of the applicable or relevant and appropriate requirements that would normally require cleanup of the groundwater to meet drinking water standards.
- Institutional controls in a variety of areas to prevent unrestricted future use of certain areas of the Site or use of contaminated groundwater.
- Further delineation of areas posing potential indoor air risks on and outside of the MMC and DMC Study Areas, and further actions to address any unacceptable risks.

EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

A number of elected officials, citizens, and state agencies supported the proposal for an alternate source of water, although a subset of comments preferred that the source of water be from an in-town groundwater well instead of the connection to the City of Middletown Water Distribution System. EPA also received comments identifying a number of technical and administrative requirements for implementing the Middletown Water Distribution System alternative. As a result, EPA retained the connection to the City of Middletown Water Distribution System as the preferred alternative water source, but identifies the development of and connection to a new groundwater source as a contingency measure in the event that the preferred alternative cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner. Given that both alternatives were presented in the Proposed Plan and EPA specifically requested comments on both alternatives, as well as the fact that these alternatives share many common elements, EPA does not consider the inclusion of AWS-3 as a contingency measure to be a significant change to the remedy.

Also included is the interim measure of continued monitoring and filtration, and provision of bottled water as necessary, of impacted residential wells, and any other residential wells within the Site-wide Groundwater Study Area that come to be impacted by Site-related contamination, as currently required under state order and state regulations, to ensure continued protectiveness of human health and the environment until construction of the alternate water supply portion of the remedy is complete and operational. This activity is currently occurring under state order, and as such, EPA does not consider the inclusion of this interim measure to be a significant change to the remedy.

O. STATE ROLE

The Connecticut Department of Environmental Protection has reviewed the various alternatives and has indicated its partial support for the selected remedy. The state has also reviewed the Remedial Investigation, Risk Assessment, and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate state environmental and facility siting laws and regulations. The State of Connecticut partially concurs with the selected remedy for the Durham Meadows Superfund Site. A copy of the declaration of concurrence is attached as Appendix C.

Appendix A
Tables

LIST OF TABLES:

Section D. Scope and Role of Response Action:

Section G.1. Human Health Risk Assessment:

Section G.2. Ecological Risk Assessment:

Section I.3. Technical Impracticability Evaluation:

Section L.3. Summary of the Estimated Remedy Costs:

Section L.4.a. Cleanup Levels By Study Area:

Table 1. Site Contaminants Summary

Principal Threats					
Source/ Source Media	**Affected Media**	**Contaminants**	**Maximum Concentration (from validated data used in HHRA)**	**Reason(s)**	**Receptors**
DNAPL Soil	Groundwater Soil Soil Vapor	VOCs 1,4-Dioxane PAHs Metals	<u>Bedrock Groundwater (ug/L):</u> 1,2-DCA (0.8) Benzene (5) cis-1,2-Dichloroethene (640) Methylene Chloride (51) Tetrachloroethene (210) Trichloroethene (2,500) Vinyl chloride (18) 1,4- Dioxane (34) Benzo(a)Anthracene (1) Benzo(a)pyrene (1) Benzo(b)fluoranthene (1) Bis(2-ethylhexyl)phthalate (7) Dibenz(a,h)anthracene (1) Indeno(1,2,3-cd)pyrene (1) Pentachlorophenol (28) Arsenic(25) Mercury (4.2) Vanadium (34.5) <u>Overburden Groundwater (ug/L):</u> TCE (66,000) <u>Soil Vapor (ppbv):</u> TCE (6,900) <u>Soil (mg/kg):</u> TCE (26) As (130) Cr (8,370)	Mobility Toxicity	Resident Commercial Worker Trespasser Construction Worker

			BaA (41) BaP (43) BbF (41) Dibenz(a,h)anthracene (9.2) Indeno(1,2,3-cd)pyrene (27)		

<u>Low Level Threats</u>

Source Media	Affected Media	Contaminants			Receptors
Soil	•Indoor Air (potential, not confirmed) •Surface Water •Sediment	VOCs PAHs Metals			Resident Commercial Worker

ROD RISK WORKSHEET

Table 2

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
Merriam Manufacturing								
	Benzo(a)anthracene	0.053	41	mg/kg	4 / 4	41	mg/kg	Max
	Benzo(a)pyrene	0.06	43	mg/kg	4 / 4	43	mg/kg	Max
	Benzo(b)fluoranthene	0.08	41	mg/kg	4 / 4	41	mg/kg	Max
	Dibenz(a,h)anthracene	0.2	9.2	mg/kg	2 / 4	9.2	mg/kg	Max
	Indeno(1,2,3-cd)pyrene	0.052	27	mg/kg	4 / 4	27	mg/kg	Max
	Arsenic	2.5	6.6	mg/kg	4 / 4	6.1	mg/kg	95% UCL - N

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the current chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in surface soil (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in surface soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples *collected at each exposure point), the EPC, and how the EPC was derived. This table indicates that the inorganic compound arsenic and the organic polycyclic aromatic hydrocarbons (PAHs) are the most frequently* detected COCs in surface soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic. Due to the limited amount of sample data for the PAHs, the maximum detected concentration was used as the default EPC for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 3

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
Merriam Manufacturing								
	Trichloroethene	0.001	26	mg/kg	13 / 35	8.3	mg/kg	95% UCL - NP
	Benzo(a)anthracene	0.052	41	mg/kg	28 / 35	14	mg/kg	95% UCL - NP
	Benzo(a)pyrene	0.05	43	mg/kg	28 / 35	15	mg/kg	95% UCL - NP
	Benzo(b)fluoranthene	0.048	41	mg/kg	30 / 35	16	mg/kg	95% UCL - NP
	Dibenz(a,h)anthracene	0.02	9.2	mg/kg	21 / 35	3.2	mg/kg	95% UCL - NP
	Indeno(1,2,3-cd)pyrene	0.052	27	mg/kg	27 / 35	10	mg/kg	95% UCL - NP
	Arsenic	0.00083	130	mg/kg	29 / 35	44	mg/kg	95% UCL - NP
	Chromium	0.0064	8370	mg/kg	35 / 35	2755	mg/kg	95% UCL - NP

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in surface soil (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in surface soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at each exposure point), the EPC, and how the EPC was derived This table indicates that the inorganic compound chromium is the most frequently detected COC in surface soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for all COCs.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 4

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current/Future
Medium: Soil Gas
Exposure Medium: Indoor Air [(a)]

Exposure Point	Chemical of Concern	Concentration Detected Minimum	Concentration Detected Maximum	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
Merriam Manufacturing								
	Trichloroethene	4.6	37082	ug/m³	4 / 5	37082	ug/m³	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

(a) Soil gas concentrations were modeled to indoor air concentrations using EPA's Johnson and Ettinger model. Measured soil gas concentrations are presented in this table.

The table represents the current/future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in soil gas (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in soil gas). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at each exposure point), the EPC, and how the EPC was derived. This table indicates that trichloroethene is the only COC in soil gas at the site. To estimate a conservative indoor air concentration from the soil gas data, the maximum detected soil gas concentration was used as the EPC for trichloroethene.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 5

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Shallow Groundwater
Exposure Medium: Indoor/Outdoor Air [(a)]

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Durham Manufacturing								
	Trichloroethene	5	66000	ug/L	19 / 24	39284	ug/L	95% UCL - T

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean).

(a) Shallow groundwater concentrations were modeled to indoor/outdoor air concentrations using EPA's Johnson and Ettinger model. Measured shallow groundwater concentrations are presented in this table.

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in shallow groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in shallow groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that trichloroethene is the only COC in shallow groundwater at the site. To estimate an indoor/outdoor air concentrations from the shallow groundwater data, the 95% UCL on the arithmetic mean was used as the EPC for trichloroethene.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table 6

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Shallow Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
Durham Manufacturing								
	Trichloroethene	5	66000	ug/L	19 / 24	39284	ug/L	95% UCL - T

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean).

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in shallow groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in shallow groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that trichloroethene is the only COC in shallow groundwater at the site. The 95% UCL on the arithmetic mean was used as the *EPC for trichloroethene.*

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 7

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Bedrock Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Durham Manufacturing - DMC#1								
	Tetrachloroethene	5	5	ug/L	1 / 2	5	ug/L	Max
	Trichloroethene	84	150	ug/L	2 / 2	150	ug/L	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean).

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in well DMC#1 bedrock groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in well DMC#1 bedrock groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the well), the EPC, and how the EPC was derived. This table indicates that the organic chemical trichloroethene is the most frequently detected COC in bedrock groundwater at well DMC#1. The maximum detected concentration was used as the default EPC for all COCs detected in well DMC#1 bedrock groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 8

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Bedrock Groundwater (Private Wells)

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
11 Maiden								
	Trichloroethene	1	8 8	ug/L	2 / 2	8.8	ug/L	Max
110 Maple								
	Tetrachloroethene	0.5	0 5	ug/L	1 / 2	0.5	ug/L	Max
	Trichloroethene	13	20	ug/L	2 / 2	20	ug/L	Max
133 Maple								
	Tetrachloroethene	0.2	0.3	ug/L	3 / 5	0.3	ug/L	Max
	Trichloroethene	0.5	16	ug/L	5 / 5	16	ug/L	Max
139 Maple								
	Tetrachloroethene	0 2	0.2	ug/L	1 / 2	0.2	ug/L	Max
	Trichloroethene	3.6	16	ug/L	2 / 2	16	ug/L	Max
168 Main								
	1,2-Dichloroethene (total)	310	380	ug/L	2 / 2	380	ug/L	Max
	Benzene	1	5	ug/L	2 / 4	5	ug/L	Max
	cis-1,2-Dichloroethene	410	410	ug/L	1 / 2	410	ug/L	Max
	Tetrachloroethene	20	38	ug/L	3 / 4	38	ug/L	Max
	Trichloroethene	1100	1300	ug/L	3 / 4	1300	ug/L	Max
	Vinyl chloride	1	11	ug/L	3 / 4	11	ug/L	Max
	Arsenic	11 3	13 8	ug/L	3 / 4	13 8	ug/L	Max
174 Main								
	1,2-Dichloroethene (total)	420	680	ug/L	2 / 2	680	ug/L	Max
	Methylene Chloride	34	34	ug/L	1 / 2	34	ug/L	Max
	Tetrachloroethene	42	70	ug/L	2 / 2	70	ug/L	Max
	Trichloroethene	1500	2500	ug/L	2 / 2	2500	ug/L	Max
	Vinyl chloride	9	9	ug/L	1 / 2	9	ug/L	Max
	Arsenic	21.5	21 5	ug/L	1 / 2	21.5	ug/L	Max
176 Main								
	Tetrachloroethene	0.3	0 8	ug/L	2 / 4	0 8	ug/L	Max
	Trichloroethene	2	80	ug/L	3 / 4	80	ug/L	Max
	Benzo(a)anthracene	1	1	ug/L	1 / 1	1	ug/L	Max
	Benzo(a)pyrene	1	1	ug/L	1 / 1	1	ug/L	Max
	Benzo(b)fluoranthene	1	1	ug/L	1 / 1	1	ug/L	Max
	Dibenz(a,h)anthracene	1	1	ug/L	1 / 1	1	ug/L	Max
	Indeno(1,2,3-cd)pyrene	1	1	ug/L	1 / 1	1	ug/L	Max
	Pentachlorophenol	28	28	ug/L	1 / 1	28	ug/L	Max
18 Maiden								
	Trichloroethene	5 8	5 8	ug/L	1 / 2	5.8	ug/L	Max
186 Main								
	Tetrachloroethene	3	4 3	ug/L	2 / 2	4 3	ug/L	Max
	Trichloroethene	27	32	ug/L	2 / 2	32	ug/L	Max
19 Maiden								
	Tetrachloroethene	0 6	0 6	ug/L	1 / 2	0 6	ug/L	Max
	Trichloroethene	0 6	12	ug/L	2 / 2	12	ug/L	Max

ROD RISK WORKSHEET

Table 8

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Bedrock Groundwater (Private Wells)

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
191 Main								
	1,2-Dichloroethane	0.8	0.8	ug/L	1 / 4	0.8	ug/L	Max
	1,2-Dichloroethene (total)	530	740	ug/L	2 / 2	740	ug/L	Max
	1,4-Dioxane	1.4	8	ug/L	5 / 7	8	ug/L	Max
	cis-1,2-Dichloroethene	640	640	ug/L	1 / 2	640	ug/L	Max
	Methylene chloride	12	12	ug/L	1 / 4	12	ug/L	Max
	Tetrachloroethene	42	78	ug/L	3 / 4	78	ug/L	Max
	Trichloroethene	1400	1800	ug/L	3 / 4	1800	ug/L	Max
	Vinyl chloride	17	18	ug/L	2 / 4	18	ug/L	Max
	Bis(2-ethylhexyl)phthalate	7	7	ug/L	1 / 3	7	ug/L	Max
	Arsenic	6.9	25	ug/L	3 / 4	25	ug/L	Max
196 Main								
	Tetrachloroethene	0.4	0.4	ug/L	2 / 3	0.4	ug/L	Max
	Trichloroethene	9.5	18	ug/L	3 / 3	18	ug/L	Max
202 Main								
	Tetrachloroethene	0.6	0.6	ug/L	1 / 2	0.6	ug/L	Max
	Trichloroethene	8.4	22	ug/L	2 / 2	22	ug/L	Max
205 Main								
	Tetrachloroethene	0.2	0.3	ug/L	2 / 3	0.3	ug/L	Max
	Trichloroethene	6.3	26	ug/L	3 / 3	26	ug/L	Max
227 Main								
	Tetrachloroethene	0.3	0.9	ug/L	2 / 2	0.9	ug/L	Max
	Trichloroethene	11	18	ug/L	2 / 2	18	ug/L	Max
235 Main								
	Tetrachloroethene	0.4	0.4	ug/L	1 / 2	0.4	ug/L	Max
	Trichloroethene	0.9	12	ug/L	2 / 2	12	ug/L	Max
238 Main								
	Trichloroethene	5.5	7.1	ug/L	2 / 2	7.1	ug/L	Max
239 Main								
	Tetrachloroethene	0.2	0.8	ug/L	2 / 2	0.8	ug/L	Max
	Trichloroethene	6.2	27	ug/L	2 / 2	27	ug/L	Max
24 Maiden								
	Trichloroethene	6	6	ug/L	1 / 2	6	ug/L	Max
242 Main								
	Tetrachloroethene	1.5	2	ug/L	2 / 2	2	ug/L	Max
	Trichloroethene	53	54	ug/L	2 / 2	54	ug/L	Max
243 Main								
	Tetrachloroethene	1.2	1.2	ug/L	1 / 2	1.2	ug/L	Max
	Trichloroethene	1.7	45	ug/L	2 / 2	45	ug/L	Max
246 Main								
	Tetrachloroethene	1.2	1.4	ug/L	2 / 2	1.4	ug/L	Max
	Trichloroethene	53	58	ug/L	2 / 2	58	ug/L	Max

ROD RISK WORKSHEET

Table 8

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Bedrock Groundwater (Private Wells)

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
248 Main								
	Tetrachloroethene	3.8	3.8	ug/L	1 / 2	3.8	ug/L	Max
	Trichloroethene	140	140	ug/L	1 / 2	140	ug/L	Max
252 Main								
	1,4-Dioxane	4	8.6	ug/L	7 / 7	8.6	ug/L	Max
	Tetrachloroethene	1	5.1	ug/L	2 / 4	5.1	ug/L	Max
	Trichloroethene	15	68	ug/L	2 / 4	68	ug/L	Max
	Bis(2-ethylhexyl)phthalate	6	6	ug/L	1 / 1	6	ug/L	Max
	Arsenic	1	1	ug/L	1 / 1	1	ug/L	Max
253 Main								
	Tetrachloroethene	1.1	2	ug/L	2 / 2	2	ug/L	Max
	Trichloroethene	66	130	ug/L	2 / 2	130	ug/L	Max
256 Main								
	1,4-Dioxane	2	14	ug/L	6 / 7	14	ug/L	Max
	Tetrachloroethene	3.4	3.4	ug/L	1 / 1	3.4	ug/L	Max
	Trichloroethene	200	200	ug/L	1 / 1	200	ug/L	Max
257 Main								
	Tetrachloroethene	0.45	1.4	ug/L	2 / 2	1.4	ug/L	Max
	Trichloroethene	38	94	ug/L	2 / 2	94	ug/L	Max
261 Main								
	Tetrachloroethene	2	4	ug/L	2 / 2	4	ug/L	Max
	Trichloroethene	110	180	ug/L	2 / 2	180	ug/L	Max
	Arsenic	6.7	6.7	ug/L	1 / 2	6.7	ug/L	Max
	Vanadium	34.5	34.5	ug/L	1 / 2	34.5	ug/L	Max
262 Main								
	Tetrachloroethene	1.5	2	ug/L	2 / 2	2	ug/L	Max
	Trichloroethene	65	73	ug/L	2 / 2	73	ug/L	Max
265 Main								
	Tetrachloroethene	1	2.3	ug/L	2 / 2	2.3	ug/L	Max
	Trichloroethene	16.5	94	ug/L	2 / 2	94	ug/L	Max
267 Main								
	Tetrachloroethene	4.2	5	ug/L	2 / 2	5	ug/L	Max
	Trichloroethene	200	220	ug/L	2 / 2	220	ug/L	Max
	Arsenic	7.9	7.9	ug/L	1 / 1	7.9	ug/L	Max

ROD RISK WORKSHEET

Table 8

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Bedrock Groundwater (Private Wells)

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
268 Main								
	1,4-Dioxane	0 905	26	ug/L	9 / 9	26	ug/L	Max
	Tetrachloroethene	3	3	ug/L	3 / 4	3	ug/L	Max
	Tnchloroethene	83	110	ug/L	3 / 4	110	ug/L	Max
	Vinyl chlonde	0 2	0 2	ug/L	1 / 4	0 2	ug/L	Max
	Benzo(a)anthracene	1	1	ug/L	1 / 3	1	ug/L	Max
	Benzo(a)pyrene	1	1	ug/L	1 / 3	1	ug/L	Max
	Benzo(b)fluoranthene	1	1	ug/L	1 / 3	1	ug/L	Max
	Dibenz(a,h)anthracene	1	1	ug/L	1 / 3	1	ug/L	Max
	Indeno(1,2,3-cd)pyrene	1	1	ug/L	1 / 3	1	ug/L	Max
	Arsenic	1 6	1 6	ug/L	1 / 3	1 6	ug/L	Max
275 Main (1998)								
	Tetrachloroethene	14	14	ug/L	1 / 1	14	ug/L	Max
	Trichloroethene	73	73	ug/L	1 / 1	73	ug/L	Max
	Vinyl chlonde	1	1	ug/L	1 / 1	1	ug/L	Max
275 Main (2004)								
	Tetrachloroethene	2	2	ug/L	1 / 1	2	ug/L	Max
	Tnchloroethene	35 5	35 5	ug/L	1 / 1	35 5	ug/L	Max
289 Main								
	Tnchloroethene	2	4 4	ug/L	3 / 4	4 4	ug/L	Max
97R Maple								
	Tetrachloroethene	0 6	1 6	ug/L	2 / 4	1 6	ug/L	Max
	Trichloroethene	19	24	ug/L	3 / 4	24	ug/L	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametnc Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Anthmetic Mean (Mean).

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in bedrock groundwater from each pnvate well (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in bedrock groundwater from each pnvate well) The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i e , the number of times the chemical was detected in the samples collected at the site) the EPC and how the EPC was denved This table indicates that the organic chemical tnchloroethene is the most frequently detected COC in bedrock groundwater at the site The maximum detected concentration was used as the EPC for all COCs detected in bedrock groundwater from each pnvate well

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 9

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

***Scenario Timeframe:* Future**
Medium: Groundwater
Exposure Medium: Bedrock Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
Site-Wide								
	1,2-Dichloroethane	0 2	0 8	ug/L	4 / 142	0 8	ug/L	Max
	1,2-Dichloroethene (total)	1	740	ug/L	16 / 20	740	ug/L	Max
	1,4-Dioxane	0 51	34	ug/L	72 / 147	34	ug/L	Max
	Benzene	0 2	5	ug/L	4 / 77	5	ug/L	Max
	cis-1,2-Dichloroethene	0 2	640	ug/L	77 / 145	640	ug/L	Max
	Methylene chloride	0.16	51	ug/L	40 / 184	51	ug/L	Max
	Tetrachloroethene	0 2	210	ug/L	94 / 189	210	ug/L	Max
	Trichloroethene	0.19	2500	ug/L	152 / 189	2500	ug/L	Max
	Vinyl Chloride	0 2	18	ug/L	13 / 189	18	ug/L	Max
	Benzo(a)anthracene	0.105	1	ug/L	3 / 27	1	ug/L	Max
	Benzo(a)pyrene	0.105	1	ug/L	3 / 27	1	ug/L	Max
	Benzo(b)fluoranthene	0.01	1	ug/L	4 / 27	1	ug/L	Max
	Bis(2-ethylhexyl)phthalate	2	7	ug/L	3 / 27	7	ug/L	Max
	Dibenz(a,h)anthracene	0.105	1	ug/L	3 / 27	1	ug/L	Max
	Indeno(1,2,3-cd)pyrene	0.105	1	ug/L	3 / 27	1	ug/L	Max
	Pentachlorophenol	28	28	ug/L	1 / 27	28	ug/L	Max
	Arsenic	0 6	25	ug/L	15 / 29	25	ug/L	Max
	Mercury	4 2	4 2	ug/L	1 / 29	4.2	ug/L	Max
	Vanadium	0.95	34.5	ug/L	16 / 29	34 5	ug/L	Max

Key

(1) Statistics Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G), Arithmetic Mean (Mean).

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in Site-wide bedrock groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in Site-wide bedrock groundwater) The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived This table indicates that the organic chemical trichloroethene is the most frequently detected COC in Site-wide bedrock groundwater at the site. The maximum detected concentration was used as the EPC for all COCs detected in Site-wide bedrock groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 10

Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
1,2-Dichloroethane	9.1E-02	9.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
1,2-Dichloroethene (total)	N/A	N/A	N/A	D	IRIS	01/05/05
1,4-Dioxane	1.1E-02	1.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Benzene	5.5E-02	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
cis-1,2-Dichloroethene	N/A	N/A	N/A	D	IRIS	01/05/05
Methylene chloride	7.5E-03	7.5E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Tetrachloroethene	5.4E-01	5.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	01/05/05
Trichloroethene	4.0E-01	4.0E-01	$(mg/kg\text{-}day)^{-1}$	C-B2	NCEA	01/05/05
Vinyl Chloride	7.5E-01	7.5E-01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
Benzo(a)anthracene	7.3E-01	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Benzo(a)pyrene	7.3E+00	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Benzo(b)fluoranthene	7.3E-01	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Bis(2-ethylhexyl)phthalate	1.4E-02	1.4E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Dibenz(a,h)anthracene	7.3E+00	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Indeno(1,2,3-cd)pyrene	7.3E-01	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Pentachlorophenol	1.2E-01	1.2E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Arsenic	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
Chromium	N/A	N/A	N/A	D	IRIS	01/05/05
Mercury	N/A	N/A	N/A	C	IRIS	01/05/05
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
1,2-Dichloroethane	2.6E-05	$(ug/m^3)^{-1}$	N/A	B2	IRIS	01/05/05
1,2-Dichloroethene (total)	N/A	N/A	N/A	D	IRIS	01/05/05
Benzene	7.8E-06	$(ug/m^3)^{-1}$	N/A	A	IRIS	01/05/05
cis-1,2-Dichloroethene	N/A	N/A	N/A	D	IRIS	01/05/05
Methylene chloride	4.7E-07	$(ug/m^3)^{-1}$	N/A	B2	IRIS	01/05/05
Tetrachloroethene	5.9E-06	$(ug/m^3)^{-1}$	N/A	B2	CalEPA	01/05/05
Trichloroethene	1.1E-04	$(ug/m^3)^{-1}$	N/A	C-B2	NCEA	01/05/05
Vinyl Chloride	4.4E-06	$(ug/m^3)^{-1}$	N/A	A	IRIS	01/05/05

Key

N/A: Not applicable

IRIS: Integrated Risk Information System, U.S. EPA

NCEA: National Center for Environmental Assessment, U.S. EPA

CalEPA = California Environmental Protection Agency

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - Indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

This table provides the carcinogenic risk information which is relevant to the contaminants of concern in soil, soil gas, and groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in this assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants. Available inhalation unit risk values are also provided for the volatile COCs.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 11

Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of Rfd: Target Organ (MM/DD/YYYY)
1,2-Dichloroethane	Chronic	2 0E-02	mg/kg-day	2 0E-02	mg/kg-day	Kidney	3000	NCEA	01/05/05
1,2-Dichloroethene (total)	Chronic	1 0E-02	mg/kg-day	1 0E-02	mg/kg-day	Blood	3000	NCEA	01/05/05
1,4-Dioxane	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	4 0E-03	mg/kg-day	4 0E-03	mg/kg-day	Immune System	300	IRIS	01/05/05
cis-1,2-Dichloroethene	Chronic	1 0E-02	mg/kg-day	1.0E 02	mg/kg-day	Blood	3000	NCEA	01/05/05
Methylene chloride	Chronic	6 0E-02	mg/kg-day	6 0E-02	mg/kg-day	Liver	100	IRIS	01/05/05
Tetrachloroethene	Chronic	1 0E-02	mg/kg-day	1 0E-02	mg/kg-day	Liver	1000	IRIS	01/05/05
Trichloroethene	Chronic	3 0E-04	mg/kg-day	3 0E-04	mg/kg-day	Liver	3000	NCEA	01/05/05
Trichloroethene	Subchronic	3 0E-04	mg/kg-day	3 0E-04	mg/kg-day	Liver	3000	NCEA	01/05/05
Vinyl Chloride	Chronic	3 0E-03	mg/kg-day	3 0E-03	mg/kg-day	Liver	30	IRIS	01/05/05
Benzo(a)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	Chronic	2 0E-02	mg/kg-day	2.0E-02	mg/kg-day	Liver	1000	IRIS	01/05/05
Dibenz(a,h)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	Chronic	3 0E-02	mg/kg-day	3 0E-02	mg/kg-day	Liver/Kidney	100	IRIS	38357
Arsenic	Chronic	3 0E-04	mg/kg-day	3 0E-04	mg/kg-day	Skin	3	IRIS	01/05/05
Chromium	Chronic	3 0E-03	mg/kg-day	7 5E-05	mg/kg-day	GI System	300	IRIS	01/05/05
Mercury	Chronic	3 0E-04	mg/kg-day	2 1E-05	mg/kg-day	CNS	1000	IRIS	01/05/05
Vanadium	Chronic	1 0E-03	mg/kg-day	2 6E-05	mg/kg-day	Kidney	300	NCEA	01/05/05

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: Target Organ	Dates (MM/DD/YYYY)
1,2-Dichloroethane	Chronic	5	ug/m³	N/A	N/A	Liver/Kidney/GI System	3000	NCEA	01/05/05
1,2-Dichloroethene (total)	Chronic	60	ug/m³	N/A	N/A	Respiratory/Liver	3000	NCEA	01/05/05
Benzene	Chronic	30	ug/m³	N/A	N/A	Immune System	300	IRIS	01/05/05
cis-1,2-Dichloroethene	Chronic	200	ug/m³	N/A	N/A	Liver	30	IRIS	01/05/05
Methylene chloride	Chronic	3000	ug/m³	N/A	N/A	Liver	100	HEAST	July 1997
Tetrachloroethene	Chronic	270	ug/m³	N/A	N/A	CNS	100	ATSDR	01/05/05
Trichloroethene	Chronic	40	ug/m³	N/A	N/A	Liver/CNS	3000	NCEA	01/05/05
Vinyl Chloride	Chronic	100	ug/m³	N/A	N/A	Liver	30	IRIS	01/05/05

Key

N/A - No information available

IRIS - *Integrated Risk Information System, U.S. EPA*

NCEA - National Center for Environmental Assessment, U.S. EPA

HEAST = Health Effects Assessment Summary Tables

ATSDR = Agency for Toxic Substances and Disease Registry

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil, soil gas and groundwater. Fourteen of the COCs have oral toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. Chronic and subchronic toxicity data available for the fourteen COCs for oral exposures have been used to develop chronic oral reference doses (RfDs), provided in this table. The available chronic and subchronic toxicty data indicate that benzene affects the immune system, methylene chloride, tetrachlorethene, trichloroethene, vinyl chloride, bis(2-ethylhexyl)phthalate, and pentachlorophenol affect the liver, 1,2-dichloroethane, pentachlorophenol, and vanadium affect the kidney, 1,2-dichloroethene and cis-1,2-dichloroethene affect the blood, arsenic affects the skin, chromium affects the gastrointestinal tract, and mercury affects the central nervous system. Reference doses are not available for 1,4-dioxane and the carcinogenic PAHs. Dermal RfDs are not available for any of the COCs. As was the case for the carcinogenic data, dermal RfDs can be extrapolated from oral RfDs by applying an adjustment factor as appropriate. Oral RfDs were adjusted for COCs with less than 50% absorption via the ingestion route (chromium, mercury, and vanadium) to derive dermal RfDs for these COCs.
Available inhalation reference concentrations (RfCs) are also provided for the volatile COCs.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 12

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Adjacent Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	Surface Soil	Merriam Manufacturing	Benzo(a)anthracene	2E-05	- -	8E-06	- -	3E-05
			Benzo(a)pyrene	2E-04	- -	9E-05	- -	3E-04
			Benzo(b)fluoranthene	2E-05	- -	8E-06	- -	3E-05
			Dibenz(a,h)anthracene	5E-05	- -	2E-05	- -	6E-05
			Indeno(1,2,3-cd)pyrene	1E-05	- -	5E-06	- -	2E-05
			Arsenic	6E-06	- -	6E-07	- -	7E-06
							Soil Risk Total =	4E-04
Soil Gas	Indoor Air	Merriam Manufacturing	Trichloroethene	- -	4E-05	- -	- -	4E-05
							Soil Gas Risk Total =	4E-05
							Total Risk =	5E-04

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the current child and adult resident at the Merriam Manufacturing Study Area. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to soil and indoor air, as well as the toxicity of the COCs. The total risk from direct exposure to contaminated soil and indoor air at this site to a future child and adult resident is estimated to be 5×10^{-4}. The COC contributing most to this risk level is benzo(a)pyrene in surface soil. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 5 in 10,000 of developing cancer as a result of site-related exposure to the COCs at the Merriam Maunfacturing Study Area.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 13								
Risk Characterization Summary - Carcinogens								
Scenario Timeframe: Future **Receptor Population: Resident** **Receptor Age: Young Child/Adult**								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Soil	Surface Soil	Merriam Manufacturing	Trichloroethene	2E-06	- -	N/A	- -	2E-06
			Benzo(a)anthracene	7E-06	- -	3E-06	- -	1E-05
			Benzo(a)pyrene	8E-05	- -	3E-05	- -	1E-04
			Benzo(b)fluoranthene	8E-06	- -	3E-06	- -	1E-05
			Dibenz(a,h)anthracene	2E-05	- -	7E-06	- -	2E-05
			Indeno(1,2,3-cd)pyrene	5E-06	- -	2E-06	- -	7E-06
			Arsenic	4E-05	- -	4E-06	- -	5E-05
							Soil Risk Total =	2E-04
Soil Gas	Indoor Air	Merriam Manufacturing	Trichloroethene	- -	4E-05	- -	- -	4E-05
							Soil Gas Risk Total =	4E-05
							Total Risk =	2E-04
Shallow Groundwater	Indoor Air	Durham Manufacturing	Trichloroethene	- -	8E-03	- -	- -	8E-03
							Groundwater Risk Total =	8E-03
							Total Risk =	N/A

Key

-- Route of exposure is not applicable to this medium.

N/A - Not applicable. Summing of soil and indoor air risks across exposure points is not applicable since risks were estimated assuming all of a receptor's exposure occurred at each exposure point.

This table provides risk estimates for the significant routes of exposure for the future child and adult resident at the Merriam and Durham Manufacturing Study Areas. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to soil and indoor air, as well as the toxicity of the COCs. The total risk from direct exposure to contaminated soil and indoor air at this site to a future child and adult resident is estimated to be 2×10^{-4} for the Merriam Maunfacturing Study Area and 8×10^{-3} for the Durham Manufacturing Study Area. The COCs contributing the most to these risk levels are benzo(a)pyrene in soil at the Marriam Manufaturing Study Area and trichloroethene in indoor air at the Durham Manufacturing Study Area. These risk levels indicate that if no clean-up action is taken, an individual would have an increased probability of 2 in 10,000 and 8 in 1,000 of developing cancer as a result of site-related exposure to the COCs at the Merriam and Durham Manufacturing Study Areas, respectively.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 14

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Merriam Manufacturing	Chromium	GI System	5E+00	- -	N/A	5E+00
							Soil Hazard Index Total =	5E+00
							GI System Hazard Index =	5E+00
Shallow Groundwater	Indoor Air	Durham Manufacturing	Trichloroethene	Liver/CNS	- -	4E+00	- -	4E+00
							Groundwater Hazard Index Total =	4E+00
							Liver Hazard Index =	4E+00
							CNS Hazard Index =	4E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future child and adult resident exposed to soil and indoor air at the Merriam and Durham Manufacturing Study Areas. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 5 for the Merriam Manufacturing Study Area and 4 for Durham Manufacturing Study Area indicates that the potential for adverse noncancer effects could occur from exposure to contaminated soil containing chromium at the Merriam Manufacturing Study Area and contaminated indoor air containing trichloroethene at the Durham Manufacturing Study Area.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 15								
Risk Characterization Summary - Carcinogens								
Scenario Timeframe: Current/Future **Receptor Population: Commercial Worker** **Receptor Age: Adult**								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Bedrock Groundwater	201 Main (DMC well 1)	Tetrachloroethene	9E-06	- -	1E-06	- -	1E-05
			Trichloroethene	2E-04	- -	9E-06	- -	2E-04
							Groundwater Risk Total =	2E-04
							Total Risk =	2E-04

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the current/future commercial worker at the Durham Maunfacturing Study Area. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's exposure to bedrock groundwater, as well as the toxicity of the COCs. The total risk from direct exposure to contaminated groundwater at this site to a current/future commercial worker is estimated to be 2×10^{-4}. The COC contributing most to this risk level is trichloroethene in bedrock groundwater. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 2 in 10,000 of developing cancer as a result of site-related exposure to the COCs at the Durham Manufacturing Study Area.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 16

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Bedrock Groundwater	201 Main (DMC well 1)	Trichloroethene	Liver	5E+00	- -	2E-01	5E+00
							Groundwater Hazard Index Total =	5E+00
							Liver Hazard Index =	5E+00

Key

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the current/future commercial worker exposed to bedrock groundwater. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 5 for the Durham Manufacturing Study Area indicates that the potential for adverse noncancer effects could occur from exposure to contaminated bedrock groundwater containing trichloroethene.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 17								
Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Future **Receptor Population: Construction Worker** **Receptor Age: Adult**								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Non-Carcinogenic Hazard Quotient**			
					Ingestion	**Inhalation**	**Dermal**	**Exposure Routes Total**
Groundwater	Shallow Groundwater	Durham Manufacturing	Trichloroethene	Liver	- -	- -	3E+01	3E+01
							Groundwater Hazard Index Total =	3E+01
							Liver Hazard Index =	3E+01

Key

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future construction worker exposed to shallow groundwater. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 30 for the Durham manufacturing Study Area indicates that the potential for adverse noncancer effects could occur from exposure to contaminated shallow groundwater containing trichloroethene.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 18

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Bedrock Groundwater	110 Maple	Tetrachloroethene	5E-06	1E-07	2E-06	- -	7E-06
			Trichloroethene	1E-04	8E-05	2E-05	- -	2E-04
							Groundwater Risk Total =	2E-04
Groundwater	Bedrock Groundwater	133 Maple	Tetrachloroethene	3E-06	6E-08	1E-06	- -	4E-06
			Trichloroethene	1E-04	6E-05	2E-05	- -	2E-04
							Groundwater Risk Total =	2E-04
Groundwater	Bedrock Groundwater	139 Maple	Tetrachloroethene	2E-06	4E-08	9E-07	- -	3E-06
			Trichloroethene	1E-04	6E-05	2E-05	- -	2E-04
							Groundwater Risk Total =	2E-04
Groundwater	Bedrock Groundwater	168 Main	Benzene	5E-06	2E-06	6E-07	- -	7E-06
			Tetrachloroethene	4E-04	8E-06	2E-04	- -	5E-04
			Trichloroethene	9E-03	5E-03	1E-03	- -	2E-02
			Vinyl chloride	1E-03	1E-05	4E-05	- -	1E-03
			Arsenic	4E-04	N/A	2E-06	- -	4E-04
							Groundwater Risk Total =	2E-02
Groundwater	Bedrock Groundwater	174 Main	Methylene Chloride	4E-06	7E-07	1E-07	- -	5E-06
			Tetrachloroethene	7E-04	1E-05	3E-04	- -	1E-03
			Trichloroethene	2E-02	1E-02	2E-03	- -	3E-02
			Vinyl chloride	8E-04	9E-06	3E-05	- -	8E-04
			Arsenic	6E-04	N/A	3E-06	- -	6E-04
							Groundwater Risk Total =	3E-02
Groundwater	Bedrock Groundwater	176 Main	Tetrachloroethene	8E-06	2E-07	4E-06	- -	1E-05
			Trichloroethene	6E-04	3E-04	8E-05	- -	1E-03
			Benzo(a)anthracene	1E-05	N/A	N/A	- -	1E-05
			Benzo(a)pyrene	1E-04	N/A	N/A	- -	1E-04
			Benzo(b)fluoranthene	1E-05	N/A	N/A	- -	1E-05
			Dibenz(a,h)anthracene	1E-04	N/A	N/A	- -	1E-04
			Indeno(1,2,3-cd)pyrene	1E-05	N/A	N/A	- -	1E-05
			Pentachlorophenol	6E-05	N/A	N/A	- -	6E-05
							Groundwater Risk Total =	1E-03

ROD RISK WORKSHEET

Table 18

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Bedrock Groundwater	186 Main	Tetrachloroethene	4E-05	9E-07	2E-05	- -	6E-05
			Trichloroethene	2E-04	1E-04	3E-05	- -	4E-04
							Groundwater Risk Total =	4E-04
Groundwater	Bedrock Groundwater	19 Maiden	Tetrachloroethene	6E-06	1E-07	3E-06	- -	9E-06
			Trichloroethene	8E-05	5E-05	1E-05	- -	1E-04
							Groundwater Risk Total =	2E-04
Groundwater	Bedrock Groundwater	191 Main	1,2-Dichloroethane	1E-06	8E-07	5E-08	- -	2E-06
			1,4-Dioxane	2E-06	N/A	5E-09	- -	2E-06
			Methylene chloride	2E-06	2E-07	5E-08	- -	2E-06
			Tetrachloroethene	7E-04	2E-05	4E-04	- -	1E-03
			Trichloroethene	1E-02	7E-03	2E-03	- -	2E-02
			Vinyl chloride	2E-03	2E-05	6E-05	- -	2E-03
			Bis(2-ethylhexyl)phthalate	2E-06	N/A	2E-06	- -	4E-06
			Arsenic	7E-04	N/A	3E-06	- -	7E-04
							Groundwater Risk Total =	3E-02
Groundwater	Bedrock Groundwater	196 Main	Tetrachloroethene	4E-06	8E-08	2E-06	- -	6E-06
			Trichloroethene	1E-04	7E-05	2E-05	- -	2E-04
							Groundwater Risk Total =	2E-04
Groundwater	Bedrock Groundwater	202 Main	Tetrachloroethene	6E-06	1E-07	3E-06	- -	9E-06
			Trichloroethene	2E-04	9E-05	2E-05	- -	3E-04
							Groundwater Risk Total =	3E-04
Groundwater	Bedrock Groundwater	205 Main	Tetrachloroethene	3E-06	6E-08	1E-06	- -	4E-06
			Trichloroethene	2E-04	1E-04	3E-05	- -	3E-04
							Groundwater Risk Total =	3E-04
Groundwater	Bedrock Groundwater	227 Main	Tetrachloroethene	9E-06	2E-07	4E-06	- -	1E-05
			Trichloroethene	1E-04	7E-05	2E-05	- -	2E-04
							Groundwater Risk Total =	2E-04

ROD RISK WORKSHEET

Table 18

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Bedrock Groundwater	235 Main	Tetrachloroethene	4E-06	8E-08	2E-06	- -	6E-06
			Trichloroethene	8E-05	5E-05	1E-05	- -	1E-04
							Groundwater Risk Total =	2E-04
Groundwater	Bedrock Groundwater	239 Main	Tetrachloroethene	8E-06	2E-07	4E-06	- -	1E-05
			Trichloroethene	2E-04	1E-04	3E-05	- -	3E-04
							Groundwater Risk Total =	3E-04
Groundwater	Bedrock Groundwater	242 Main	Tetrachloroethene	2E-05	4E-07	9E-06	- -	3E-05
			Trichloroethene	4E-04	2E-04	5E-05	- -	7E-04
							Groundwater Risk Total =	7E-04
Groundwater	Bedrock Groundwater	243 Main	Tetrachloroethene	1E-05	2E-07	6E-06	- -	2E-05
			Trichloroethene	3E-04	2E-04	4E-05	- -	5E-04
							Groundwater Risk Total =	6E-04
Groundwater	Bedrock Groundwater	246 Main	Tetrachloroethene	1E-05	3E-07	7E-06	- -	2E-05
			Trichloroethene	4E-04	2E-04	6E-05	- -	7E-04
							Groundwater Risk Total =	7E-04
Groundwater	Bedrock Groundwater	248 Main	Tetrachloroethene	4E-05	8E-07	2E-05	- -	5E-05
			Trichloroethene	1E-03	6E-04	1E-04	- -	2E-03
							Groundwater Risk Total =	2E-03
Groundwater	Bedrock Groundwater	252 Main	1,4-Dioxane	2E-06	N/A	5E-09	- -	2E-06
			Tetrachloroethene	5E-05	1E-06	2E-05	- -	7E-05
			Trichloroethene	5E-04	3E-04	7E-05	- -	8E-04
			Bis(2-ethylhexyl)phthalate	1E-06	N/A	2E-06	- -	3E-06
			Arsenic	3E-05	N/A	1E-07	- -	3E-05
							Groundwater Risk Total =	9E-04
Groundwater	Bedrock Groundwater	253 Main	Tetrachloroethene	2E-05	4E-07	9E-06	- -	3E-05
			Trichloroethene	9E-04	5E-04	1E-04	- -	2E-03
							Groundwater Risk Total =	2E-03

ROD RISK WORKSHEET

Table 18

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Bedrock Groundwater	256 Main	1,4-Dioxane	3E-06	N/A	8E-09	- -	3E-06
			Tetrachloroethene	3E-05	7E-07	2E-05	- -	5E-05
			Trichloroethene	1E-03	8E-04	2E-04	- -	2E-03
							Groundwater Risk Total =	2E-03
Groundwater	Bedrock Groundwater	257 Main	Tetrachloroethene	1E-05	3E-07	7E-06	- -	2E-05
			Trichloroethene	7E-04	4E-04	9E-05	- -	1E-03
							Groundwater Risk Total =	1E-03
Groundwater	Bedrock Groundwater	261 Main	Tetrachloroethene	4E-05	8E-07	2E-05	- -	6E-05
			Trichloroethene	1E-03	7E-04	2E-04	- -	2E-03
			Arsenic	2E-04	N/A	9E-07	- -	2E-04
							Groundwater Risk Total =	2E-03
Groundwater	Bedrock Groundwater	262 Main	Tetrachloroethene	2E-05	4E-07	9E-06	- -	3E-05
			Trichloroethene	5E-04	3E-04	7E-05	- -	9E-04
							Groundwater Risk Total =	9E-04
Groundwater	Bedrock Groundwater	265 Main	Tetrachloroethene	2E-05	5E-07	1E-05	- -	3E-05
			Trichloroethene	7E-04	4E-04	9E-05	- -	1E-03
							Groundwater Risk Total =	1E-03
Groundwater	Bedrock Groundwater	267 Main	Tetrachloroethene	5E-05	1E-06	2E-05	- -	7E-05
			Trichloroethene	2E-03	9E-04	2E-04	- -	3E-03
			Arsenic	2E-04	N/A	1E-06	- -	2E-04
							Groundwater Risk Total =	3E-03

ROD RISK WORKSHEET

Table 18

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Bedrock Groundwater	268 Main						
			1,4-Dioxane	5E-06	N/A	2E-08	- -	5E-06
			Tetrachloroethene	3E-05	6E-07	1E-05	- -	4E-05
			Trichloroethene	8E-04	4E-04	1E-04	- -	1E-03
			Vinyl chloride (adult)	2E-05	2E-07	7E-07	- -	2E-05
			Benzo(a)anthracene	1E-05	N/A	N/A	- -	1E-05
			Benzo(a)pyrene	1E-04	N/A	N/A	- -	1E-04
			Benzo(b)fluoranthene	1E-05	N/A	N/A	- -	1E-05
			Dibenz(a,h)anthracene	1E-04	N/A	N/A	- -	1E-04
			Indeno(1,2,3-cd)pyrene	1E-05	N/A	N/A	- -	1E-05
			Arsenic	4E-05	N/A	2E-07	- -	4E-05
							Groundwater Risk Total =	2E-03
Groundwater	Bedrock Groundwater	275 Main (1998)						
			Tetrachloroethene	1E-04	3E-06	7E-05	- -	2E-04
			Trichloroethene	5E-04	3E-04	7E-05	- -	9E-04
			Vinyl chloride	9E-05	1E-06	3E-06	- -	9E-05
							Groundwater Risk Total =	1E-03
Groundwater	Bedrock Groundwater	275 Main (2004)						
			Tetrachloroethene	2E-05	4E-07	9E-06	- -	3E-05
			Trichloroethene	3E-04	1E-04	3E-05	- -	4E-04
							Groundwater Risk Total =	5E-04
Groundwater	Bedrock Groundwater	97R Maple						
			Tetrachloroethene	2E-05	3E-07	8E-06	- -	2E-05
			Trichloroethene	2E-04	1E-04	2E-05	- -	3E-04
							Groundwater Risk Total =	3E-04
							Total Risk =	N/A

Key

-- Route of exposure is not applicable to this medium.

N/A - Not applicable. Summing of groundwater risks across exposure points is not applicable since risks were estimated assuming all of a receptor's exposure occurred at each exposure point.

This table provides risk estimates for the significant routes of exposure for the current young child and adult resident. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's and child's exposure to bedrock groundwater, as well as the toxicity of the COCs. The total risk from direct exposure to contaminated groundwater at this site to a current resident is estimated to range between 2 x 10^{-4} and 3 x 10^{-2}. The COCs contributing to these risk levels are benzene, 1,2-dichloroethane, 1,4-dioxane, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno (1,2,3-cd)pyrene, bis(2-ethylhexyl)phthalate, pentachlorophenol, and arsenic. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of between 2 in 10,000 and 3 in 100 of developing cancer as a result of site-related exposure to COCs in private bedrock wells.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 19

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Bedrock Groundwater	11 Maiden	Trichloroethene	Liver	3E+00	3E-02	3E-01	3E+00
							Groundwater Hazard Index Total =	3E+00
							Liver Hazard Index =	3E+00
Groundwater	Bedrock Groundwater	110 Maple	Trichloroethene	Liver	6E+00	6E-02	7E-01	7E+00
							Groundwater Hazard Index Total =	7E+00
							Liver Hazard Index =	7E+00
Groundwater	Bedrock Groundwater	133 Maple	Trichloroethene	Liver	5E+00	5E-02	5E-01	6E+00
							Groundwater Hazard Index Total =	6E+00
							Liver Hazard Index =	6E+00
Groundwater	Bedrock Groundwater	139 Maple	Trichloroethene	Liver	5E+00	5E-02	5E-01	6E+00
							Groundwater Hazard Index Total =	6E+00
							Liver Hazard Index =	6E+00
Groundwater	Bedrock Groundwater	168 Main	1,2-Dichloroethene (total)	Blood	4E+00	9E-01	2E-01	5E+00
			cis-1,2-Dichloroethene	Blood	4E+00	3E-01	3E-01	5E+00
			Trichloroethene	Liver	4E+02	4E+00	4E+01	5E+02
			Arsenic	Skin	4E+00	N/A	2E-02	4E+00
							Groundwater Hazard Index Total =	5E+02
							Liver Hazard Index =	5E+02
							Blood Hazard Index =	9E+00
							Skin Hazard Index =	4E+00
Groundwater	Bedrock Groundwater	174 Main	1,2-Dichloroethene (total)	Blood	7E+00	2E+00	4E-01	9E+00
			Trichloroethene	Liver	8E+02	8E+00	9E+01	9E+02
			Arsenic	Skin	7E+00	N/A	3E-02	7E+00
							Groundwater Hazard Index Total =	9E+02
							Skin Hazard Index =	7E+00
							Blood Hazard Index =	9E+00
							Liver Hazard Index =	9E+02

ROD RISK WORKSHEET

Table 19								
Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Current Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Bedrock Groundwater	176 Main	Trichloroethene	Liver	3E+01	3E-01	3E+00	3E+01
							Groundwater Hazard Index Total =	3E+01
							Liver Hazard Index =	3E+01
Groundwater	Bedrock Groundwater	18 Maiden	Trichloroethene	Liver	2E+00	2E-02	2E-01	2E+00
							Groundwater Hazard Index Total =	2E+00
							Liver Hazard Index =	2E+00
Groundwater	Bedrock Groundwater	186 Main	Trichloroethene	Liver	1E+01	1E-01	1E+00	1E+01
							Groundwater Hazard Index Total =	1E+01
							Liver Hazard Index =	1E+01
Groundwater	Bedrock Groundwater	19 Maiden	Trichloroethene	Liver	4E+00	4E-02	4E-01	4E+00
							Groundwater Hazard Index Total =	4E+00
							Liver Hazard Index =	4E+00
Groundwater	Bedrock Groundwater	191 Main	1,2-Dichloroethene (total)	Blood	7E+00	2E+00	4E-01	9E+00
			cis-1,2-Dichloroethene	Blood	6E+00	5E-01	5E-01	7E+00
			Trichloroethene	Liver	6E+02	6E+00	6E+01	6E+02
			Arsenic	Skin	8E+00	N/A	4E-02	8E+00
							Groundwater Hazard Index Total =	7E+02
							Skin Hazard Index =	8E+00
							Blood Hazard Index =	2E+01
							Liver Hazard Index =	6E+02
Groundwater	Bedrock Groundwater	196 Main	Trichloroethene	Liver	6E+00	6E-02	6E-01	6E+00
							Groundwater Hazard Index Total =	6E+00
							Liver Hazard Index =	6E+00
Groundwater	Bedrock Groundwater	202 Main	Trichloroethene	Liver	7E+00	7E-02	8E-01	8E+00
							Groundwater Hazard Index Total =	8E+00
							Liver Hazard Index =	8E+00

ROD RISK WORKSHEET

Table 19

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Bedrock Groundwater	205 Main	Trichloroethene	Liver	8E+00	8E-02	9E-01	9E+00
							Groundwater Hazard Index Total =	9E+00
							Liver Hazard Index =	9E+00
Groundwater	Bedrock Groundwater	227 Main	Trichloroethene	Liver	6E+00	6E-02	6E-01	6E+00
							Groundwater Hazard Index Total =	6E+00
							Liver Hazard Index =	6E+00
Groundwater	Bedrock Groundwater	235 Main	Trichloroethene	Liver	4E+00	4E-02	4E-01	4E+00
							Groundwater Hazard Index Total =	4E+00
							Liver Hazard Index =	4E+00
Groundwater	Bedrock Groundwater	238 Main	Trichloroethene	Liver	2E+00	2E-02	2E-01	3E+00
							Groundwater Hazard Index Total =	3E+00
							Liver Hazard Index =	3E+00
Groundwater	Bedrock Groundwater	239 Main	Trichloroethene	Liver	9E+00	9E-02	9E-01	1E+01
							Groundwater Hazard Index Total =	1E+01
							Liver Hazard Index =	1E+01
Groundwater	Bedrock Groundwater	24 Maiden	Trichloroethene	Liver	2E+00	2E-02	2E-01	2E+00
							Groundwater Hazard Index Total =	2E+00
							Liver Hazard Index =	2E+00
Groundwater	Bedrock Groundwater	242 Main	Trichloroethene	Liver	2E+01	2E-01	2E+00	2E+01
							Groundwater Hazard Index Total =	2E+01
							Liver Hazard Index =	2E+01
Groundwater	Bedrock Groundwater	243 Main	Trichloroethene	Liver	1E+01	1E-01	2E+00	2E+01
							Groundwater Hazard Index Total =	2E+01
							Liver Hazard Index =	2E+01

ROD RISK WORKSHEET

Table 19								
Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Current								
Receptor Population: Resident								
Receptor Age: Young Child/Adult								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Non-Carcinogenic Hazard Quotient**			
					Ingestion	**Inhalation**	**Dermal**	**Exposure Routes Total**
Groundwater	Bedrock Groundwater	246 Main	Trichloroethene	Liver	2E+01	2E-01	2E+00	2E+01
							Groundwater Hazard Index Total =	2E+01
							Liver Hazard Index =	2E+01
Groundwater	Bedrock Groundwater	248 Main	Trichloroethene	Liver	4E+01	5E-01	5E+00	5E+01
							Groundwater Hazard Index Total =	5E+01
							Liver Hazard Index =	5E+01
Groundwater	Bedrock Groundwater	252 Main	Trichloroethene	Liver	2E+01	2E-01	2E+00	2E+01
							Groundwater Hazard Index Total =	2E+01
							Liver Hazard Index =	2E+01
Groundwater	Bedrock Groundwater	253 Main	Trichloroethene	Liver	4E+01	4E-01	4E+00	5E+01
							Groundwater Hazard Index Total =	5E+01
							Liver Hazard Index =	5E+01
Groundwater	Bedrock Groundwater	256 Main	Trichloroethene	Liver	6E+01	6E-01	7E+00	7E+01
							Groundwater Hazard Index Total =	7E+01
							Liver Hazard Index =	7E+01
Groundwater	Bedrock Groundwater	257 Main	Trichloroethene	Liver	3E+01	3E-01	3E+00	3E+01
							Groundwater Hazard Index Total =	3E+01
							Liver Hazard Index =	3E+01
Groundwater	Bedrock Groundwater	261 Main	Trichloroethene	Liver	6E+01	6E-01	6E+00	6E+01
			Arsenic	Skin	2E+00	N/A	9E-03	2E+00
			Vanadium	Kidney	3E+00	N/A	6E-01	4E+00
							Groundwater Hazard Index Total =	7E+01
							Skin Hazard Index =	2E+00
							Kidney Hazard Index =	4E+00
							Liver Hazard Index =	6E+01

ROD RISK WORKSHEET

Table 19								
Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Current **Receptor Population: Resident** **Receptor Age: Young Child/Adult**								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Non-Carcinogenic Hazard Quotient**			
					Ingestion	**Inhalation**	**Dermal**	**Exposure Routes Total**
Groundwater	Bedrock Groundwater	262 Main	Trichloroethene	Liver	2E+01	2E-01	2E+00	3E+01
							Groundwater Hazard Index Total =	3E+01
							Liver Hazard Index =	3E+01
Groundwater	Bedrock Groundwater	265 Main	Trichloroethene	Liver	3E+01	3E-01	3E+00	3E+01
							Groundwater Hazard Index Total =	3E+01
							Liver Hazard Index =	3E+01
Groundwater	Bedrock Groundwater	267 Main	Trichloroethene	Liver	7E+01	7E-01	8E+00	8E+01
			Arsenic	Skin	3E+00	N/A	1E-02	3E+00
							Groundwater Hazard Index Total =	8E+01
							Skin Hazard Index =	3E+00
							Liver Hazard Index =	8E+01
Groundwater	Bedrock Groundwater	268 Main	Trichloroethene	Liver	4E+01	4E-01	4E+00	4E+01
							Groundwater Hazard Index Total =	4E+01
							Liver Hazard Index =	4E+01
Groundwater	Bedrock Groundwater	275 Main (1998)	Trichloroethene	Liver	2E+01	2E-01	2E+00	3E+01
							Groundwater Hazard Index Total =	3E+01
							Liver Hazard Index =	3E+01
Groundwater	Bedrock Groundwater	275 Main (2004)	Trichloroethene	Liver	1E+01	1E-01	1E+00	1E+01
							Groundwater Hazard Index Total =	1E+01
							Liver Hazard Index =	1E+01
Groundwater	Bedrock Groundwater	289 Main	Trichloroethene	Liver	1E+00	1E-02	2E-01	2E+00
							Groundwater Hazard Index Total =	2E+00
							Liver Hazard Index =	2E+00
Groundwater	Bedrock Groundwater	97R Maple	Trichloroethene	Liver	8E+00	8E-02	8E-01	9E+00
							Groundwater Hazard Index Total =	9E+00
							Liver Hazard Index =	9E+00

ROD RISK WORKSHEET

Table 19								
Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Current Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Key N/A - Toxicity criteria are not available to quantitatively address this route of exposure.								
This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the current young child and adult resident using bedrock groundwater for potable purposes. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of between 2 and 900 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated bedrock groundwater containing 1,2-dichloroethene, cis-1,2-dichloroethene, trichloroethene, arsenic, and vanadium.								

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 20

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Bedrock Groundwater	Site-Wide	1,2-Dichloroethane	1E-06	8E-07	5E-08	--	2E-06
			1,4-Dioxane	7E-06	N/A	2E-08	--	7E-06
			Benzene	5E-06	2E-06	6E-07	--	7E-06
			Methylene chloride	7E-06	1E-06	2E-07	--	8E-06
			Tetrachloroethene	2E-03	4E-05	1E-03	--	3E-03
			Trichloroethene	2E-02	1E-02	2E-03	--	3E-02
			Vinyl Chloride	2E-03	2E-05	6E-05	--	2E-03
			Benzo(a)anthracene	1E-05	N/A	N/A	--	1E-05
			Benzo(a)pyrene	1E-04	N/A	N/A	--	1E-04
			Benzo(b)fluoranthene	1E-05	N/A	N/A	--	1E-05
			Bis(2-ethylhexyl)phthalate	2E-06	N/A	2E-06	--	4E-06
			Dibenz(a,h)anthracene	1E-04	N/A	N/A	--	1E-04
			Indeno(1,2,3-cd)pyrene	1E-05	N/A	N/A	--	1E-05
			Pentachlorophenol	6E-05	N/A	N/A	--	6E-05
			Arsenic	7E-04	N/A	3E-06	--	7E-04
							Groundwater Risk Total =	4E-02
							Total Risk =	4E-02

Key

-- Route of exposure is not applicable to this medium.

N/A - Not applicable.

This table provides risk estimates for the significant routes of exposure for the future young child and adult resident. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's and child's exposure to bedrock groundwater, as well as the toxicity of the COCs. The total risk from direct exposure to contaminated groundwater at this site to a future resident is estimated to be 4 x 10^{-2}. The COCs contributing to these risk levels are benzene, 1,2-dichloroethane, 1,4-dioxane, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, and arsenic. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 4 in 100 of developing cancer as a result of site-related exposure to COCs in bedrock groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table 21

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Bedrock Groundwater	Site-Wide						
			1,2-Dichloroethene (total)	Blood	7E+00	2E+00	4E-01	9E+00
			cis-1,2-Dichloroethene	Blood	6E+00	5E-01	5E-01	7E+00
			Tetrachloroethene	Liver	2E+00	9E-02	8E-01	3E+00
			Trichloroethene	Liver	8E+02	8E+00	9E+01	9E+02
			Arsenic	Skin	8E+00	N/A	4E-02	8E+00
			Mercury	CNS	4E+00	N/A	2E-02	4E+00
			Vanadium	Kidney	3E+00	N/A	6E-01	4E+00
							Groundwater Hazard Index Total =	9E+02
							Liver Hazard Index =	9E+02
							Blood Hazard Index =	2E+01
							CNS Hazard Index =	4E+00
							Kidney Hazard Index =	4E+00
							Skin Hazard Index =	8E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future young child and adult resident using bedrock groundwater for potable purposes. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 900 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated bedrock groundwater containing 1,2-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, trichloroethene, arsenic, mercury, and vanadium.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table 22: *Selection of contaminants of potential concern in surface water from Ball Brook*

Screening-level ecological risk assessment

Durham Meadows Superfund Site

Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site		Arithmetic means: detects only	Arithmetic means: detects +1/2 ND	Maximum detected conc. on site		Maximum background conc.		Surface water benchmarks	Source	Hazard quotient	COPC?	Reason
VOCs (ug/L)														
1,1,1-Trichloroethane	1/6	1.0	J	1.0	2.3	1	J	ND		11	(2)	9.09E-02	NO	a
1,2-Dichloroethylene isomers	2/6	6.0		7.0	4.0	8		ND		590	(2)	1.36E-02	NO	a
Trichloroethylene	2/6	4.0		4.0	3.0	4		2.0	J	47	(2)	8.51E-02	NO	a
SVOCs (ug/L)														
Bis(2-ethylhexyl)phthalate	1/6	2.0	J	2.0	2.9	2	J	ND		3	(2)	6.67E-01	NO	a
Diethylphthalate	1/6	5.8	J	5.8	3.6	5.8	J	ND		210	(2)	2.76E-02	NO	a
Dimethylphthalate	1/6	1.9	J	1.9	2.9	1.9	J	ND		NA	-	-	**YES**	c
Metals - unfiltered (ug/L, unless otherwise noted)														
Aluminum	5/6	24		185.6	156.3	475		837		87	(1)	5.46E+00	**YES**	b
Barium	6/6	59.4		132.7	132.7	265		176		4	(2)	6.63E+01	**YES**	b
Calcium (mg/L)	6/6	30		38.1	38.1	48.8		35		116	(3)	4.21E-01	NO	a,d
Copper	2/6	9.1		9.35	3.6	9.6		ND		9	(1)	1.07E+00	**YES**	b
Iron	6/6	92.2		295.4	295.4	880		1200		1000	(1)	8.80E-01	NO	a
Magnesium (mg/L)	6/6	5.1		5.2	5.2	5.3		5.4		82	(3)	6.46E-02	NO	a,d
Manganese	6/6	25		60.5	60.5	118		53.9		120	(2)	9.83E-01	NO	a
Potassium (mg/L)	6/6	1.8		2.7	2.7	3.7		6.4		53	(3)	6.98E-02	NO	a,d
Sodium (mg/L)	6/6	12		16.5	16.5	18.9		18.6		680	(3)	2.78E-02	NO	a,d
Zinc	6/6	1.8		16.7	16.7	43.9		4.6		120	(1)	3.66E-01	NO	a
Metals - filtered (ug/L, unless otherwise noted)														
Aluminum	3/6	26.8		133	71.5	278		ND		87	(1)	3.20E+00	**YES**	b
Barium	6/6	56	J	125.9	125.9	251		141		4	(2)	6.28E+01	**YES**	b

Table 22: Selection of contaminants of potential concern in surface water from Ball Brook
Screening-level ecological risk assessment
Durham Meadows Superfund Site
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site	Arithmetic means: detects only	Arithmetic means: detects +1/2 ND	Maximum detected conc. on site	Maximum background conc.	Surface water benchmarks	Source	Hazard quotient	COPC?	Reason
Calcium (mg/L)	6/6	29.3	41.9	41.9	60.4	37	116	(3)	5.21E-01	NO	a,d
Copper	2/6	5.2	6.8	2.8	8.3	ND	9	(1)	9.22E-01	NO	a
Iron	6/6	48.5	127.2	127.2	294	116	1000	(1)	2.94E-01	NO	a
Magnesium (mg/L)	6/6	5.1	5.5	5.5	6.0	5.8	82	(3)	7.32E-02	NO	a,d
Manganese	6/6	16.4	52.2	52.2	115	89.6	120	(2)	9.58E-01	NO	a
Potassium (mg/L)	6/6	1.9	2.8	2.8	3.9	3.4	53	(3)	7.36E-02	NO	a,d
Sodium (mg/L)	6/6	11.6	16.8	16.8	20	18.5	680	(3)	2.94E-02	NO	a,d
Vanadium	2/6	2.0	2.2	1.2	2.3	ND	20	(2)	1.15E-01	NO	a
Zinc	6/6	5.3	14.3	14.3	34.5	3.8	120	(1)	2.88E-01	NO	a

NA = not available

ND = not detected

Only those contaminants present above their analytical detection limit (DL) in at least one sample from the site were retained; contaminants present below their analytical DL in all the site samples were omitted.

Note 1: The benchmarks used in selecting surface water contaminants of potential concern (COPC) were as follows:

(1) U.S. EPA. 2002. National Recommended Water Quality Criteria: 2002. EPA-822-R-02-047.

(2) Secondary chronic values in Suter, G.W. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. Oak Ridge National Laboratory. ES/ER/TM-96/R2.

(3) Lowest chronic values in Suter, G.W. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. Oak Ridge National Laboratory. ES/ER/TM-96/R2.

Note 2: The reason codes are as follows:

a = the max conc. does not exceed its screening value

b = the max. conc. exceeds its screening value

Table 22: Selection of contaminants of potential concern in surface water from Ball Brook Screening-level ecological risk assessment Durham Meadows Superfund Site Durham, CT											
Analyte	Frequency of detection	Minimum detected conc. on site	Arithmetic means: detects only	Arithmetic means: detects +1/2 ND	Maximum detected conc. on site	Maximum background conc.	Surface water benchmarks	Source	Hazard quotient	COPC?	Reason
c = no benchmark is available											
d = the analyte is a physiological electrolyte											

Table 23: Selection of contaminants of potential concern in sediment from Ball Brook
Screening-level ecological risk assessment
Durham Meadows Superfund Site,
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site		Arithmetic means		Maximum detected conc. on site		Maximum background conc.		"No Effect" sediment benchmarks	Source	Hazard quotient	COPC?	Reason
				Detects only	Detects + 1/2 ND									
VOCs (ug/kg dry weight)														
1,1,1-Trichloroethane	1/5	4.0	J	4.0	4.3	4.0	J	4.4	L	170	(3)	2.35E-02	NO	a
1,2-Dichloroethylene isomers	1/5	3.1	J	3.1	4.5	3.1	J	ND		31	(5)	1.00E-01	NO	a
Methylene Chloride	2/5	3.0	J	18.5	10.1	34.0		2,7	L,B	NA	-	-	**YES**	c
Tetrachloroethylene	2/5	3.3	J	4.1	3.9	3.8	J	5.8	L	530	(3)	7.17E-03	NO	a
Trichloroethylene	2/5	2.5	J	3.5	3.7	2.6	J	2.2	L	1,600	(3)	1.63E-03	NO	a
Vinyl Chloride	1/5	1.8	J	1.8	4.2	1.8	J	ND		15,186	(6)	1.19E-04	NO	a
Trichlorofluoromethane	3/5	7.6	J	13.0	9.4	17.0		24		3,398	(6)	5.00E-03	NO	a
sec-Butylbenzene	1/5	3.3	J	4.7	4.3	3.3	J	ND		NA	-	-	**YES**	c
SVOCs (ug/kg dry weight)														
Acenaphthene	5/5	11		24.5	24.5	44.5		57		16	(2)	2.78E+00	**YES**	b
Acenaphthylene	5/5	50		138.8	138.8	280		110		44	(2)	6.36E+00	**YES**	b
Anthracene	5/5	46		117.4	117.4	210		230		57.2	(1)	3.67E+00	**YES**	b
Benzo(a)anthracene	5/5	360		756	756	1450		1500		108	(1)	1.34E+01	**YES**	b
Benzo(a)pyrene	5/5	550		1078	1078	2050		2000		150	(1)	1.37E+01	**YES**	b
Benzo(b)fluoranthene	5/5	820		1682	1682	3150		3100		NA	-	-	**YES**	c
Benzo(ghi)perylene	5/5	400		776	776	1400		1400		170	(4)	8.24E+00	**YES**	b
Benzo(k)fluoranthene	5/5	310		556	556	1000		920		240	(4)	4.17E+00	**YES**	b
Benzoic Acid	2/5	160	J	259	305	278	J	190	J	NA	-	-	**YES**	c
Bis(2-ethylhexyl)phthalate	1/5	1300		1300	398	1300		ND		890,000	(5)	1.46E-03	NO	a
Butyl Benzyl Phthalate	1/5	150	J	150	166.6	150	J	ND		11,000	(3)	1.36E-02	NO	a
Carbazole	2/5	110	J	143	165	175	J	160	J	284,678	(6)	6.15E-04	NO	a

Table 23: Selection of contaminants of potential concern in sediment from Ball Brook
Screening-level ecological risk assessment
Durham Meadows Superfund Site,
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site		Arithmetic means		Maximum detected conc. on site		Maximum background conc.		"No Effect" sediment benchmarks	Source	Hazard quotient	COPC?	Reason
				Detects only	Detects + 1/2 ND									
Chrysene	5/5	520		1020	1020	1900		1800		166	(1)	1.14E+01	**YES**	b
Di-n-butylphthalate	1/5	110	J	110	159	110	J	60	J	11,000	(3)	1.00E-02	NO	a
Dibenzo(a,h)anthracene	5/5	110		223	223	435		370		33	(1)	1.32E+01	**YES**	b
Fluoranthene	5/5	890		1702	1702	3300		3600		423	(1)	7.80E+00	**YES**	b
Fluorene	5/5	25		49.5	49.5	88.5		86		77.4	(1)	1.14E+00	**YES**	b
Indeno(1,2,3-cd)pyrene	5/5	520		1016	1016	1850		1800		200	(4)	9.25E+00	**YES**	b
Naphthalene	5/5	7.6		13.5	13.5	24		15		176	(1)	1.36E-01	NO	a
Phenanthrene	5/5	340		746	746	1400		1600		204	(1)	6.86E+00	**YES**	b
Pyrene	5/5	970		1768	1768	3300		3500		195	(1)	1.69E+01	**YES**	b
Sum of PAHs	-	6133.0		11667.0	11667.0	21804		-		1,610	(1)	1.35E+01	**YES**	b
Pesticides (ug/kg dry weight)														
4,4'-DDD	2/5	1.6	J	1.8	1.2	1.9		2.7		1.88	(1)	1.01E+00	**YES**	b
4,4'-DDE	2/5	2.4	J	4.3	2.2	6.1		3.5		3.16	(1)	1.93E+00	**YES**	b
Alpha Chlordane	1/5	1.8	J	1.8	1.0	1.8	J	1.8		7	(4)	2.60E-01	NO	a
Metals (mg/kg dry weight)														
Aluminum	5/5	5800		11780	11780	22000		13000		NA	-	-	**YES**	c
Barium	5/5	55.8		121	121	314		147		NA	-	-	**YES**	c
Beryllium	3/5	0.7		1.0	0.7	1.4		1.1		NA	-	-	**YES**	c
Calcium	5/5	1090		2230	2230	4250		2850		NA	-	-	NO	c,d
Chromium	5/5	8.2		16.0	16.0	32.0		19.5		43.4	(1)	7.37E-01	NO	a
Cobalt	5/5	3.5		9.0	9.0	17.8		7.6		NA	-	-	**YES**	c
Copper	5/5	6.8		59.8	59.8	250		22.5		31.6	(1)	7.91E+00	**YES**	b
Iron	5/5	7900		14800	14800	26000		18000		20,000	(4)	1.30E+00	**YES**	b
Lead	3/5	55.1		57.5	38.3	60.0		63.2		35.8	(1)	1.68E+00	**YES**	b

Table 23: Selection of contaminants of potential concern in sediment from Ball Brook

Screening-level ecological risk assessment

Durham Meadows Superfund Site,

Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site	Arithmetic means: Detects only	Arithmetic means: Detects + 1/2 ND	Maximum detected conc. on site	Maximum background conc.	"No Effect" sediment benchmarks	Source	Hazard quotient	COPC?	Reason
Magnesium	5/5	1710	3454	3454	7090	3640	NA	-	-	NO	c,d
Manganese	5/5	204	386	386	746	592	460	(4)	1.62E+00	**YES**	b
Nickel	4/5	4.3	11.1	9.5	20.2	13.7	22.7	(1)	8.90E-01	NO	a
Vanadium	5/5	15.9	29.6	29.6	53.5	32.2	NA	-	-	**YES**	c
Zinc	5/5	37.3	188	188	680	68.9	121	(1)	5.62E+00	**YES**	b

NA = not available

ND = not detected

Only those contaminants present above their analytical detection limit (DL) in at least one sample from the site were retained; contaminants present below their analytical DL in all the site samples were omitted.

Note 1: The benchmarks used in selecting sediment contaminants of potential concern (COPC) were as follows:

(1) MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

(2) Long, E.R., D.D. MacDonald, S.L. Smith and F.D. Calder. 1995. Incidence of adverse biological effects with ranges of chemical concentrations in marine and estuarine sediments. Environ. Manag. 19:81-97.

(3) U.S. EPA. 1996. ECO Update: Ecotox Thresholds. EPA 540/F-95/038. January, 1996.

(4) Persaud, D., R. Jaagumagi and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of Environment and Energy.

(5) Jones, D.S., G.W. Suter and R.N. Hull. 1997. Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision. Oak Ridge National Laboratory. ES/ER/TM-95/R4.

(6) This benchmark was calculated using the EPA's Equilibrium Partitioning (Eq-P) approach

Note 2: The Reason codes are as follows:

Table 23: Selection of contaminants of potential concern in sediment from Ball Brook
Screening-level ecological risk assessment
Durham Meadows Superfund Site,
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site	Arithmetic means		Maximum detected conc. on site	Maximum background conc.	"No Effect" sediment benchmarks	Source	Hazard quotient	COPC?	Reason
			Detects only	Detects + 1/2 ND							
a = the maximum concentration does not exceed its "no effect" sediment screening value											
b = the maximum concentration exceeds its "no effect" sediment screening value											
c = no sediment screening value is available											
d = analyte is a physiological electrolyte											

Table 24: Selection of contaminants of potential concern in wetland soil
Screening-level ecological risk assessment
Durham Meadows Superfund Site,
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site		Arithmetic means: Detects only	Arithmetic means: Detects + 1/2 ND	Maximum detected conc. on site		Maximum background conc.	Benchmark	Receptor type	Hazard quotient	COPC?	Reason
VOCs (ug/kg)													-
Methylene chloride	2 / 6	2.5	J	32.3	15.5	62		NA	21,400	Mammal	2.90E-03	NO	a
Tetrachloroethylene	1 / 6	-		18	8.3	18	L	NA	2,770	Mammal	6.50E-03	NO	a
1,1,1-Trichloroethane	1 / 6	-		16	8.0	16	J	NA	2,060	Mammal	7.77E-03	NO	a
Trichloroethylene	1 / 6	-		10	7.0	10	J	NA	1,387	Mammal	7.21E-03	NO	a
Trichlorofluoromethane	2 / 6	5.8	J	33.4	15.8	61		NA	NA	NA	NA	**YES**	c
SVOCs (ug/kg)													
Acenaphthene	5 / 6	2.3	J	33.9	30.2	110		NA	20,000	Plant	5.50E-03	NO	a
Acenaphthylene	6 / 6	16		501	501	2100		NA	NA	NA	NA	**YES**	c
Anthracene	6 / 6	7.8		141	141	530		NA	NA	NA	NA	**YES**	c
Benzo(a)anthracene	6 / 6	63		1256	1256	5300		NA	NA	NA	NA	**YES**	c
Benzo(a)pyrene	6 / 6	89		2812	2812	13000		NA	1,980	Mammal	6.57E+00	**YES**	b
Benzo(b)fluoranthene	6 / 6	140		4563	4563	21000		NA	NA	NA	NA	**YES**	c
Benzo(g,h,i)perylene	6 / 6	79		2372	2372	11000		NA	NA	NA	NA	**YES**	c
Benzo(k)fluoranthene	6 / 6	51		1257	1257	5500		NA	NA	NA	NA	**YES**	c
Benzoic acid	2 / 6	220	J	425	713	630	J	NA	NA	NA	NA	**YES**	c
Carbazole	2 / 6	110	J	110	353	110	J	NA	NA	NA	NA	**YES**	c
Chrysene	6 / 6	88		1551	1551	6200		NA	NA	NA	NA	**YES**	c
Dibenzo(a,h)anthracene	6 / 6	20		708	708	3200		NA	NA	NA	NA	**YES**	c
Fluoranthene	6 / 6	140		2263	2263	8800		NA	NA	NA	NA	**YES**	c
Fluorene	6 / 6	3.7		43.6	43.6	120		NA	30,000	Earthworm	4.00E-03	NO	a
Indeno(1,2,3-cd)pyrene	6 / 6	100		3197	3197	15000		NA	NA	NA	NA	**YES**	c
2-Methylnaphthalene	1 / 6	-		130	377	130	J	NA	NA	NA	NA	**YES**	c
Naphthalene	5 / 6	2.5		42.5	37.4	100		NA	NA	NA	NA	**YES**	c

Table 24: Selection of contaminants of potential concern in wetland soil
Screening-level ecological risk assessment
Durham Meadows Superfund Site,
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site		Arithmetic means: Detects only	Arithmetic means: Detects + 1/2 ND	Maximum detected conc. on site		Maximum background conc.	Benchmark	Receptor type	Hazard quotient	COPC?	Reason
Phenanthrene	6 / 6	20		517	517	1300		NA	NA	NA	NA	YES	c
Pyrene	6 / 6	140		2868	2868	12000		NA	NA	NA	NA	YES	c
Pesticides/PCBs (ug/kg)													
4,4'-DDE	4 / 6	2.1	J	2.9	2.3	3.8		NA	NA	NA	NA	YES	c
alpha-Chlordane	1 / 5	-		2.1	1.1	2.1	J	NA	1,800	Avian	1.17E-03	NO	a
Dieldrin	1 / 6	-		2.4	1.2	2.4	J	NA	0.28	SSL	8.57E+00	YES	b
Metals (mg/kg)													
Aluminum	6 / 6	8500		14000	14000	19000		NA	0.3	SSL	6.33E+04	YES	b
Barium	6 / 6	87.4		273	273	780		NA	330	SSL	2.36E+00	YES	b
Beryllium	6 / 6	0.51		0.9	0.9	1.4		NA	35	SSL	4.00E-02	NO	a
Cadmium	2 / 6	2.8		6.0	2.5	9.1		NA	0.38	SSL	2.39E+01	YES	b
Chromium	6 / 6	14.9		1491	1491	8370		NA	5,000	SSL	1.67E+00	YES	b
Cobalt	6 / 6	4.0		7.7	7.7	10.4		NA	13	SSL	8.00E-01	NO	a
Copper	6 / 6	11.4		79.3	79.3	276		NA	61	SSL	4.52E+00	YES	b
Iron	6 / 6	9200		19000	19000	29000		NA	NA	NA	NA	YES	c
Lead	6 / 6	31.9		287	287	915		NA	16	SSL	5.72E+01	YES	b
Manganese	6 / 6	140		588	588	1350		NA	322	Mammal	4.19E+00	YES	b
Mercury	4 / 6	0.39		2.8	1.9	5.4		NA	0.10	Earthworm	5.40E+01	YES	b
Nickel	6 / 6	8.3		14	14	20.6		NA	11.22	Mammal	1.84E+00	YES	b
Vanadium	5 / 6	19		32	30.4	46.2		NA	0.71	Mammal	6.47E+01	YES	b
Zinc	5 / 6	136		515	452	1670		NA	12	Avian	1.39E+02	YES	b
Notes													

Table 24: Selection of contaminants of potential concern in wetland soil
Screening-level ecological risk assessment
Durham Meadows Superfund Site,
Durham, CT

Analyte	Frequency of detection	Minimum detected conc. on site	Arithmetic means		Maximum detected conc. on site	Maximum background conc.	Benchmark	Receptor type	Hazard quotient	COPC?	Reason
			Detects only	Detects + 1/2 ND							
COPC - Chemical of potential concern											
Note 1: the benchmarks used in selecting wetland soil contaminants of potential concern (COPC) were as follows:											
SSL - USEPA Interim Final Ecological Soil Screening Level (USEPA, 2003)											
Mammal - Benchmark based on lowest mammalian value (Sample, *et al.*, 1996)											
Avian - Benchmark based on lowest avian value (Sample *et al.*, 1996)											
Earthworm - Benchmark based on toxicity concentrations for earthworm (Efroymson, *et al.*, 1997a)											
NA - Benchmark not available											
Note 2: The Reason codes are as follows:											
a = the maximum concentration does not exceed its "no effect" soil screening value											
b = the maximum concentration exceeds its "no effect" soil screening value											
c = no soil screening value is available											

Table 25: Ecological exposure pathways and endpoints Screening-level ecological risk assessment *Durham Meadows Superfund Site* Durham, CT					
Receptor group	**Listed species?**	**Main exposure media**	**Exposure routes**	**Assessment endpoints**	**Measurement endpoints**
benthic invertebrates	NO	sediment	ingestion and direct contact with chemicals in sediment	maintain the long-term stability and viability of the benthic invertebrate community present within the substrate in Ball Brook	• compare the mean concentrations of COPCs measured Ball Brook sediment samples to published benchmarks
fish	NO	surface water	Ingestion and direct contact with chemicals in surface water	maintain the long-term stability and viability of the fish community within Ball Brook	• compare the mean concentrations of COPCs measured in Ball Brook surface water samples to published benchmarks
soil organisms	NO	soil	direct contact (plants & earthworms), ingestion (earthworms)	maintain the long-term stability and viability of the soil invertebrate and plant community within the wet meadow	• compare the mean contaminant levels measured in wet meadow soil samples to published benchmarks
small mammals	NO	soil and soil invertebrates	ingestion	maintain the long-term stability and viability of small-mammal populations that may inhabit the wet meadow	• calculate an estimated daily dose in the short-tailed shrew based on the ingestion of soil and soil invertebrates

Table 26: Hazard quotients for surface water from Ball Brook
Durham Meadows Superfund Sites
Durham, CT

Analyte	Chronic surface water benchmark	Site locations		Reference locations			Chronic HQ[b]	Ratios		
		Mean conc. (detects +1/2 NDs)	Maximum conc.	Mean conc. (detects only)	Mean conc. (detects +1/2 NDs)	Maximum. conc.[a]		Site Max. over Ref. Mean (detects only)	Site Max. over Ref. Mean (detects+1/2 NDs)	Site Max. over Ref. Max
SVOC (ug/L)										
Dimethylphthalate	NA	2.9	1.9 J	-	3.8 U	6 U	-	-	5.00E-01	3.17E-01
Metals - unfiltered (ug/L)										
Aluminum	87	156.3	475	430	220	837	**1.80E+00**	1.10E+00	2.16E+00	5.68E-01
Barium	4.0	132.7	265	92	92	176	**3.32E+01**	2.88E+00	2.88E+00	1.51E+00
Copper	9.0	3.6	9.6	-	1.2 U	0.8 U	4.00E-01	-	8.00E+00	1.28E+01
Metals - filtered (ug/L)										
Aluminum	87	71.5	278	-	10 U	10 U	8.22E-01	-	2.78E+01	2.78E+01
Barium	4.0	125.9	251	83	83	141	**3.15E+01**	3.02E+00	3.02E+00	1.78E+00

[a] for analytes flagged as "U", the value shown is 1/2DL

[b] chronic HQ = site mean concentration (detects + 1/2 NDs) /chronic surface water benchmark

DL = detection limit

ND = not detected

bold = HQ > 1.0

Table 27: Hazard quotients for the sediment samples from Ball Brook
Screening-level ecological risk assessment

Durham Meadows Superfund Site

Durham, CT

Analyte	Sediment benchmarks: "no-effect" benchmark	Source	"effect" benchmark	Source	BB6 (reference location)[a]		Site arith. mean (detects +1/2 DL)	Hazard quotients (HQs): "no effect" HQs[b]	"effect" HQs[c]	Ratio of ref. conc. over site arith. mean
VOCs (ug/kg dry weight)										
Methylene Chloride	NA	-	NA	-	2.7	U	10.1	-	-	2.67E-01
sec-Butylbenzene	NA	-	NA	-	4.2	U	4.0	-	-	1.05E+00
SVOCs (ug/kg dry weight)										
Acenaphthene	16	(2)	536	(1*)	57		24.5	**1.53E+00**	4.57E-02	2.33E+00
Acenaphthylene	44	(2)	536	(1*)	100		139	**3.15E+00**	2.59E-01	7.20E-01
Anthracene	57.2	(1)	845	(1)	230		117	**2.05E+00**	1.39E-01	1.96E+00
Benzo(a)anthracene	108	(1)	1,050	(1)	1,500		756	**7.00E+00**	7.20E-01	1.98E+00
Benzo(a)pyrene	150	(1)	1,450	(1)	2,000		1,078	**7.19E+00**	7.43E-01	1.86E+00
Benzo(b)fluoranthene	NA	-	536	(1*)	3,100		1,682	-	**3.14E+00**	1.84E+00
Benzo(ghi)perylene	170	(3)	536	(1*)	1,400		776	**4.56E+00**	**1.45E+00**	1.80E+00
Benzo(k)fluoranthene	240	(3)	536	(1*)	920		556	**2.32E+00**	**1.04E+00**	1.65E+00
Benzoic Acid	NA	-	NA	-	330	UJ	305	-	-	1.08E+00
Chrysene	166	(1)	1,290	(1)	1,800		1,020	**6.14E+00**	7.91E-01	1.76E+00
Dibenzo(a,h)anthracene	33	(1)	536	(1*)	370		223	**6.76E+00**	4.16E-01	1.66E+00
Fluoranthene	423	(1)	2,230	(1)	3,600		1,702	**4.02E+00**	7.63E-01	2.12E+00
Fluorene	77.4	(1)	536	(1)	86		49.5	6.40E-01	9.24E-02	1.74E+00
Indeno(1,2,3-cd)pyrene	200	(3)	536	(1*)	1,800		1,016	**5.08E+00**	**1.90E+00**	1.77E+00
Phenanthrene	204	(1)	1,170	(1)	1,600		746	**3.66E+00**	6.38E-01	2.14E+00
Pyrene	195	(1)	1,520	(1)	3,500		1,768	**9.07E+00**	**1.16E+00**	1.98E+00
Sum of Total PAHs	1,610	(1)	22,800	(1)	22,078		11,667	**7.25E+00**	5.12E-01	1.89E+00
Pesticides (ug/kg dry weight)										
4,4'-DDD	1.88	(1)	28	(1)	1.5	J	1.2	6.60E-01	4.43E-02	1.21E+00
4,4'-DDE	3.16	(1)	31.3	(1)	2.0	J	2.2	7.09E-01	7.16E-02	8.93E-01
Metals (mg/kg dry weight)										
Aluminum	NA	-	NA	-	12,000		1.2	-	-	1.03E+04
Barium	NA	-	NA	-	102		121	-	-	8.43E-01
Beryllium	NA	-	NA	-	0.91		0.7	-	-	1.31E+00
Cobalt	NA	-	NA	-	7.6		9.0	-	-	8.41E-01
Copper	31.6	(1)	149	(1)	22.5		59.8	**1.89E+00**	4.01E-01	3.76E-01
Iron	20,000	(3)	40,000	(3)	18,000		14,800	7.40E-01	3.70E-01	1.22E+00
Lead	35.8	(1)	128	(1)	59.9		38.3	**1.07E+00**	2.99E-01	1.56E+00
Manganese	460	(3)	1,100	(3)	592		386	8.40E-01	3.51E-01	1.53E+00
Vanadium	NA	-	NA	-	17.7	U	29.6	-	-	5.99E-01
Zinc	121	(1)	459	(1)	54	U	188	**1.56E+00**	4.10E-01	2.87E-01

[a] if an analyte was not present at a concentration above its detection limit (flagged as U or UJ), then the value shown is 1/2 DL

[b] "no effect" HQ = site arithmetic mean conc. (detects + 1/2 NDs)/"no effect" sediment benchmark

Table 27: Hazard quotients for the sediment samples from Ball Brook Screening-level ecological risk assessment Durham Meadows Superfund Site Durham, CT									
	Sediment benchmarks					Site arith. mean (detects +1/2 DL)	Hazard quotients (HQs)		
Analyte	"no-effect" benchmark	Source	"effect" benchmark	Source	BB6 (reference location)[a]		"no effect" HQs[b]	"effect" HQs[c]	Ratio of ref. conc. over site arith. mean
[c] "effect" HQ = site arithmetic mean conc. (detects + 1/2 NDs)/"effect" sediment benchmark									
Benchmark sources:									
(1) MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.									
(2) Long, E.R., D.D. MacDonald, S.L. Smith and F.D. Calder. 1995. Incidence of adverse biological effects with ranges of chemical concentrations in marine and estuarine sediments. Environ. Manag. 19:81-97.									
(3) Persaud, D., R. Jaagumagi and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of Environment and Energy.									
note:									
* the value shown is for fluorene, the lowest-available probable effect concentration (PEC) for PAHs (MacDonald et al., 2000).									
HQ = site mean concentration (detects + 1/2 NDs) /"no effect" or "effect" sediment benchmark									

Table 28: Hazard quotients for shrew (maximum exposure scenario) **Screening-level ecological risk assessment** Durham Meadows Superfund Site Durham, CT							
	Analyte	**Total dose (mg/kg-day)**	**No effect TRV (mg/kg-day)**	**Total HQ (max. exposure)**	**Percent food HQ**	**Percent soil HQ**	**Percent surface water HQ**
	VOCs						
	Trichlorofluoromethane	0.22	107	<0.1	99.7	0.3	NA
	SVOCs						
	Acenaphthylene	1.5	159	<0.1	99.7	0.3	NA
	Anthracene	0.47	1189	<0.1	99.7	0.3	NA
X	Benzo(a)anthracene	4.0	1.5	**2.6**	99.7	0.3	NA
X	Benzo(b)fluoranthene	11	1.5	**6.9**	99.7	0.3	NA
	Benzo(g,h,i)perylene	5.1	159	<0.1	99.7	0.3	NA
X	Benzo(k)fluoranthene	3.7	1.5	**2.4**	99.7	0.3	NA
	Benzoic acid	2.2	1099	<0.1	99.7	0.3	NA
	Carbazole	0.42	159	<0.1	99.7	0.3	NA
X	Chrysene	5.4	1.5	**3.5**	99.7	0.3	NA
X	Dibenzo(a,h)anthracene	1.9	1.5	**1.2**	99.7	0.3	NA
	Fluoranthene	8.0	149	<0.1	99.7	0.3	NA
X	Indeno(1,2,3-cd)pyrene	6.8	1.5	**4.4**	99.7	0.3	NA
	2-Methylnaphthalene	0.50	135	<0.1	99.7	0.3	NA
	Naphthalene	0.21	238	<0.1	99.7	0.3	NA
	Phenanthrene	3.3	159	<0.1	99.7	0.3	NA
	Pyrene	7.7	159	<0.1	99.6	0.4	NA
	Pesticides/PCBs						
	4,4'-DDE	0.016	3.2	<0.1	99.7	0.3	NA
	alpha-Chlordane	0.0088	5.4	<0.1	99.7	0.3	NA
	Dieldrin	0.010	0.044	0.2	99.7	0.3	NA
	Metals						
X	Aluminum	420	58	**7.2**	44.2	55.8	NA
X	Barium	20	12	**1.7**	51.8	48.2	NA
X	Cadmium	4.1	2.1	**1.9**	97.2	2.8	NA
X	Chromium	104	20	**5.3**	0.5	99.5	NA
	Copper	5.4	33	0.2	36.4	63.6	NA
	Iron	546	NA	NA	NA	NA	NA
X	Lead	28	18	**1.6**	59.1	40.9	NA
	Manganese	22	442	<0.1	23.2	76.8	NA
X	Mercury	0.12	0.070	**1.7**	43.3	56.7	NA
	Nickel	1.7	88	<0.1	85.4	14.6	NA

Table 28: Hazard quotients for shrew (maximum exposure scenario)
Screening-level ecological risk assessment
Durham Meadows Superfund Site
Durham, CT

	Analyte	Total dose (mg/kg-day)	No effect TRV (mg/kg-day)	Total HQ (max. exposure)	Percent food HQ	Percent soil HQ	Percent surface water HQ
X	Vanadium	0.86	0.43	**2.0**	37.1	62.9	NA
	Zinc	101	352	0.3	79.7	20.3	NA

Notes:
HQ = Hazard quotient
TRV = Toxicity Reference Value
X = Indicates a COPC with a HQ > 1.0
Total Dose = Sum of exposure from ingestion of animal (prey) and soil
NA = Not Applicable

Table 29: Hazard quotients for the shrew (mean exposure scenario)
Screening-level ecological risk assessment
Durham Meadows Superfund Site
Durham , CT

	Analyte	Total dose (mg/kg-day)	No effect TRV (mg/kg-day)	Total HQ (mean exposure)	Percent food HQ	Percent soil HQ	Percent surface water HQ
	SVOCs						
X	Benzo(a)anthracene	1.8	1.5	**1.2**	99.7	0.3	NA
X	Benzo(b)fluoranthene	5	1.5	**3.4**	99.7	0.3	NA
X	Benzo(k)fluoranthene	1.7	1.5	**1.1**	99.7	0.3	NA
X	Chrysene	2.6	1.5	**1.7**	99.7	0.3	NA
X	Indeno(1,2,3-cd)pyrene	3.6	1.5	**2.3**	99.7	0.3	NA
	Metals						
X	Aluminum	312	58	**5.4**	44.2	55.8	NA
	Barium	8	12	0.7	51.8	48.2	NA
	Cadmium	1.6	2.1	0.8	97.8	2.2	NA
X	Chromium	23	20	**1.1**	2.6	97.4	NA
	Iron	354	NA	NA	NA	NA	NA
	Lead	11	18	0.6	63.8	36.2	NA
X	Mercury	0.07	0.070	**1.0**	63.3	36.7	NA
X	Vanadium	0.54	0.43	**1.2**	37.1	62.9	NA
Notes:							
HQ = Hazard quotient							
TRV = Toxicity Reference Value							
X = Indicates a COPC with a HQ > 1.0							
Total Dose = Sum of exposure from ingestion of animal (prey) and soil							
NA = Not Applicable							

Table 30. Compounds To Which Technical Impracticability Waiver Will Apply

Contaminant of Concern	USEPA MCL (ug/L)	Minimum of Applicable CT RSRs (1) (ug/L)	HH RBG ILCR = 1E-06 or HI = 1 (ug/L)	Maximum Groundwater Concentration (5) (ug/L)	
				Bedrock	DMC Overburden
1,1-Dichloroethane	--	70		126	93
1,1-Dichloroethene	7	1		82.4	23,000
1,1,1-TCA	200	200		600	18,460
1,2-Dichloroethane	5	1		4	(2)
1,2-Dichloroethene (total)	--	--	104	740	58020
1,4-Dioxane	--	--	5.2	34	(4)
Benzene	5	1		27.8	50
cis-1,2-DCE	70	70		1017	(3)
Ethylbenzene	700	700		4700	(2)
Methylene chloride	5	5		53	4,157,000
PCE	5	5		410	7,900
Toluene	1,000	1,000		2700	37000
TCE	5	5		4200	170,000
Vinyl chloride	2	1.6		170	88
Xylene	10,000	530		26000	310
Benzo(a)anthracene	--	0.06		1	(7)
Benzo(a)pyrene	0.2	0.2		1	(7)
Benzo(b)fluoranthene	--	0.08		1	(7)
Benzo(k)fluoranthene	--	0.3		0.8	(7)
Bis(2-ethylhexyl)phthalate	6	2		7	(7)
Dibenzo(a,h)anthracene	--	0.5		1	(7)
Indeno(1,2,3-c,d)pyrene	--	0.5		1	(7)
Pentachlorophenol	1	1		28	(7)
Phenanthrene	--	0.077		0.7	(7)

Table 30. Compounds To Which Technical Impracticability Waiver Will Apply

Contaminant of Concern	USEPA MCL (ug/L)	Minimum of Applicable CT RSRs (1) (ug/L)	HH RBG ILCR = 1E-06 or HI = 1 (ug/L)	Maximum Groundwater Concentration (5) (ug/L)	
				Bedrock	DMC Overburden
Arsenic	10	4		25	(2)
Copper	1,300	48		754	(7)
Lead	15 (6)	13		435	3.7
Mercury	2	0.4		4.2	(2)
Vanadium	--	50		34.5	(7)
Zinc	--	123		377	(7)

DCE – Dichloroethylene

ug/L – micrograms per liter (equivalent to parts per billion, ppb)

-- Not available

NA - Not applicable due to lack of toxicity values

(1) The lowest of the CT RSR GA/GAA GWPC, SWPC, and the current and proposed RES VC and I/C VC are presented.

(2) The analyte was not reported as detected, based on available data.

(3) Cis-1,2-DCE was not reported. Total 1,2-DCE (cis and trans) was reported at a maximum concentration of 58,020 ppb.

(4) The analyte 1,4-dioxane has not been analyzed for in overburden monitoring wells at the DMC Study Area.

(5) From reported historical records.

(6) The value presented for lead is a treatment technique action level.

(7) This analyte was not analyzed for, based on available data.

Table 31. Cost Estimate Summary for MMC Study Area

Capital Costs for MMC Study Area

Description	Quantity	Unit	Unit Cost	Total
1. Pre-Remedial Study (SVE)				
Sampling and analyses (soil and soil vapor)		LS		$18,000
Field equipment		LS		$2,500
Surveying		LS		$5,000
Data evaluation	75	HR	$75	$5,625
2. Treatability Study				
Treatability work plan	40	HR	$100	$4,000
Equipment mobilization		LS		$1,500
SVE Pilot Test		LS		$12,000
Treatability study report	40	HR	$100	$4,000
3. Soil Vapor Extraction System				
Equipment mobilization	1	LS		$5,000
Submittals and plans	1	LS		$18,000
Install SVE System	1	LS		$81,000
Install Vapor Monitoring Wells	5	EA	$1,500	$7,500
Subtotal (SVE System)				$164,125
Contingency Allowances (30%)				$49,238
Subtotal [Remedy Implementation]				$213,363
Project Management (8%)				$17,069
Remedial Design (15%)				$32,004
Construction Management (10%)				$21,336
Institutional Controls				$15,000
Total Capital Cost (SVE System)				**$298,772**
4. Site Preparation and Management (Excavation)				
Equipment mobilization		LS		$10,000
Submittals and plans		LS		$20,000
Temporary facilities		LS		$10,000
Erosion control measures	1,600	LF	$4	$6,400
Clearing and grubbing	1	LS	$10,000	$10,000
B. Pre-Remedial Soil Sampling				
Drill rig	5	day	$1,500	$7,500
Sampling and analysis		LS		$70,000
Field equipment	1	EA	$2,500	$2,500
Surveying	1	EA	$5,000	$5,000
Data evaluation	75	HR	$75.00	$5,625
C. Excavate and Backfill				
Excavate soil	4,800	CY	$5	$24,000
Dust control and air monitoring	1	EA	$10,000	$10,000
Post-remedial sampling	50	EA	$500	$25,000
Furnish clean fill	5,760	CY	$24	$140,000
D. Soil Disposal (non-haz)	7,200	ton	$70	$504,000
Subtotal (Excavation)				$850,025
Contingency Allowances (30%)				$255,007
Subtotal [Remedy Implementation]				$1,105,032
Project Management				$101,000
Remedial Design				$135,000
Construction Management				$122,000
Institutional Controls				$15,000
Total Capital Cost (Excavation)				**$1,478,032**
Total Capital Cost (MMC Study Area)				**$1,776,804**

Table 31. Cost Estimate Summary for MMC Study Area

Operation and Maintenance Cost for MMC Study Area

Description	Quantity	Unit	Unit Cost	Total
1. SVE System O&M (Years 1-7)				
Operational inspections and maintenance	160	hr	$75	$12,000
Equipment maintenance allowance		LS		$500
Electricity allowance		LS		$1,000
Disposal allowance		LS		$1,000
2. Annual Site Monitoring (Year 1-7)				
Soil vapor monitoring (Year 1-7)	1	event	$6,500	$6,500
Groundwater monitoring (Year 1-50)	1	event	$6,500	$6,500
Subtotal				$27,500
Contingency allowances				$8,250
Technical Support				$8,250
Project Management				$1,375
Total Annual O&M Cost				$45,375

Periodic Costs for MMC Study Area

Description	Quantity	Unit	Unit Cost	Total
Five year review (Year 5, 10,...50)	10	EA	$10,000	$100,000
Update Institutional Controls Plan	1	EA	$4,000	$4,000
Remedial Action Report	1	EA	$10,000	$10,000
Total Periodic Cost				$114,000

Notes

1. Cost estimates may be refined when the remedy is designed and implemented and are within +50 to -30% accuracy expectation.
2. Abbreviations

   LS = lump sum; HR = hour; EA = each; CY = cubic yard

Table 32. Summary of Present Worth Analysis - MMC Study Area

Year	Capital Cost	Annual O&M Cost	Periodic Cost	Total Cost	Discount Factor (7%)	Present Worth of O&M Cost	Present Worth of Periodic Cost
0	$298,772			$298,772			
1		$45,375		$45,375	0.935	$42,407	
2		$45,375		$45,375	0.873	$39,632	
3		$45,375		$45,375	0.816	$37,040	
4		$45,375		$45,375	0.763	$34,616	
5		$45,375	$24,000	$69,375	0.713	$32,352	$17,112
6		$45,375		$45,375	0.666	$30,235	
7	$1,478,032	$45,375		$1,523,407	0.623	$28,257	
8		$12,350		$12,350	0.582	$7,188	
9		$12,350		$12,350	0.544	$6,718	
10		$12,350	$10,000	$22,350	0.508	$6,278	$5,083
11		$12,350		$12,350	0.475	$5,867	
12		$12,350		$12,350	0.444	$5,484	
13		$12,350		$12,350	0.415	$5,125	
14		$12,350		$12,350	0.388	$4,790	
15		$12,350	$10,000	$22,350	0.362	$4,476	$3,624
16		$12,350		$12,350	0.339	$4,183	
17		$12,350		$12,350	0.317	$3,910	
18		$12,350		$12,350	0.296	$3,654	
19		$12,350		$12,350	0.277	$3,415	
20		$12,350	$10,000	$22,350	0.258	$3,191	$2,584
21		$12,350		$12,350	0.242	$2,983	
22		$12,350		$12,350	0.226	$2,788	
23		$12,350		$12,350	0.211	$2,605	
24		$12,350		$12,350	0.197	$2,435	
25		$12,350	$10,000	$22,350	0.184	$2,275	$1,842
26		$12,350		$12,350	0.172	$2,127	
27		$12,350		$12,350	0.161	$1,987	
28		$12,350		$12,350	0.150	$1,857	
29		$12,350		$12,350	0.141	$1,736	
30		$12,350	$10,000	$22,350	0.131	$1,622	$1,314
31		$12,350		$12,350	0.123	$1,516	
32		$12,350		$12,350	0.115	$1,417	
33		$12,350		$12,350	0.107	$1,324	
34		$12,350		$12,350	0.100	$1,238	
35		$12,350	$10,000	$22,350	0.094	$1,157	$937
36		$12,350		$12,350	0.088	$1,081	
37		$12,350		$12,350	0.082	$1,010	
38		$12,350		$12,350	0.076	$944	
39		$12,350		$12,350	0.071	$882	
40		$12,350	$10,000	$22,350	0.067	$825	$668
41		$12,350		$12,350	0.062	$771	
42		$12,350		$12,350	0.058	$720	
43		$12,350		$12,350	0.055	$673	
44		$12,350		$12,350	0.051	$629	
45		$12,350	$10,000	$22,350	0.048	$588	$476
46		$12,350		$12,350	0.044	$550	
47		$12,350		$12,350	0.042	$514	
48		$12,350		$12,350	0.039	$480	
49		$12,350		$12,350	0.036	$449	
50		$12,350	$10,000	$22,350	0.034	$419	$339
Totals	$1,776,804	$848,675	$114,000	$2,739,479		$348,420	$33,980

Total Net Present Worth $2,159,205

$2.2 million

Table 33. Cost Estimate Summary for DMC Study Area

Capital Costs for DMC Study Area

Description	Quantity	Unit	Unit Cost	Total
1. Site Preparation and Management				
Equipment mobilization	1	LS		$5,000
Submittals and plans	1	LS		$8,740
Temporary facilities	1	LS		$5,000
Erosion control measures	500	LF	$4.00	$2,000
Excavation support system	2,800	SF	$9.18	$25,704
Utility dismantling/replacement	1	LS		$50,000
2. Pre-Remedial Soil Sampling				
Drill rig	5	day	$1,500	$7,500
Sampling and analysis		LS		$30,500
Field equipment		LS		$2,500
Surveying		LS		$5,000
Data evaluation	75	HR	$75	$5,625
3. Excavate and Backfill				
Excavate soil	5,100	CY	$5	$25,500
Dust control and air monitoring	1	EA		$10,000
Post-remedial sampling	15	EA	$550	$8,250
Furnish clean fill	6,120	CY	$24	$146,880
4. Soil Disposal (RCRA listed soil)	7650	ton	$225	$1,721,250
Subtotal				$2,059,449
Contingency Allowances (30%)				$617,835
Project Management				$72,318
Remedial Design				$86,782
Construction Management				$86,782
Institutional Controls				$15,000
Total Capital Cost				**$2,938,166**

Operation and Maintenance Cost for DMC Study Area

Description	Quantity	Unit	Unit Cost	Total
Site Monitoring				
Groundwater sample collection	1	event	$6,500	$6,500
Contingency Allowances (30%)				$1,950
Technical Support				$3,575
Project Management				$975
Total Annual O&M Cost				**$13,000**

Periodic Costs for DMC Study Area

Description	Quantity	Unit	Unit Cost	Total
Five year review (Year 5, 10,...50)	10	EA	$10,000	$100,000
Update Institutional Controls Plan (Year 5)	1	EA	$4,000	$4,000
Remedial Action Report (Year 10)	1	EA	$10,000	$10,000
Total Periodic Costs				**$114,000**

Notes

1. Cost estimates may be refined when the remedy is designed and implemented and are within +50 to -30% accuracy expectation.
2. Abbreviations
   LS = lump sum; HR = hour; EA = each; CY = cubic yard; SF = square foot

Table 34. Summary of Present Worth Analysis - DMC Study Area

Year	Capital Cost	Annual O&M Cost	Periodic Cost	Total Cost	Discount Factor (7%)	Present Worth of O&M Cost	Present Worth of Periodic Cost
0	$2,938,166			$2,938,166			
1		$13,000		13000	0.935	$12,155	
2		$13,000		13000	0.873	$11,349	
3		$13,000		13000	0.816	$10,608	
4		$13,000		13000	0.763	$9,919	
5		$13,000	$24,000	$37,000	0.713	$9,269	$17,112
6		$13,000		13,000	0.666	$8,658	
7		$13,000		13,000	0.623	$8,099	
8		$13,000		13,000	0.582	$7,566	
9		$13,000		13,000	0.544	$7,072	
10		$13,000	$10,000	$23,000	0.508	$6,604	$5,080
11		$13,000		$13,000	0.475	$6,175	
12		$13,000		$13,000	0.444	$5,772	
13		$13,000		$13,000	0.415	$5,395	
14		$13,000		$13,000	0.388	$5,044	
15		$13,000	$10,000	$23,000	0.362	$4,706	$3,620
16		$13,000		$13,000	0.339	$4,407	
17		$13,000		$13,000	0.317	$4,121	
18		$13,000		$13,000	0.296	$3,848	
19		$13,000		$13,000	0.277	$3,601	
20		$13,000	$10,000	$23,000	0.258	$3,354	$2,580
21		$13,000		$13,000	0.242	$3,146	
22		$13,000		$13,000	0.226	$2,938	
23		$13,000		$13,000	0.211	$2,743	
24		$13,000		$13,000	0.197	$2,561	
25		$13,000	$10,000	$23,000	0.184	$2,392	$1,840
26		$13,000		$13,000	0.172	$2,236	
27		$13,000		$13,000	0.161	$2,093	
28		$13,000		$13,000	0.150	$1,950	
29		$13,000		$13,000	0.141	$1,833	
30		$13,000	$10,000	$23,000	0.131	$1,703	$1,310
31		$13,000		$13,000	0.123	$1,599	
32		$13,000		$13,000	0.115	$1,495	
33		$13,000		$13,000	0.107	$1,391	
34		$13,000		$13,000	0.100	$1,300	
35		$13,000	$10,000	$23,000	0.0937	$1,218	$937
36		$13,000		$13,000	0.0875	$1,138	
37		$13,000		$13,000	0.0818	$1,063	
38		$13,000		$13,000	0.0765	$995	
39		$13,000		$13,000	0.0715	$930	
40		$13,000	$10,000	$23,000	0.0668	$868	$668
41		$13,000		$13,000	0.0624	$811	
42		$13,000		$13,000	0.0583	$758	
43		$13,000		$13,000	0.0545	$709	
44		$13,000		$13,000	0.0509	$662	
45		$13,000	$10,000	$23,000	0.0476	$619	$476
46		$13,000		$13,000	0.0445	$579	
47		$13,000		$13,000	0.0416	$541	
48		$13,000		$13,000	0.0389	$506	
49		$13,000		$13,000	0.0363	$472	
50		$13,000	$10,000	$23,000	0.0339	$441	$339
Totals	$2,938,166	$650,000	$114,000	$3,702,166		$179,409	$33,962

Total Net Present Worth $3,151,537

$3.2 million

Table 35. Cost Estimate Summary for Alternative Water Supply

Capital Costs for Alternative Water Supply

Description	Quantity	Unit	UNIT Unit Cost	TOTAL Total
1. Mobilization/Demobilization	1	LS		$20,000
2. Site Preparation				
Erosion and Sediment Control Systems	1	LS	$15,000	$15,000
Test Pits	26	EA	$250	$6,500
Rock Removal	1200	CY	$60	$72,000
3. Public Safety				
Maintenance & Protection of Traffic	1	LS	$100,000	$100,000
Uniform Police (State Road Work)	220	Day	$400	$88,000
4. Water Main Installation				
6" DIP Water Main	7900	LF	$63	$497,700
6" DIP Water Main-Extension from Middletown	7500	LF	$63	$472,500
Wedge Blowoff	3	EA	$1,000	$3,000
6" Gate Valve and box	54	EA	$1,150	$62,100
Dewatering	1	LS	$15,000	$15,000
Stream Crossing	3	EA	$12,000	$36,000
Copper water service connection (1" or 2")	85	EA	$844	$71,765
Water meter (1" or 2")	85	EA	$305	$25,925
Supply from property line to house (1" or 2")	6717	LF	$30	$201,510
Disinfection of water main	1	LS	$15,000	$15,000
Pressure and leakage tests	1	LS	$10,000	$10,000
5. Shut-down of former water systems				
Potable well abandonment	85	EA	$1,800	$153,000
Remove existing point of use systems	53	EA	$350	$18,550
6. Pavement/Sidewalk Repairs				
Sawcutting and Removal of Pavement		LS		$166,405
Temporary Paving		LS		$57,000
Permanent Paving		LS		$509,200
Driveway Repair/Replacement		LS		$23,220
Pavement Markings		LS		$5,400
Turf Establishment		LS		$248,000
Sidewalk Repairs		LS		$16,000
Subtotal				$2.908,775
Contingency Allowances (30%)				$872,632
Subtotal [Remedy Implementation]				$3,781,407
Project Management				$189,070
Remedial Design				$302,513
Construction Management				$226,884
Institutional Controls				$50,000
Total Capital Cost				**$4,549,874**

Table 35. Cost Estimate Summary for Alternative Water Supply

Annual Operation and Maintenance Cost for Alternative Water Supply

Description	Quantity	Unit	UNIT Unit Cost	TOTAL Total
1. System maintenance/replacement	50	Year	$75,628	$3,781,400
2. Labor (O&M, regulatory compliance, admin)	50	Year	$40,000	$2,000,000
Subtotal				$5,781,400
Technical Support (15%)				$867,210
Contingency Allowances (30%)				$1,734,420
Project Management (5%)				$289,070
Total O&M Cost				**$8,672,100**
Annual O&M Cost				**$173,442**

Periodic Costs for Alternative Water Supply

Description	Quantity	Unit	UNIT Unit Cost	Total
Five year review (Year 5,10...50)	10	EA	$5,000	$50,000
Update Institutional Controls Plan	1	EA	$4,000	$4,000
Remedial Action Report	1	EA	$10,000	$10,000
Total Periodic Cost				**$64,000**

Notes

1. Cost estimates may be refined when the remedy is designed and implemented and are within +50 to -30% accuracy expectation.
2. Abbreviations
   LS = lump sum; HR = hour; EA = each; CY = cubic yard; SF = square foot; LF = linear foot

Table 36. Summary of Present Worth Analysis - Alternative Water Supply

Year	Capital Cost	Annual O&M Cost	Periodic Cost	Discount Factor (7%)	Present Worth of O&M Cost	Present Worth of Periodic Cost
	$4,549,874					
1		$173,442		0.935	$162,168	
2		$173,442		0.873	$151,415	
3		$173,442		0.816	$141,529	
4		$173,442		0.763	$132,336	
5		$173,442	$9,000	0.713	$123,664	$6,417
6		$173,442		0.666	$115,512	
7		$173,442		0.623	$108,054	
8		$173,442		0.582	$100,943	
9		$173,442		0.544	$94,352	
10		$173,442	$5,000	0.508	$88,109	$2,540
11		$173,442		0.475	$82,385	
12		$173,442		0.444	$77,008	
13		$173,442		0.415	$71,978	
14		$173,442		0.388	$67,295	
15		$173,442	$5,000	0.362	$62,786	$1,810
16		$173,442		0.339	$58,797	
17		$173,442		0.317	$54,981	
18		$173,442		0.296	$51,339	
19		$173,442		0.277	$48,043	
20		$173,442	$5,000	0.258	$44,748	$1,290
21		$173,442		0.242	$41,973	
22		$173,442		0.226	$39,198	
23		$173,442		0.211	$36,596	
24		$173,442		0.197	$34,168	
25		$173,442	$5,000	0.184	$31,913	$920
26		$173,442		0.172	$29,832	
27		$173,442		0.161	$27,924	
28		$173,442		0.150	$26,016	
29		$173,442		0.141	$24,455	
30		$173,442	$5,000	0.131	$22,721	$655
31		$173,442		0.123	$21,333	
32		$173,442		0.115	$19,946	
33		$173,442		0.107	$18,558	
34		$173,442		0.100	$17,344	
35		$173,442	$5,000	0.0937	$16,252	$469
36		$173,442		0.0875	$15,176	
37		$173,442		0.0818	$14,188	
38		$173,442		0.0765	$13,268	
39		$173,442		0.0715	$12,401	
40		$173,442	$5,000	0.0668	$11,586	$334
41		$173,442		0.0624	$10,823	
42		$173,442		0.0583	$10,112	
43		$173,442		0.0545	$9,453	
44		$173,442		0.0509	$8,828	
45		$173,442	$5,000	0.0476	$8,256	$238
46		$173,442		0.0445	$7,718	
47		$173,442		0.0416	$7,215	
48		$173,442		0.0389	$6,747	
49		$173,442		0.0363	$6,296	
50		$173,442	$15,000	0.0339	$5,880	$509
Totals	$4,549,874	$8,672,100	$64,000		$2,393,621	$15,181

Total Net Present Worth — $6,958,676 — **$7.0 million**

Table 37. Cost Estimate Summary for Site-wide Groundwater Study Area

Capital Costs for Site-wide Groundwater Study Area Monitoring

Description	Quantity	Unit	UNIT Unit Cost	Total
1. Mobilization/Demobilization	1	LS	$5,000	$5,000
2. Installation of bedrock well	8	EA	$8,000	$64,000
3. Well Development	8	EA	$2,000	$16,000
Subtotal				$85,000
Contingency Allowances (30%)				$25,500
SUBTOTAL [Remedy Implementation]				$110,500
Project Management (8%)				$8,840
Construction Management (10%)				$11,050
Institutional Controls				$5,000
Total Capital Cost				**$135,390**

Operation and Maintenance Cost for Site-wide Groundwater Study Area Monitoring

Description	Quantity	Unit	Unit Cost	Total
Groundwater Sampling				
Equipment and Labor to Collect	12	event	$8,420	$101,040
Sample Analysis	12	event	$13,600	$163,200
Subtotal				$264,240
Technical Support (15%)				$39,636
Contingency Allowances (30%)				$79,272
Project Management (5%)				$13,212
Total O&M Cost				**$396,360**
total Annual O&M Cost				**$39,636**

Periodic Costs for Site-wide Groundwater Study Area Monitoring

Description	Quantity	Unit	UNIT Unit Cost	Total
Five year review (Years 5 - 10)	2	EA	$10,000	$20,000
Update Institutional Controls Plan	1	EA	$4,000	$4,000
Remedial Action Report (Year 10)	1	EA	$10,000	$10,000
Total Periodic Cost				**$34,000**

Notes

1. Cost estimates may be refined when the remedy is designed and implemented and are within +50 to -30% accuracy expectation.
2. Abbreviations
   LS = lump sum; HR = hour; EA = each; CY = cubic yard; SF = square foot; LF = linear foot

Table 38. Summary of Present Worth Analysis - Site-wide Groundwater Study Area

Year	Capital Cost	Annual O&M Cost	Periodic Cost	Discount Factor (7%)	Present Worth of O&M Cost	Present Worth of Periodic Cost
0	$135,390					
1		$39,636		0.935	$37,043	
2		$39,636		0.873	$34,620	
3		$39,636		0.816	$32,355	
4		$39,636		0.763	$30,238	
5		$39,636	$14,000	0.713	$28,260	$9,982
6		$39,636		0.666	$26,411	
7		$39,636		0.623	$24,683	
8		$39,636		0.582	$23,069	
9		$39,636		0.544	$21,559	
10		$39,636	$20,000	0.508	$20,149	$10,167
Totals	$135,390	$396,360	$34,000		**$278,387**	$20,149

Total Present Worth Cost	$433,925
	$434,000

Table 39. Cost Estimate Summary for Sitewide Groundwater Study Area
Contingency Remedy for Hydraulic Containment by Groundwater Extraction

Capital Costs for Source Zone Hydraulic Containment

Description	*Quantity*	*Unit*	**UNIT** *Unit Cost*	**TOTAL** *Total*
1. Mobilization/Demobilization	1	LS	$10,000	$10,000
2. Site Preparation				
Submitals	1	LS	$16,600	$16,600
Erosion and Sediment Control Systems	1	LS	$1,000	$1,000
Rock Removal	333	CY	$60	$19,980
3. Public Safety				
Maintenance & Protection of Traffic	1	LS	$30,000	$30,000
Uniform Police (State Road Work)	30	Day	$400	$12,000
4. Pre-Remedial Study				
Drill Rig	1	LS	$25,000	$25,000
Sampling and Analysis	1	LS	$39,100	$39,100
Pump Test	1	LS	$5,000	$5,000
Surveying	1	LS	$7,500	$7,500
Data Evaluation	150	HR	$75	$11,250
5. Treatability Study				
Work Plan	125	LS	$100	$12,500
Equipment Mobilization	1	LS	$27,000	$27,000
Sampling and Analysis	1	LS	$71,250	$71,250
Data Evaluation	300	HR	$100	$30,000
6. Groundwater Extraction System				
Extraction Well Drilling	7	EA	$11,000	$77,000
Well Pumps Installation	7	EA	$3,000	$21,000
Well Development	7	EA	$2,000	$14,000
7. Groundwater Treatment System				
Building Preparation and Construction	1	LS	$375,950	$375,950
Dewatering Allowance	1	LS	$15,000	$15,000
Treatment Equipment and Instrumentation	1	LS	$510,300	$510,300
Piping from extraction to treatment & to discharge	1	LS	$135,000	$135,000
Initial Start-up	1	LS	$19,330	$19,330
8. Groundwater Monitoring Wells	6	EA	$21,000	$126,000
9. Pavement/Sidewalk Repairs				
Sawcutting and Removal of Pavement	1	LS	$46,900	$46,900
Local Road Pavement Repair	1	LS	$54,800	$54,800
State Road Pavement Repair	1	LS	$34,250	$34,250
Replace Concrete Pavement with Bituminous	1	LS	$18,900	$18,900
Driveway Repair/Replacement	1	LS	$3,450	$3,450
Pavement Markings	1	LS	$3,000.00	$3,000
Turf Establishment	1	LS	$5,000	$5,000
Stream Crossing	1	EA	$12,000	$12,000
Sidewalk Repairs	1	LS	$1,440.00	$1,440
Subtotal				$1,791,500
Contingency Allowances (30%)				$537,450
Subtotal [Remedy Implementation]				$2,328,950
Project Management				$139,737
Remedial Design				$279,474
Construction Management				$186,316
Institutional Controls				$10,000
Total Capital Cost				**$2,944,477**

Table 39. Cost Estimate Summary for Sitewide Groundwater Study Area
Contingency Remedy for Hydraulic Containment by Groundwater Extraction

Annual Operation and Maintenance Cost for Alternative Water Supply

Description	Quantity	Unit	UNIT Unit Cost	TOTAL Total
1. Treatment and Building	50	Year	$128,779	$6,438,950
2. Sludge Handling	50	Year	$43,750	$2,187,500
3. Chemical	50	Year	$19,054	$952,700
4. Sampling and Analysis	50	Year	$51,600	$2,580,000
5. Extraction System	50	Year	$23,000	$1,150,000
Subtotal				$13,309,150
Technical Support (15%)				$1,996,373
Contingency Allowances (30%)				$3,992,745
Project Management (5%)				$665,458
Total O&M Cost				**$19,963,725**
Annual O&M Cost				**$399,275**

Periodic Costs for Alternative Water Supply

Description	Quantity	Unit	UNIT Unit Cost	Total
Five year review (Year 5,10...100)	20	EA	$10,000	$200,000
Update Institutional Controls Plan	1	EA	$4,000	$4,000
Remedial Action Report	3	EA	$10,000	$30,000
Total Periodic Cost				**$234,000**

Notes
1. Cost estimates may be refined when the remedy is designed and implemented and are within +50 to -30% accuracy expectation.
2. Abbreviations
   LS = lump sum; HR = hour; EA = each; CY = cubic yard; SF = square foot; LF = linear foot

Table 40. Summary of Present Worth Analysis - Sitewide Groundwater Contingency Remedy for Hydraulic Containment by Groundwater Extraction

Year	Capital Cost	Annual O&M Cost	Periodic Cost	Discount Factor (7%)	Present Worth of O&M Cost	Present Worth of Periodic Cost
	$2,944,477					
1		$399,275		0.935	$373,154	
2		$399,275		0.873	$348,742	
3		$399,275		0.816	$325,927	
4		$399,275		0.763	$304,605	
5		$399,275	$14,000	0.713	$284,677	$9,982
6		$399,275		0.666	$266,053	
7		$399,275		0.623	$248,648	
8		$399,275		0.582	$232,381	
9		$399,275		0.544	$217,179	
10		$399,275	$10,000	0.508	$202,971	$5,083
11		$399,275		0.475	$189,692	
12		$399,275		0.444	$177,283	
13		$399,275		0.415	$165,685	
14		$399,275		0.388	$154,846	
15		$399,275	$10,000	0.362	$144,715	$3,624
16		$399,275		0.339	$135,248	
17		$399,275		0.317	$126,400	
18		$399,275		0.296	$118,131	
19		$399,275		0.277	$110,403	
20		$399,275	$20,000	0.258	$103,180	$5,168
21		$399,275		0.242	$96,430	
22		$399,275		0.226	$90,122	
23		$399,275		0.211	$84,226	
24		$399,275		0.197	$78,716	
25		$399,275	$10,000	0.184	$73,566	$1,842
26		$399,275		0.172	$68,753	
27		$399,275		0.161	$64,255	
28		$399,275		0.150	$60,052	
29		$399,275		0.141	$56,123	
30		$399,275	$10,000	0.131	$52,452	$1,314
31		$399,275		0.123	$49,020	
32		$399,275		0.115	$45,813	
33		$399,275		0.107	$42,816	
34		$399,275		0.100	$40,015	
35		$399,275	$10,000	0.094	$37,397	$937
36		$399,275		0.088	$34,951	
37		$399,275		0.082	$32,664	
38		$399,275		0.076	$30,527	
39		$399,275		0.071	$28,530	
40		$399,275	$10,000	0.067	$26,664	$668
41		$399,275		0.062	$24,919	
42		$399,275		0.058	$23,289	
43		$399,275		0.055	$21,766	
44		$399,275		0.051	$20,342	
45		$399,275	$10,000	0.048	$19,011	$476
46		$399,275		0.044	$17,767	
47		$399,275		0.042	$16,605	
48		$399,275		0.039	$15,519	
49		$399,275		0.036	$14,503	
50		$399,275	$20,000	0.034	$13,554	$679

Table 40. Summary of Present Worth Analysis - Sitewide Groundwater Contingency Remedy for Hydraulic Containment by Groundwater Extraction

Year	Capital Cost	Annual O&M Cost	Periodic Cost	Discount Factor (7%)	Present Worth of O&M Cost	Present Worth of Periodic Cost
51		$399,275		0.032	$12,668	
52		$399,275		0.030	$11,839	
53		$399,275		0.028	$11,064	
54		$399,275		0.026	$10,341	
55		$399,275	$10,000	0.024	$9,664	$242
56		$399,275		0.023	$9,032	
57		$399,275		0.021	$8,441	
58		$399,275		0.020	$7,889	
59		$399,275		0.018	$7,373	
60		$399,275	$10,000	0.017	$6,890	$173
61		$399,275		0.016	$6,440	
62		$399,275		0.015	$6,018	
63		$399,275		0.014	$5,625	
64		$399,275		0.013	$5,257	
65		$399,275	$10,000	0.012	$4,913	$123
66		$399,275		0.011	$4,591	
67		$399,275		0.011	$4,291	
68		$399,275		0.010	$4,010	
69		$399,275		0.0094	$3,748	
70		$399,275	$10,000	0.0088	$3,503	$88
71		$399,275		0.0082	$3,274	
72		$399,275		0.0077	$3,059	
73		$399,275		0.0072	$2,859	
74		$399,275		0.0067	$2,672	
75		$399,275	$10,000	0.0063	$2,497	$63
76		$399,275		0.0058	$2,334	
77		$399,275		0.0055	$2,181	
78		$399,275		0.0051	$2,039	
79		$399,275		0.0048	$1,905	
80		$399,275	$10,000	0.0045	$1,781	$45
81		$399,275		0.0042	$1,664	
82		$399,275		0.0039	$1,555	
83		$399,275		0.0036	$1,454	
84		$399,275		0.0034	$1,358	
85		$399,275	$10,000	0.0032	$1,270	$32
86		$399,275		0.0030	$1,186	
87		$399,275		0.0028	$1,109	
88		$399,275		0.0026	$1,036	
89		$399,275		0.0024	$969	
90		$399,275	$10,000	0.0023	$905	$23
91		$399,275		0.0021	$846	
92		$399,275		0.0020	$791	
93		$399,275		0.0019	$739	
94		$399,275		0.0017	$691	
95		$399,275	$10,000	0.0016	$645	$16
96		$399,275		0.0015	$603	
97		$399,275		0.0014	$564	
98		$399,275		0.0013	$527	
99		$399,275		0.0012	$492	
100		$399,275	$20,000	0.0012	$460	$23
Totals	$2,944,477	$39,927,450	$234,000		$5,697,348	$30,600

Total Net Present Worth $8,672,425

$8.7 million

Table 41. Cleanup Levels for the MMC Study Area				
Carcinogenic Chemical of Concern	Cancer Classification	Interim Soil Cleanup Level (ug/kg)	Basis	RME Risk
Surface Soil				
Tetrachloroethene	B2	100	CT RSR (GA/GAA PMC)	4E-08
Trichloroethene	C-B2	100	CT RSR (GA/GAA PMC)	3E-08
Benzo(a)anthracene	B2	1000	CT RSR (RES DEC, GA/GAA PMC)	7E-07
Benzo(a)pyrene	B2	1000	CT RSR (RES & I/C DEC)	7E-06
Benzo(b)fluoranthene	B2	1000	CT RSR (RES DEC, GA/GAA PMC)	7E-07
Benzo(k)fluoranthene	B2	1000	CT RSR (GA/GAA PMC)	7E-08
Chrysene	B2	1000	CT RSR (GA/GAA PMC)	7E-09
Dibenz(a,h)anthracene	B2	1000	CT RSR (RES & I/C DEC)	7E-06
Indeno(1,2,3-cd)pyrene	B2	1000	CT RSR (RES DEC, GA/GAA PMC)	7E-07
Arsenic	A	10000	CT RSR (RES DEC)	1E-05
Subsurface Soil				
Trichloroethene	C-B2	100	CT RSR (GA/GAA PMC)	3E-08
Carcinogenic Chemical of Concern	**Cancer Classification**	**Interim Soil Vapor Cleanup Level (ug/m^3)**	**Basis**	**RME Risk**
Soil Vapor				
Trichloroethene	C-B2	752	CT RSR (proposed RES VC)	9E-07

Table 41. Cleanup Levels for the MMC Study Area				
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Interim Soil Cleanup Level (ug/kg)**	**Basis**	**RME Hazard Quotient**
Surface Soil				
Tetrachloroethene	Liver	100	CT RSR (GA/GAA PMC)	0.00005
Trichloroethene	Liver	100	CT RSR (GA/GAA PMC)	0.002
Acenaphthylene	General Toxicity	8400	CT RSR (GA/GAA PMC)	0.003
Benzo(g,h,i)perylene	General Toxicity	4200	CT RSR (GA/GAA PMC)	0.002
Fluoranthene	Blood/Liver/Kidney	5600	CT RSR (GA/GAA PMC)	0.001
Phenanthrene	General Toxicity	4000	CT RSR (GA/GAA PMC)	0.001
Pyrene	Kidney	4000	CT RSR (GA/GAA PMC)	0.001
Arsenic	Skin	1000	CT RSR (RES DEC)	0.2
Chromium	GI System	100000	CT RSR (RES and I/C DEC)	0.2
Mercury	CNS	20000	CT RSR (RES DEC)	1
Subsurface Soil				
1,2,4-Trimethylbenzene	General Toxicity/Liver/Kidney	7000	CT RSR (GA/GAA PMC)	0.0008
Trichloroethene	Liver	100	CT RSR (GA/GAA PMC)	0.002
Xylene (total)	General Toxicity	19500	CT RSR (GA/GAA PMC)	0.0005
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Interim Soil Vapor Cleanup Level (ug/m^3)**	**Basis**	**RME Hazard Quotient**
Soil Vapor				
Trichloroethene	Liver/CNS	752	CT RSR (proposed RES VC)	0.0005

Key

CT RSR - Connecticut Remediation Standard Regulations

GA/GAA PMC - Pollutant Mobility Criteria for Class GA/GAA groundwater

RES DEC - Residential Direct Exposure Criteria

I/C DEC - Industrial/Commercial Direct Exposure Criteria

RES VC - Residential Volatilization Criteria

Table 42. Interim Cleanup Levels for the DMC Study Area				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Interim Cleanup Level (ug/L)**	**Basis**	**RME Risk**
Shallow Groundwater				
Tetrachloroethene	B2	5	CT RSR (GA/GAA GWPC)	3E-08
Trichloroethene	C-B2	5	CT RSR (GA/GAA GWPC)	6E-09
Vinyl Chloride	A	1.6	CT RSR (proposed GWVC)	1E-09
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Interim Cleanup Level (ug/L)**	**Basis**	**RME Hazard Quotient**
Shallow Groundwater				
1,1,1-Trichloroethane	Liver	200	CT RSR (GA/GAA GWPC)	0.00002
Ethylbenzene	Liver/Kidney	700	CT RSR (GA/GAA GWPC)	0.0005
Tetrachloroethene	Liver	5	CT RSR (GA/GAA GWPC)	0.00004
Toluene	Liver/Kidney	1000	CT RSR (GA/GAA GWPC)	0.0002
Trichloroethene	Liver	5	CT RSR (GA/GAA GWPC)	0.003
Vinyl Chloride	Liver	1.6	CT RSR (proposed GWVC)	0.00004
Xylene	General Toxicity	530	CT RSR (GA/GAA GWPC)	0.002

Key

CT RSR - Connecticut Remediation Standard Regulations

GA/GAA GWPC - Groundwater Protection Criteria for Class GA/GAA groundwater

HH RBG - Human health risk-based goal

HQ - Hazard Quotient

ILCR - Incremental Lifetime Cancer Risk

MCL - Safe Drinking Water Act Maximum Contaminant Level

RES GWVC - Residential Volatilization Criteria

SWPC - Surface Water Protection Criteria

Table 43. Interim Cleanup Levels for the Site-wide Groundwater Study Area				
Carcinogenic Chemical of Concern	Cancer Classification	Interim Cleanup Level (ug/L)	Basis	RME Risk
Bedrock Groundwater				
1,2-Dichloroethane	B2	1	CT RSR (GA/GAA GWPC)	2E-06
Benzene	A	1	CT RSR (GA/GAA GWPC)	1E-06
Methylene Chloride	B2	5	MCL and CT RSR (GA/GAA GWPC)	7E-07
Tetrachloroethene	B2	5	MCL and CT RSR (GA/GAA GWPC)	5E-05
Trichloroethene	C-B2	5	MCL and CT RSR (GA/GAA GWPC)	4E-05
Vinyl Chloride	A	1.6	CT RSR (proposed GWVC)	1E-04
1,4-Dioxane	B2	5.2	HH RBG (ILCR=10-6)	1E-06
Benzo(a)anthracene	B2	0.06	CT RSR (GA/GAA GWPC)	8E-07
Benzo(a)pyrene	B2	0.2	MCL and CT RSR (GA/GAA GWPC)	3E-05
Benzo(b)fluoranthene	B2	0.078	HH RBG (ILCR=10-6)	1E-06
Benzo(k)fluoranthene	B2	0.3	CT RSR (SWPC)	4E-07
Bis(2-ethylhexyl)phthalate	B2	2	CT RSR (GA/GAA GWPC)	5E-07
Dibenz(a,h)anthracene	B2	0.0078	HH RBG (ILCR=10-6)	1E-06
Indeno(1,2,3-cd)pyrene	B2	0.078	HH RBG (ILCR=10-6)	1E-06
Pentachlorophenol	B2	1	MCL and CT RSR (GA/GAA GWPC)	2E-06
Arsenic	A	4	CT RSR (SWPC)	1E-04

Table 43. Interim Cleanup Levels for the Site-wide Groundwater Study Area				
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Interim Cleanup Level (ug/L)**	**Basis**	**RME Hazard Quotient**
Bedrock Groundwater				
1,1-Dichloroethane	Kidney	70	CT RSR (GA/GAA GWPC)	0.07
1,1-Dichloroethene	Liver	1	CT RSR (RES GWVC)	0.002
1,2-Dichloroethane	Kidney	1	CT RSR (GA/GAA GWPC)	0.005
1,2-Dichloroethene (total)	Blood	104	HH RBG (HQ=1)	1
Benzene	Immune System	1	CT RSR (GA/GAA GWPC)	0.02
cis-1,2-Dichloroethene	Blood	70	CT RSR (GA/GAA GWPC)	0.7
Methylene Chloride	Liver	5	MCL and CT RSR (GA/GAA GWPC)	0.008
Tetrachloroethene	Liver	5	MCL and CT RSR (GA/GAA GWPC)	0.05
Trichloroethene	Liver	5	MCL and CT RSR (GA/GAA GWPC)	2
Vinyl Chloride	Liver	1.6	CT RSR (proposed GWVC)	0.05
Bis(2-ethylhexyl)phthalate	Liver	2	CT RSR (GA/GAA GWPC)	0.01
Pentachlorophenol	Liver/Kidney	1	MCL and CT RSR (GA/GAA GWPC)	0.003
Phenanthrene	*General Toxicity*	0.077	CT RSR (SWPC)	*0.0004*
Arsenic	Skin	4	CT RSR (SWPC)	1
Mercury	CNS	0.4	CT RSR (SWPC)	0.4
Vanadium	Kidney	10	HH RBG (HQ = 1)	1
Zinc	Blood	123	CT RSR (SWPC)	0.04

Key

CT RSR - Connecticut Remediation Standard Regulations

GA/GAA GWPC - Groundwater Protection Criteria for Class GA/GAA groundwater

HH RBG - Human health risk-based goal

HQ - Hazard Quotient

ILCR - Incremental Lifetime Cancer Risk

MCL - Safe Drinking Water Act Maximum Contaminant Level

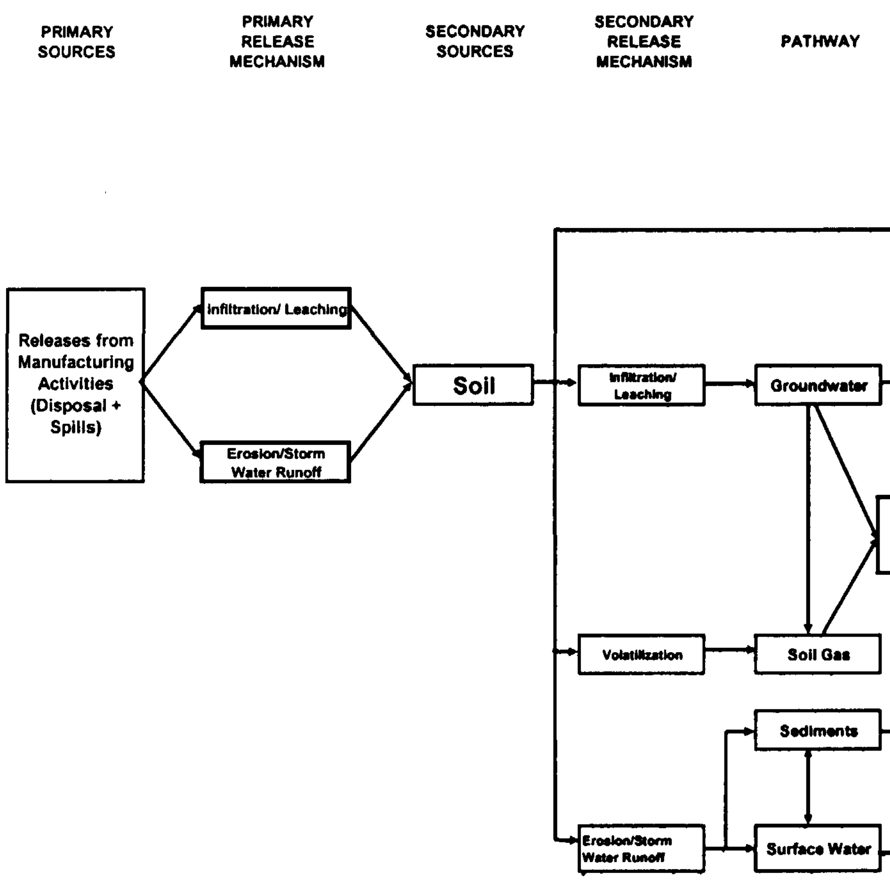
RES GWVC - Residential Volatilization Criteria

SWPC - Surface Water Protection Criteria

Appendix B
Figures

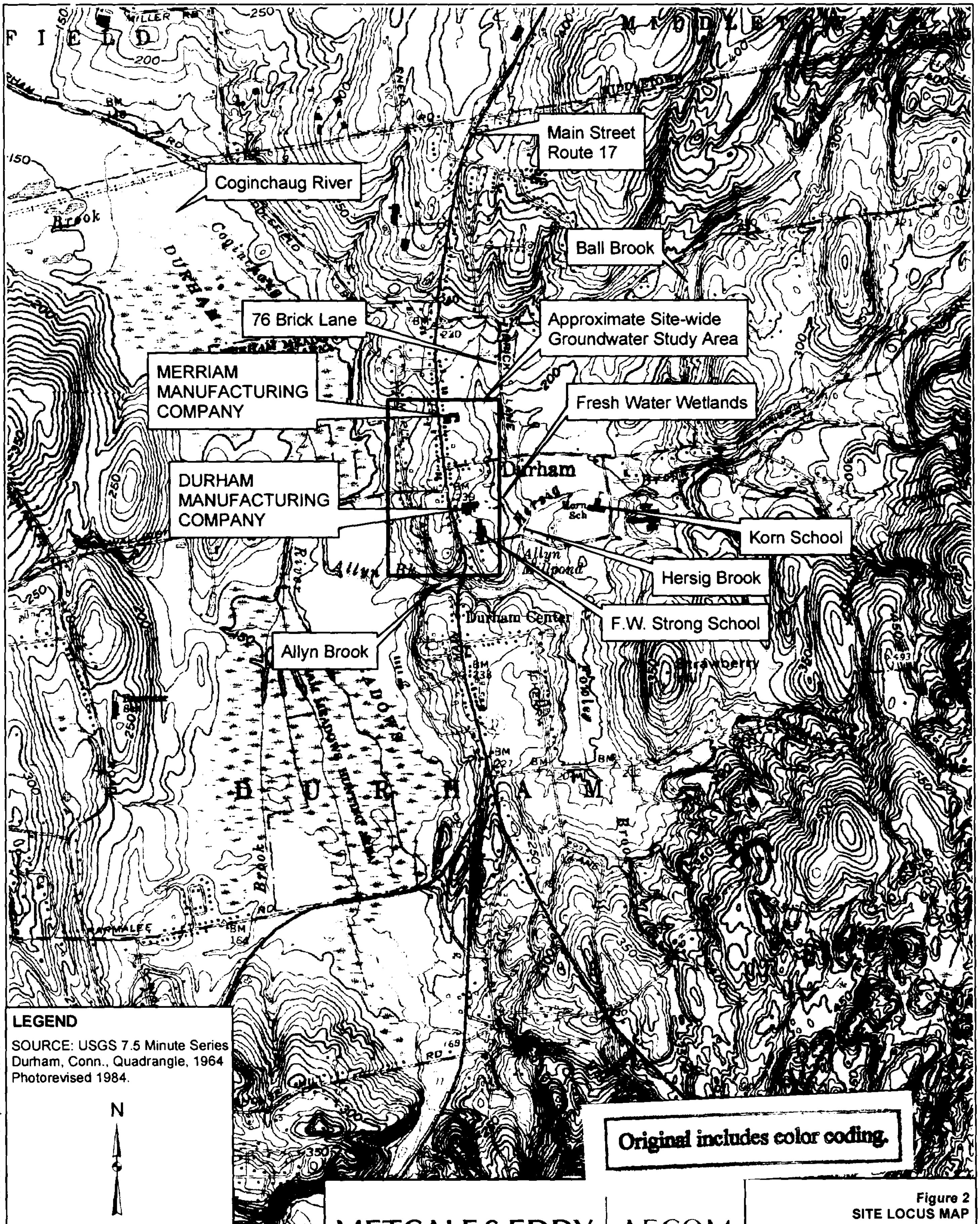
List of Figures:

Figure 1. Conceptual Site Model



RECEPTOR

Pathway	EXPOSURE ROUTE	HUMAN: Trespasser	HUMAN: Resident	HUMAN: Commercial Worker	HUMAN: Construction Worker	HUMAN: Recreational User	BIOTA: Terrestrial	BIOTA: Aquatic
Soil	Ingestion	●	●	●	●		●	
Soil	Inhalation				●			
Soil	Dermal Contact	●	●	●	●		●	
Groundwater	Ingestion		●	●				
Groundwater	Inhalation		●					
Groundwater	Dermal Contact		●	●	●			
Indoor Air	Inhalation		●	●				
Outdoor Air	Inhalation				●			
Sediments	Ingestion					●		●
Sediments	Dermal Contact					●		●
Surface Water	Ingestion						●	●
Surface Water	Dermal Contact					●		●



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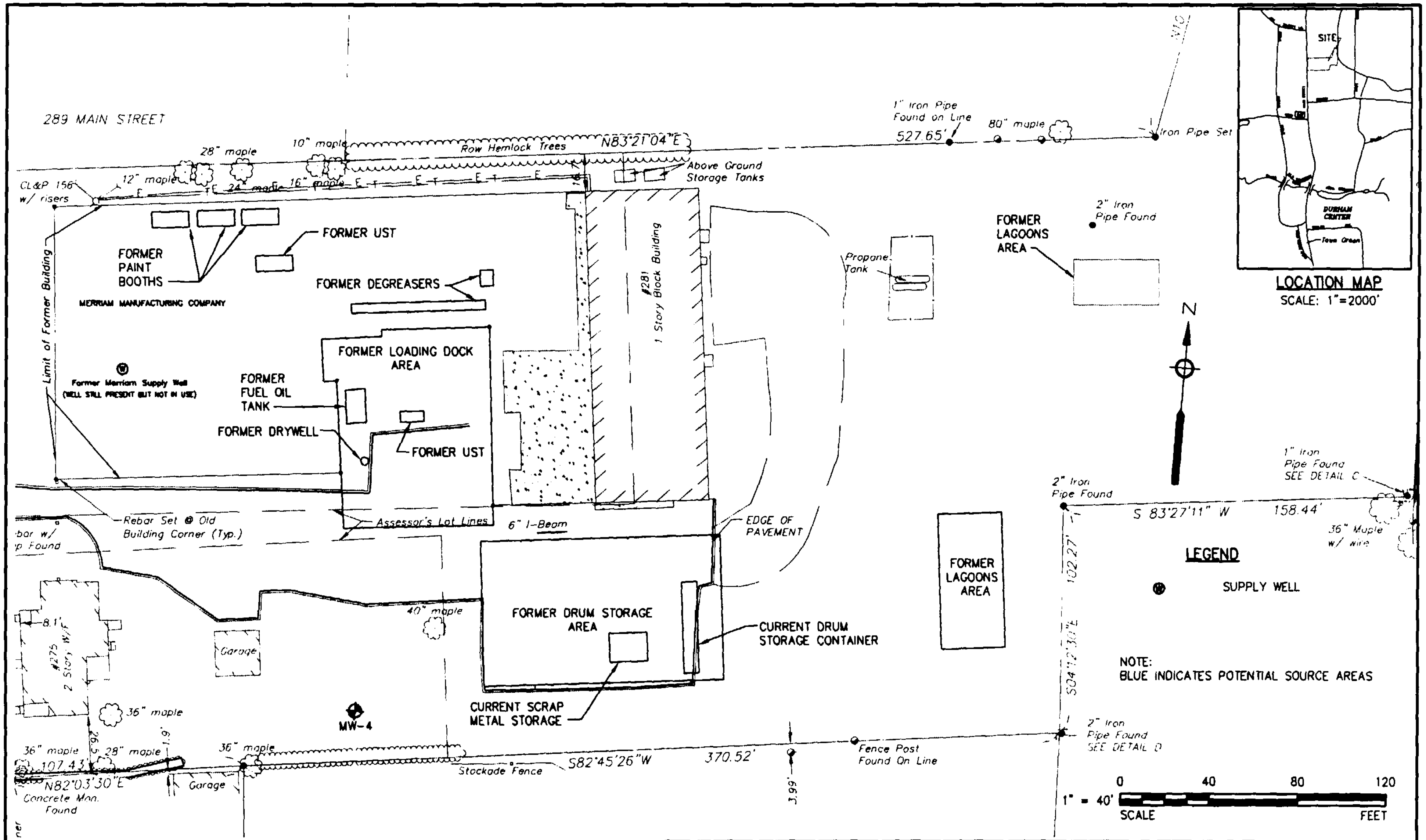
METCALF & EDDY | AECOM

Figure 2
SITE LOCUS MAP

Durham Meadows Superfund Site
Durham, Connecticut



METCALF & EDDY | AECOM

FIGURE 3
SITE PLAN AND APPROXIMATE LOCATIONS OF FORMER SITE FEATURES
MMC STUDY AREA
DURHAM MEADOWS SUPERFUND SITE
DURHAM, CONNECTICUT

SCALE:	1"=40'	04-19-05	WPB

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ANSI B - 3-8-05

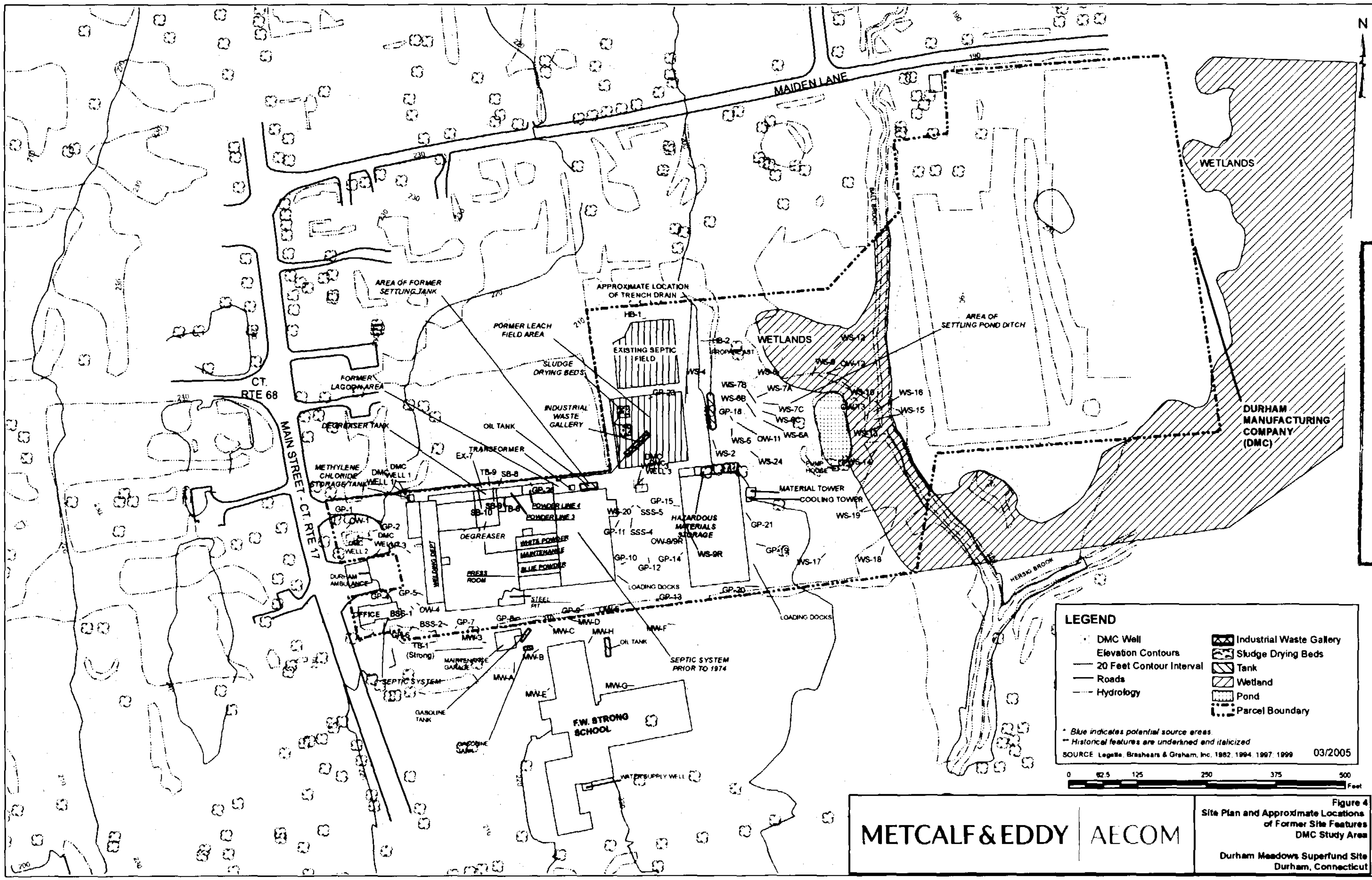
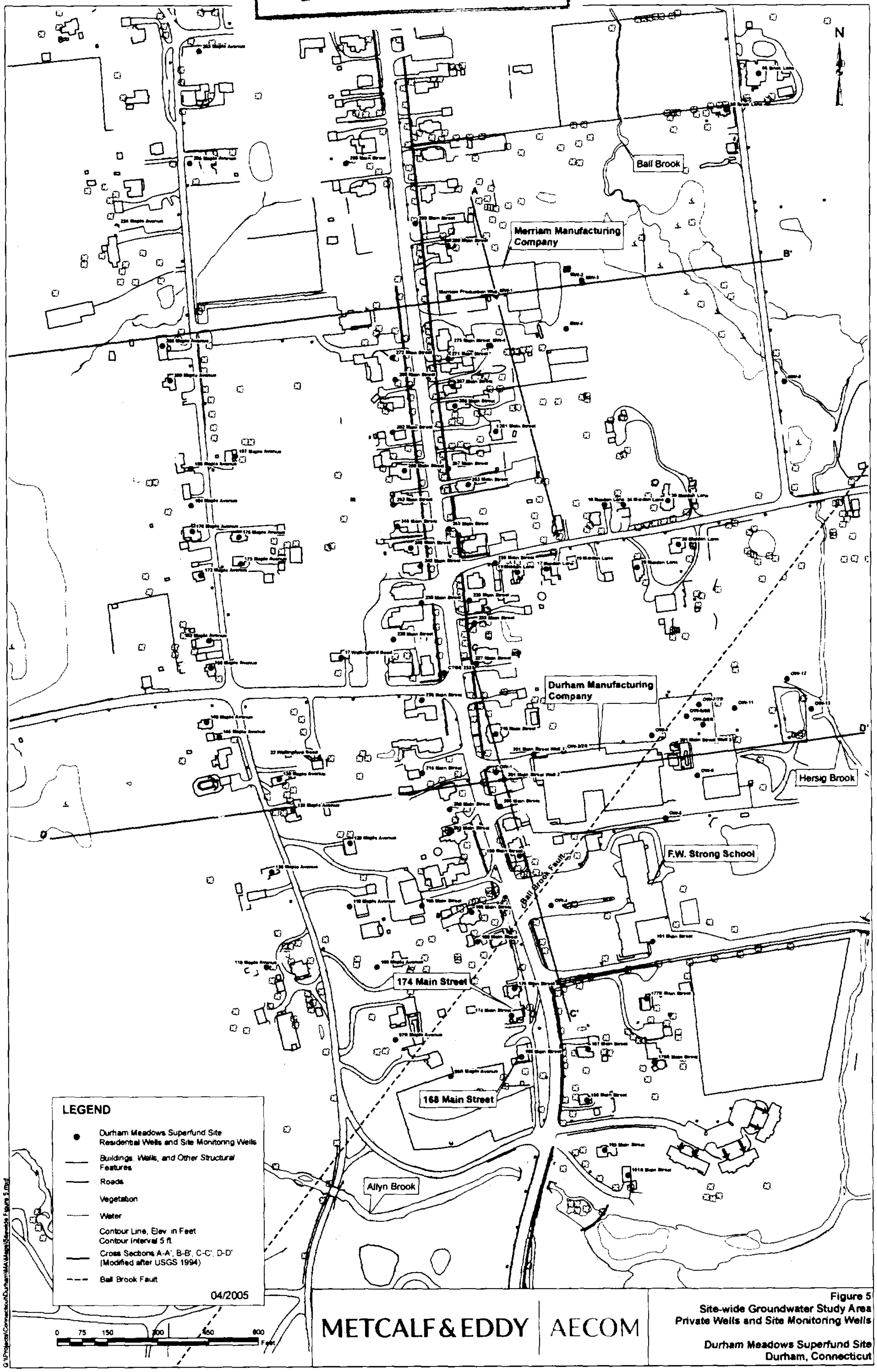


Figure 4
Site Plan and Approximate Locations of Former Site Features
DMC Study Area

Durham Meadows Superfund Site
Durham, Connecticut

Original includes color coding.

Original includes color coding.



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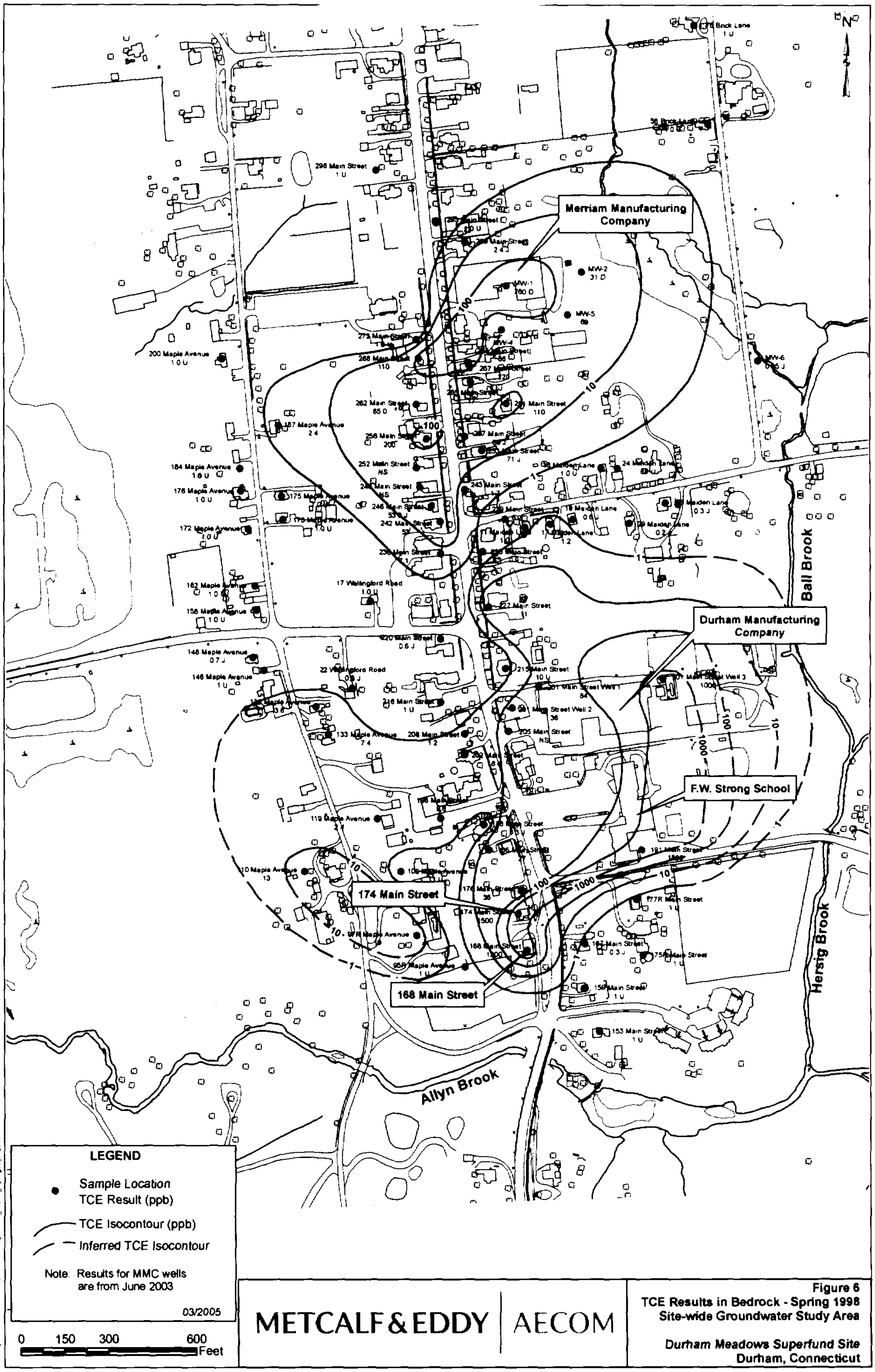

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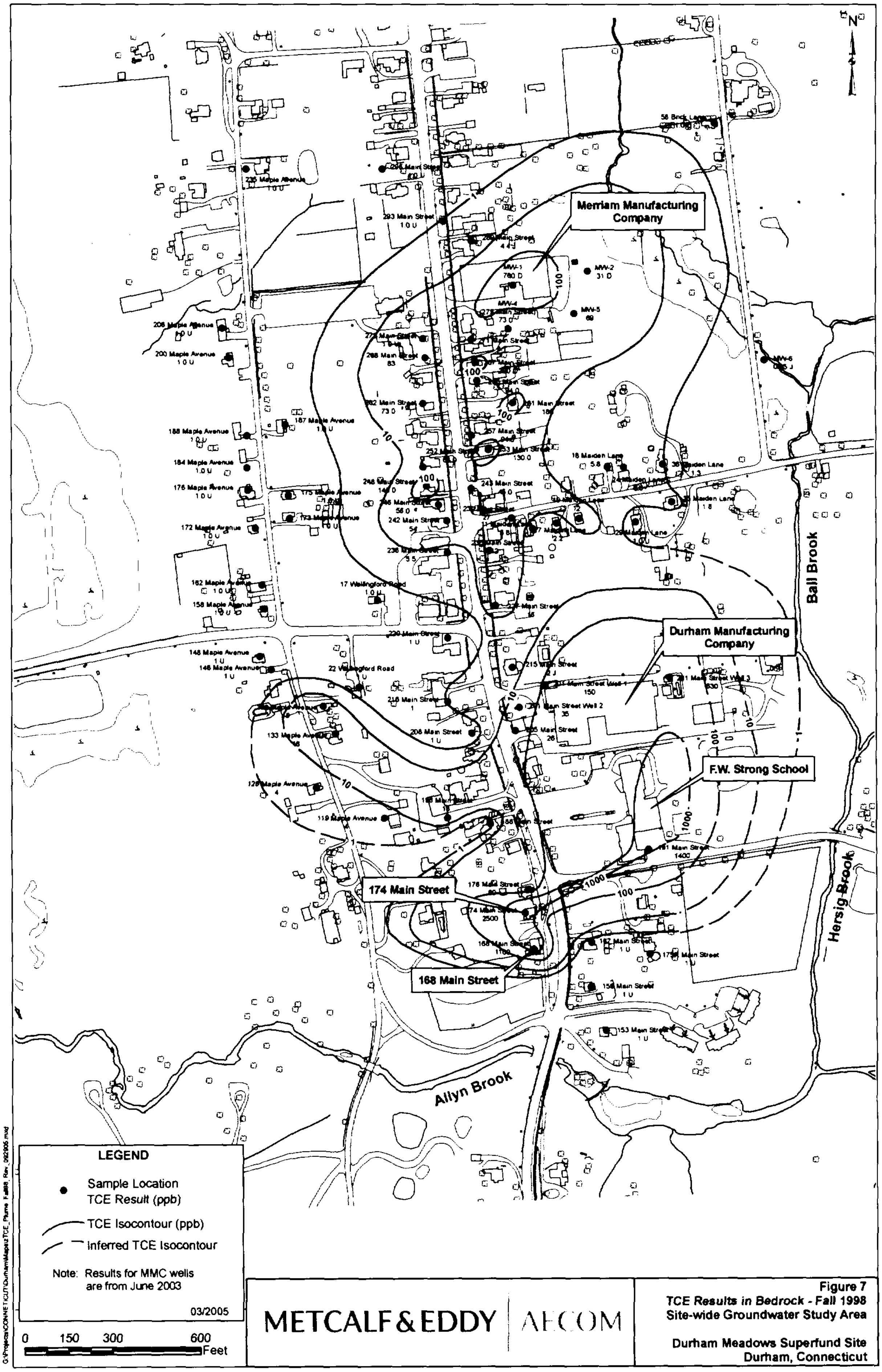

Figure 7
TCE Results in Bedrock - Fall 1998
Site-wide Groundwater Study Area

Durham Meadows Superfund Site
Durham, Connecticut

Original includes color coding.

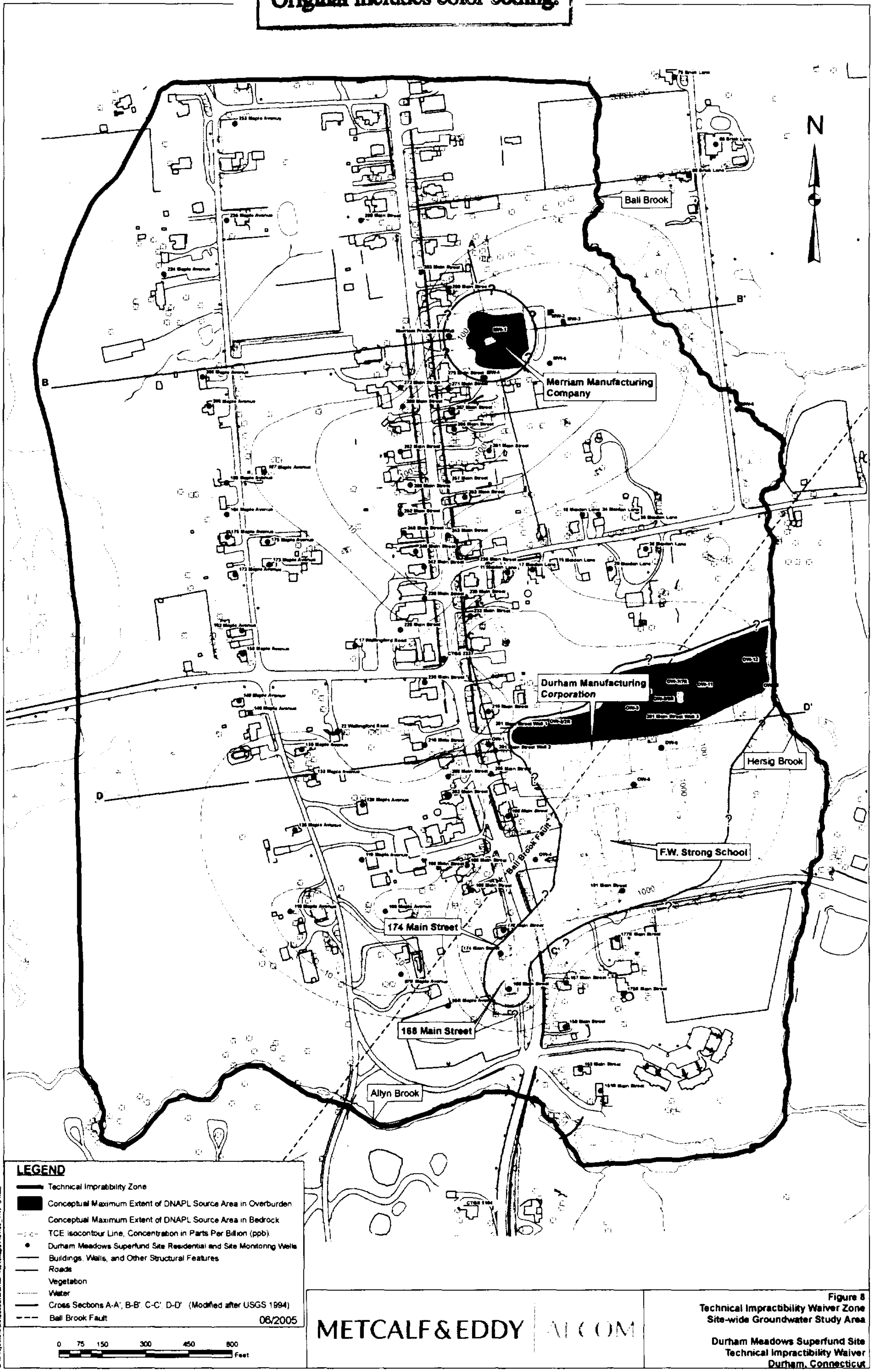

Figure 8
Technical Impractibility Waiver Zone
Site-wide Groundwater Study Area

Durham Meadows Superfund Site
Technical Impractibility Waiver
Durham, Connecticut

Appendix C
State of Connecticut Letter of Partial Concurrence

STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

79 ELM STREET · HARTFORD, CT 06106-5127

PHONE: 860-424-3001

Gina McCarthy
Commissioner

September 30, 2005

Ms. Susan Studlien
Director
Office of Site Remediation and Restoration
EPA New England
1 Congress Street, Suite 1100 (Mail Code HIO)
Boston MA 02114-2023

Subject: Letter of Partial Concurrence with Proposed Remedy for Durham Meadows NPL Site, Durham CT

Dear Ms. Studlien,

The Connecticut Department of Environmental Protection (DEP) has reviewed the remedy being selected by EPA for the Durham Meadows site in Southington, Connecticut. DEP concurs with most components of the selected remedy, but does not concur with the component of the remedy in which EPA is proposing to address the risk to public health posed by the volatile organic compounds in shallow ground water that may migrate into existing or future buildings overlying the ground water plume.

DEP concurs with the following components of the selected remedy which comply with State ARARS and which will fully protect public health and the environment:

- excavation and offsite disposal of contaminated soil, in conjunction with soil vapor extraction, at the Merriam Manufacturing Company (MMC) Study Area (including excavation of a localized area of contaminated surface soil from an adjacent residential property)
- excavation and off-site disposal of hot spot areas at the Durham Manufacturing Company (DMC)
- extension of the Middletown Water Distribution System to provide an alternative source of drinking water (public water) to all residences currently affected by groundwater contamination and also to a buffer zone of residences located near the contaminated area. Development of and connection to a water distribution system from a new groundwater source is retained as a contingency measure. Continuation of interim measures including monitoring and treatment (filtration) of impacted residential wells, and provision of bottled water, as needed are also included
- implementing monitoring of the dissolved groundwater plume to ensure the plume is not expanding beyond its current general boundary
- a contingency to implement a groundwater extraction system for hydraulic containment if the overall plume or source zone is spreading or migrating beyond its current boundary
- implementation of a Technical Impracticability Waiver of the applicable or relevant and appropriate requirements that would normally require cleanup of the groundwater to meet drinking water standards, since it is not technically practicable to clean up the groundwater to drinking water standards in a reasonable amount of time

- institutional controls, primarily in the form of Environmental Land Use Restrictions (ELURs) as defined in the CT RSRs, and/or by local ordinance, in a variety of areas to prevent unrestricted future use of certain areas of the Site or contaminated groundwater

Further, DEP supports the proposed collection of additional data to further delineate areas posing potential indoor air risks on and outside of both the Merriam Manufacturing Company and Durham Meadows Company Study Areas within the Durham Meadows Site. However, DEP does not concur with the vapor intrusion component of the remedy which proposes that actions will be taken to address potential indoor air risks (due to volatilization) if unacceptable risks are identified. DEP's position is that, since it has already been demonstrated that volatile organic compounds in the shallow groundwater plume at the Durham Meadows site pose risk outside EPA's acceptable risk range, Connecticut's Remediation Standard Regulations are applicable requirements (ARARs) over the full areal extent of the shallow groundwater plume (regardless of parcel boundaries) without any additional parcel-specific risk assessments. If exceedances of the volatilization criteria for groundwater or soil vapor contained in Connecticut's Remediation Standard Regulations are identified anywhere in the areal extent of the shallow groundwater plume, the actions described in the remedy to address potential vapor intrusion should be triggered. Because of the approach being proposed by EPA for the parcels described above, DEP does not believe the proposed remedy for vapor intrusion complies with State ARARs and we are concerned that the final remedial actions will not be adequately protective of public health.

However, the DEP supports every other component of the remedy, all of which are in compliance with State ARARs, and are necessary and appropriate actions that will remove significant sources of pollution from the environment and provide a safe supply of drinking water to the residents of Durham. We look forward to working with you and other state and local officials as we move toward implementation of this clean-up to assure that Durham Manufacturing, a valued and valuable member of Connecticut's business community, is not unduly burdened by the costs of this effort. It will require a solid public-private partnership to ensure that the remediation we all agree is necessary does not come at the cost of losing this community enterprise.

Yours truly,

Gina McCarthy
Commissioner

GM/cal

Appendix D
Responsiveness Summary

THE RESPONSIVENESS SUMMARY

A. PREFACE

In July 2005, the United States Environmental Protection Agency (EPA) issued a Proposed Plan for the cleanup of the Durham Meadows Superfund Site (Site) in Durham, Connecticut. The Proposed Plan was based on the Draft Final Baseline Human Health Risk Assessment, Remedial Investigation, Feasibility Study, and Technical Impracticability Evaluation Reports. These reports, the Proposed Plan, and all supporting documents were presented in an Administrative Record and made available at public information repositories at the Durham Public Library and at EPA's office in Boston, Massachusetts.

The Proposed Plan included notice of a technical impracticability waiver for federal and state requirements that would normally require cleanup of groundwater to meet drinking water standards. The Proposed Plan also included notice of a potential determination, and solicited comment on the proposed determination, to minimize destruction, loss or degradation of wetlands pursuant to Section 404 of the Clean Water Act and Executive Order 11990 (Protection of Wetlands), should work in wetlands areas be required. Similarly, the Proposed Plan included notice of a potential determination, and solicited comment on the proposed determination, to minimize potential harm to floodplains pursuant to Executive Order 11988 (Protection of Floodplains), should work in floodplain areas at or around the Site be required. Additionally, the Proposed Plan notified the public of the availability of a Draft Reuse Assessment as part of the Site Administrative Record, and solicited comments on this document.

From July 13, 2005 to August 12, 2005, the Agency held a 30 day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public. EPA held a public meeting on July 12, 2005, to discuss the Proposed Plan, and held a public hearing on July 28, 2005, to accept any oral comments. The comment period for the Proposed Plan ended on August 12, 2005.

Comments were submitted by a total of 27 entities, either during the public hearing, in writing, or both. This Responsiveness Summary groups these entities into the following categories:

- Individuals and elected officials (23 total),
- Connecticut Department of Public Health
- City of Middletown Water & Sewer Department,
- Connecticut Department of Environmental Protection, and
- Durham Manufacturing Company.

A transcript of the public hearing and all written comments received during the comment period are attached to this Responsiveness Summary, which is attached to the Record of Decision. The purpose of this Responsiveness Summary is to provide a concise and complete summary of significant comments received from the public during the public comment period, and provide EPA's response to these comments. EPA considered all of the comments summarized in this document before selecting the final remedy for the Site.

Several individuals mentioned the presence of "dioxin" in the drinking water, and that it is not effectively captured by the carbon filters. "1,4-Dioxane" is the compound that was recently identified in groundwater, and carbon filters do not capture this contaminant as effectively as other volatile organic compounds (VOCs) present in groundwater. 1,4-Dioxane, however, should not be confused with "dioxin," which is a different type of contaminant; dioxin is NOT present in groundwater at the Site.

In addition, as a group, Congressmen Robert Simmons and Rosa DeLauro, and Senators Christopher J. Dodd and Joseph I. Lieberman, submitted two letters to EPA Administrator Stephen L. Johnson during the public comment period. The Members of Congress and/or their representatives conducted a meeting with personnel from EPA's Headquarters office, EPA's Region I office (by telephone), and the Durham Manufacturing Company on July 21, 2005. EPA's response letters to the Members of Congress, dated August 2, 2005, are provided in the Administrative Record, available at the Site repositories in Boston, Massachusetts, and at the Durham Public Library in Durham, Connecticut. The issues presented in the letters, and discussed during the July 21, 2005 meeting, however, did not focus on the Site remedy; the letters and EPA's response are therefore not included in or attached to this Responsiveness Summary.

B. SUMMARY OF CITIZENS' AND LOCAL OFFICIALS' COMMENTS

Twenty-three individuals and local and elected officials submitted comments, either during the public hearing, in writing, or both. Where appropriate, EPA has grouped similar comments and prepared a single response.

<u>Citizen Comment 1:</u> Elected officials expressed support for excavation and off-site disposal of soil from properties owned by the responsible parties and adjacent properties, and future monitoring for possible plume migration, and requested that impact of cleanup activities be minimized on neighboring properties and residences.

<u>Response to Citizen Comment 1:</u> Some short-term impacts to the community from construction related to cleanup activities are expected, however, EPA is committed to minimizing these impacts to the extent possible. Dust control measures and air monitoring will be required as necessary, and all construction workers will be required to have appropriate health and safety training. Truck traffic and noise will be restricted to certain hours of the day, and EPA will work very closely with the Town of Durham

during coordination of these activities. The duration of actual excavation will be minimized to the extent possible.

Citizen Comment 2: Elected officials requested that institutional controls, while necessary, should not place excessive limitations on future use of the properties, and asked EPA to consider the Town's rural character and the Main Street Historic District. One elected official specifically stated institutional controls be implemented to the fullest extent as required to protect current and future occupants and neighbors. Another elected official specifically requested that land use restrictions not indefinitely prohibit the redevelopment of the Merriam Manufacturing Company property.

Response to Citizen Comment 2: The two main reasons EPA must require institutional controls at this Site are to prevent certain groundwater and/or land uses to ensure protection of human health and the environment, and also to ensure the integrity of the remedial alternatives to be implemented. EPA endeavors to not place excessive limitations on future use of properties when it requires institutional controls, to the extent that protectiveness and remedy integrity can be maintained. The significant restrictions associated with institutional controls in the different Study Areas can be found in the Record of Decision, under Section L.2., Description of Remedial Alternatives.

With respect to the Merriam Manufacturing Company (MMC) Study Area, EPA specifically tailored the cleanup of this Study Area to allow for any future use allowed by the Town of Durham's zoning regulations (either for residential or industrial/commercial purposes). The significant restrictions of the institutional controls at this property will be to ensure that any new structures on the property will be constructed to minimize potential inhalation risks from any remaining contamination, and to prevent the future use of groundwater for drinking water. After remedy completion, the restrictions on future use are expected to be minimal.

Citizen Comment 3: Elected officials and eight individuals expressed general support for the Durham Manufacturing Company (DMC). Officials and individuals noted that DMC is the Town's largest taxpayer, is a responsible member of the community, supports employee participation in voluntary fire and ambulance needs, and has been cooperative throughout the Superfund process. Several elected officials specifically requested that EPA also consider financial contributions already made by the company during cleanup negotiations. One elected official and one individual requested that EPA place no further demands at all on Durham Manufacturing Company. One individual stated that the cleanup plan should discuss potential adverse financial impacts to the Durham Manufacturing Company. Two individuals commented that the responsible parties were not out of compliance at the time they disposed, therefore they should not be held liable.

Response to Citizen Comment 3: EPA recognizes the community's support for the Durham Manufacturing Company (DMC), and we also recognize that DMC has already spent considerable funds on site work. In preparing and selecting a cleanup plan, EPA selects a remedy that protects human health and the environment, complies with applicable and relevant and appropriate requirements (ARARs), and satisfies EPA's other remedy selection criteria, including cost. EPA considered cost in developing the remedy alternative, and the selected remedy is the most cost-effective remedy that satisfies EPA's remedy selection criteria.

In selecting a remedy, however, EPA does not consider the financial impact of the remedy on any particular party or entity. After a remedy is selected, EPA typically looks to the potentially responsible parties to perform or pay for the cleanup. Now that EPA has issued this cleanup plan, EPA intends to discuss with all responsible parties the performance and/or financing of the cleanup work and reimbursement of past costs that have been incurred at the Site. It is EPA's national policy that responsible parties should fund a cleanup in the first instance before a cleanup is financed through the federal Superfund. If a potentially responsible party is unable to pay for or perform a cleanup, that party can claim an inability to pay, which EPA would evaluate pursuant to established guidance and procedures.

Under the Superfund law, DMC is a liable, responsible party even though it may not have violated any laws or regulations when it disposed of hazardous substances If a person or entity falls within one of the four classes of potentially responsible parties (PRPs), the Superfund law imposes strict liability for all response costs at the site. This means that PRPs are liable even if the problems caused by the hazardous substance release were unforeseeable; the PRP acted in good faith; or state-of-the-art management practices were used at the time the materials were disposed. The courts have consistently upheld this retroactive liability scheme.

<u>Citizen Comment 4:</u> One individual expressed concern regarding adverse impacts of the soil cleanup remedy on the Durham Manufacturing Company's ongoing business.

<u>Response to Citizen Comment 4:</u> EPA's primary goal for the cleanup alternative selected for the DMC Study Area is mitigation of risk to human health, as well as mass contaminant removal in order to remove source areas that continue to contribute to groundwater contamination to the maximum extent practicable. During the screening of remedial alternatives for this Study Area, EPA considered the implementability of certain alternatives, as well as potential impacts on surrounding residents and businesses. While potential adverse financial impacts are not explicitly addressed in the cleanup plan, EPA will seek to minimize the disruption to DMC's ongoing business to the extent possible. (Further discussion of this issue is provided in the Response to DMC Comment 6.)

<u>Citizen Comment 5:</u> One elected official and five individuals requested that more pressure be put on Merriam Manufacturing Company, with three individuals specifically mentioning the fact that Merriam Manufacturing Company is no longer filtering and monitoring residences as it is required to under state order.

<u>Response to Citizen Comment 5:</u> As discussed above in the response to Citizen Comment 3, EPA will work with all interested parties to examine ways to equitably pay

for a Site-wide remedy. If the negotiations to perform and/or finance the cleanup of the Site are unsuccessful, EPA will consider enforcement action against any non-settling PRP.

Citizen Comment 6: Three individuals stated that the companies were responsible for the pollution and should be held liable. One individual stated further that the primary contributors should be held accountable since the source of any grants and EPA funding is the taxpayers. One individual specified that the cost of hook-ups to a water system for the public facilities, businesses and residences with contaminated private water supplies should be borne by Merriam Manufacturing Company and the Durham Manufacturing Company, and that a special tax assessment would allow municipal bonding to be paid off by these companies over an extended period of time.

Response to Citizen Comment 6: The two companies in question are PRPs as defined under the Superfund Law (see Response to Citizen Comment 3), and EPA will seek to enter cleanup negotiations with these parties. Any municipal bonding or special tax assessment issues are at the discretion at the Town of Durham.

Citizen Comment 7: An individual stated that the source of funding for cleanup is a very significant component of the plan, and that it is hard to make a decision if the source of funding is unclear.

Response to Citizen Comment 7: EPA's Feasibility Study outlines the estimated cost for each remedial alternative developed and considered for the Site. EPA's Proposed Plan outlines these alternatives and their estimated costs, and presents EPA's preferred alternative (or combination of alternatives). While the cost of the remedy is one of nine criteria that EPA uses to evaluate the remedial alternatives, the source of funding is not taken into consideration in the Record of Decision. The final cleanup plan is not identified until the Record of Decision is issued, and until this happens, EPA cannot enter into negotiations with PRPs to discuss performance and/or financing of the selected remedy.

It is EPA's strong preference that the PRPs perform and/or fund cleanup work at Superfund sites, and the Superfund Law is structured to encourage this (see Response to Citizen Comment 3). If PRPs cannot or will not perform a remedy, Superfund monies may be made available in the future towards this Site, as necessary.

Citizen Comment 8: Several elected officials expressed support for the future connection to the Middletown Water Distribution System or another alternative source of public water, with certain of the officials specifically identifying the connection to the Middletown Water Distribution System. Eight individuals also specifically expressed support for an alternative water supply. One individual stated they prefer using their own well water, despite the contamination, but is ultimately in favor of the public water supply.

Response to Citizen Comment 8: As a point of note, apart from the one comment above indicating a general preference to continue using existing well water, EPA did not receive any comments specifically opposing the alternative water supply options. More specific comments related to this issue follow. EPA determined that Alternative AWS-2 Connection to Middletown Water Distribution System was the most cost effective of the remedial alternatives as it meets the threshold criteria and provides the best balance of the five balancing criteria as described in Section K of the Record of Decision.

Citizen Comment 9: One elected official and one individual requested that the water line specifically include fire flow capacity.

Response to Citizen Comment 9: Under the Superfund law, EPA is limited to addressing only the potable water needs of impacted citizens at the Superfund Site. The alternative analyzed in EPA's Feasibility Study, AWS-2 Connection to the Middletown Water Distribution System, is limited to providing water service only to the Durham Meadows Superfund Site for drinking water purposes.

With respect to fire protection, however, Appendix I of the Feasibility Study does provide a breakout of additional costs that would be required to provide fire protection, including greater capacity piping as well as the added cost for hydrants. An additional cost estimate of $70,000 is provided for including the Strong School, located at 191 Main Street, to the water line. The additional capital costs to provide all additional costs necessary to provide pipe capacity for fire protection, range from approximately $200,000 to $600,000. This range is a function of the potential fire flow demands.

Citizen Comment 10: Two individuals asked who would pay for the annual cost of water provided from the Middletown Water Distribution System.

Response to Citizen Comment 10: Cost estimates for this alternative include all costs associated with hookup of individual homes and abandonment of on-site private drinking water wells. EPA's authority does not include providing funding of the actual supply of water to individual homeowners. EPA expects that this cost would be borne by the homeowners.

Implementation of this alternative requires the development of administrative and operation and maintenance functions. Administrative responsibilities will include billing, as well as customer service, and regulatory compliance. Under alternative AWS-2, Connection to the Middletown Water Distribution System, administrative agreements between the City of Middletown and the Town of Durham shall be required to formally assign these responsibilities. It is expected, therefore, that the City of Middletown and/or the Town of Durham will determine the cost of water for homeowners.

Citizen Comment 11: An individual asked if the City of Middletown could contribute money to the Town of Durham if residents have to pay for water.

Response to Citizen Comment 11: The City of Middletown is not a responsible party at the Durham Meadows Superfund Site, and therefore has no specific obligation to contribute financially toward this project. As a point of note, the City of Middletown charges its own residents for their direct water use.

Citizen Comment 12: Four individuals want the connection to the Middletown Water System to provide a more extensive hookup to residences beyond the Superfund Site. A few individuals mentioned areas impacted by local gasoline stations. One individual mentioned the Durham Heights area (due to the use of septic systems on undersized lots) and an area adjacent to the closed Durham-Middlefield Landfill, and also stated that water line connection should be designed to include hook-up to the Durham Center Water System. Last, one individual suggested that cleaning up groundwater is one of the mandates of Superfund, therefore EPA should meet the spirit of that mandate by hooking up residences outside of the plume area.

Response to Citizen Comment 12: Under the Superfund law, EPA is limited to addressing only the potable water needs of citizens at the Superfund Site that are or may come to be impacted by Site-related contaminants. The alternatives analyzed in EPA's Feasibility Study are all limited to providing water service only to the Durham Meadows Superfund Site for drinking water purposes.

EPA understands that there are other areas within the Town of Durham that may potentially benefit from provision of an alternate supply of water, including the areas mentioned by the citizens in their comments. Should the Town of Durham or other officials wish to enter into discussions regarding these other areas (and potentially with other parties affiliated with these areas) in an attempt to coordinate an effort that is broader than just the Superfund Site, EPA will participate in these discussions. Superfund monies cannot, however, be used to directly address areas outside of the Superfund Site.

Citizen Comment 13: Two individuals specifically commented that areas impacted by MTBE [methyl tertiary-butyl ether] contamination from gas stations should also be addressed since the federal government mandated use of MTBE as a gasoline additive. A third individual suggested that the gas companies participate in funding a water line.

Response to Citizen Comment 13: As previously stated, under the Superfund law, EPA is limited to addressing only the potable water needs of impacted citizens at the Superfund Site. MTBE is not a Site-specific contaminant at the Durham Meadows Superfund Site, and the MTBE contamination in groundwater elsewhere in the Town of Durham has not commingled with contamination at the Superfund Site. The State of Connecticut is currently addressing areas impacted by gasoline contamination under the Underground Storage Tank program.

Citizen Comment 14: One individual wants EPA and elected officials to work together to expedite the extension of a water main, and expressed frustration that it could take two years before residents could get public water.

Response to Citizen Comment 14: As previously stated, EPA does understand that there are other areas within the Town of Durham that may potentially benefit from provision of an alternate supply of water, and EPA will participate in discussions with the Town of Durham or other officials, should they wish to explore an effort to bring an alternate source of water to an area broader than the Superfund Site. Superfund monies cannot, however, be used to directly address areas outside of the Superfund Site.

With regard to the implementing of a water main extension, it is expected that actual construction may take approximately six months to complete. Preliminary activities required prior to construction will add to the amount of time before an alternate water supply is extended to area residents. EPA typically negotiates with the responsible parties regarding the performance or financing of implementing the remedy at the Site. Conducting these negotiations, entering into a legal agreement to finalize the decisions made during the negotiations, designing the implementation of the alternate water supply portion of the remedy, and finalizing the administrative agreements required between the town(s) to administer, operate and maintain the alternate water supply, are expected to take a minimum of one year. While the amount of time required to implement the legal and administrative portions of the remedy might be frustrating, it is crucial that these matters be finalized before actual construction begins.

It is important to note that until the water main extension is complete and operational, the remedy includes the continued monitoring and maintenance of existing filters, and provision of bottled water as necessary, to protect public health.

Citizen Comment 15: Regarding the specific source of an alternate water supply, eight individuals specifically stated a preference between the Middletown Water Distribution System and an in-town source of water, with five individuals preferring water from Middletown, and three individuals preferring an in-town source. One individual suggested that an in-town source of water may result in a savings to taxpayers.

Response to Citizen Comment 15: As outlined in Section K of the Record of Decision, the City of Middletown Water Distribution System (Middletown) is selected as the source of alternative water in the first instance, because it is the most cost effective of the remedial alternatives as it meets the threshold criteria and provides the best balance of the five balancing criteria. EPA does recognize, however, that an in-town well may be a viable alternative. A contingency measure of an alternate water supply via development of and connection to a new groundwater source is retained in the Record of Decision in the event that a connection to Middletown cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner.

Citizen Comment 16: An individual stated that the Connecticut Water Company, instead of a municipality, should propose a source of water.

Response to Citizen Comment 16: It is EPA's understanding that the Connecticut Water Company is currently contracted by the Town of Durham to operate its water system. The Town of Durham, however, is primarily responsible for the Durham Center Water System, and is currently focused on making the necessary improvements and upgrades to that system.

The Durham Center Water System was previously owned and operated by AquaSource, Inc. (AquaSource was also previously affiliated with the Eastern Connecticut Regional Water Company, which is not the same as the Connecticut Water Company.) In 2002-2003, the Town of Durham purchased the in-town water systems, and the water service rights to the town. Since then, the Town of Durham has been investigating other possible locations for a primary source of water to replace the current system's inadequate water supply. As part of this effort, the Town of Durham has been working with the Connecticut Water Company, as well as other entities, including the Connecticut Department of Public Health, and the Connecticut Department of Environmental Protection.

Citizen Comment 17: One individual suggested specific wells in town that should be investigated as a possible source for the Site, including the Durham Center Water System, and a well source at an elderly housing complex, a reservoir in the Town of Wallingford which abuts the Town of Durham. Certain other pieces of property located on Route 17 were also suggested as potential sources of water, although in later correspondence, the individual indicated that the properties were no longer available for this use.

Response to Citizen Comment 17: Under Alternative AWS-3, Development of a New Groundwater Source and Distribution System, a new groundwater source would be developed in close proximity to the Study Area (presumably within the town boundaries) and a distribution system would be installed within the Study Area. When EPA evaluated this alternative in the Feasibility Study, adequate data was not available to determine a definitive well source in Town, therefore the Feasibility Study presents this alternative to include installation and development of a new groundwater supply, assumed to be upgradient to the north and east of the Study Area, although a specific supply location was not investigated. The cost estimate for this alternative includes costs related to the installation and development of the supply well.

As outlined in the Proposed Plan, there are a variety of existing well locations that could possibly be further investigated as potential sources, including but not limited to the Durham Fairgrounds wells, the DMC cooling water well, a well at the Parsons Manufacturing Company, or other potential well locations within the Town of Durham. The Durham Fairgrounds wells to the south west of the Study Area are currently being investigated by the Town of Durham as a potential source for the Durham Center water system. The DMC cooling water well (well #2) may have capacity to provide an adequate source of water for the Study Area, although there is no information available to confirm this. A well located at the Parsons Manufacturing Company may reportedly have enough capacity as well. The Parsons and DMC wells are both currently contaminated, however, and would require treatment prior to distribution for drinking water purposes. The need for treatment would increase the cost estimate for this alternative. Federal and state agencies may also prefer clean water supply options over contaminated sources.

With respect to the specific suggestions for possible sources, the current wells used by the Durham Center Water System do not have adequate capacity to service the Superfund Site. As mentioned, the Town of Durham is currently investigating the Durham Fairgrounds wells as a potential source for its own system. The well at the elderly housing complex suggested by the individual is one of two smaller systems included as part of the Town of Durham's 2002-2003 acquisition; it is expected that these smaller systems do not have the capacity to service additional areas. A connection to the Town of Wallingford's distribution system was initially reviewed, but not pursued as a viable alternative as the distance to the closest possible connection was much farther away than the Middletown system. EPA did not conduct independent testing on any other properties to support their possible use for public water.

<u>Citizen Comment 18:</u> Three individuals stated that the cost of connecting residences to the Middletown Water Distribution System should be paid for through grant monies or directly by EPA or CT DEP. One of these individual mentioned financing possibilities of local bonding, private expenditures and special taxation. Another individual stated that the towns of Plymouth and Harwinton were able to get state or federal money to deal with similar situations. A fourth individual stated that the federal government has provided the Town with money to purchase local property (White's Farm) to use for a source of water, and that the water main ends close to the Site.

<u>Response to Citizen Comment 18:</u> The cost of connecting residences impacted by the Superfund Site is part of the selected remedy and shall be borne by the responsible parties and/or the federal Superfund. Superfund monies cannot, however, be used to directly address areas outside of the Superfund Site. CT DEP is currently funding a portion of the monitoring and filtration required at the Site (at homes impacted by the Merriam Manufacturing Company), but the source of this funding is limited and cannot be used to connect residences to the Middletown Water Distribution System. Any municipal bonding or special taxation issues are at the discretion at the Town of Durham.

Regarding the towns of Plymouth and Harwinton, it is EPA's understanding that the State of Connecticut utilized special funds to extend existing water lines, only after pursuing the responsible parties involved in each situation.

It is EPA's understanding that the Town of Durham is currently investigating the possibility of improving and using wells located on the Town's White's Farm property for the Durham Center Water System, but has not yet made any such connection to these wells. EPA is also not aware of the funding source (if any) utilized by the Town of Durham, to secure ownership of this property.

Citizen Comment 19: Two individuals expressed concern that the contaminated groundwater plume would spread beyond the area EPA currently identifies for alternate water supply provision. One individual questioned how the flow of the contaminated groundwater plume might be impacted by shutting off local drinking water wells and bringing in another source of water, or construction related to the cleanup remedy or future development at the Durham Manufacturing Company, and whether additional residents would be able to be hooked up to a water main if the plume spread.

Response to Citizen Comment 19: The distribution zone of the alternative water supply, whether from the City of Middletown Water Distribution System or from an in-town source, is sized to provide a permanent source of drinking water to all residences currently affected by groundwater contamination as well as a buffer zone of residences located near the contaminated area. It is assumed 85 service connections would be made to the water mains (38 homes are currently on filters due to Site contamination).

EPA believes that the buffer zone of residences around those currently impacted is reasonable and conservative based on the nature and extent of the contaminated groundwater plume, and EPA's expectation regarding how the groundwater plume will move after local drinking water wells stop pumping and a new source of water is brought to the area. As part of the Site-wide Groundwater Study Area remedy, EPA will implement a monitoring well network to determine whether the plume is migrating or attenuating, and ensure the plume does not migrate to areas that are currently not affected by groundwater contamination. As a contingency alternative, if it is found that the plume is migrating, EPA shall require implementation of a groundwater extraction system to hydraulically contain the contaminated groundwater source and prevent further migration into areas that are not currently contaminated. Extracted groundwater would be piped to a centralized treatment system.

The contaminant mass removal that will be accomplished by source control remedies implemented at the Merriam Manufacturing Company and Durham Manufacturing Company Study Areas will further reduce the levels of contamination emanating from the sources. EPA does not expect that construction related to any portion of the cleanup remedy will cause the groundwater plume to migrate.

Finally, while EPA does not expect any scenario in which contaminated groundwater migrates into previously uncontaminated areas and affects additional private drinking water wells, if this does occur, the protection of human health will be of primary importance to EPA.

Citizen Comment 20: One individual asked if EPA had studied the long term health impact of contaminants in groundwater, specifically mentioning the presence of 1,4-dioxane.

Response to Citizen Comment 20: EPA's Baseline Human Health Risk Assessment Report, dated June 2005, assessed the estimated long term risk to human health posed by various media in the different Study Areas. Risk from the domestic use of contaminated groundwater (e.g., ingestion of contaminated drinking water, dermal contact, and vapor inhalation while showering and bathing), was estimated for current and future residents. It was determined that there is a risk posed by the use of contaminated groundwater for household purposes, using EPA's risk assumption of a worst-case scenario in which residents are drinking untreated (unfiltered) water. EPA's calculation of risk for this site also includes consideration of health impacts for 1,4-dioxane, as documented in EPA's Baseline Human Health Risk Assessment Report, dated June 2005.

This report is available in the Site Administrative Record, located at the Durham Public Library.

Citizen Comment 21: An individual stated that the presence of the Strong Middle School at the Site should raise the priority of this Site above others. Another individual expressed concern about the need for testing at Strong School, due to past bus depot and automotive repair maintenance and classes at that property.

Response to Citizen Comment 21: With regard to drinking water concerns, the EPA Feasibility Study provides for an additional cost estimate to include hookup of the Strong School, located at 191 Main Street, to the alternative water supply. While the Strong School was previously using an on-site well, filtered to remove groundwater contamination, as of August 2004, the school uses wells at the Coginchaug Regional High School and the Korn Elementary School that are upgradient of the Durham Meadows Site.

With respect to soil testing at the Strong School, EPA has no evidence to suggest that solvent use and disposal at the adjacent DMC Study Area occurred on the Strong School property. Prior to initiating the RI/FS, EPA reviewed historical data regarding the Strong School's own activities with respect to the bus maintenance area and automotive repair shop, and conducted interviews with past students and teachers regarding these activities. EPA found no information to suggest solvent use or spills, and as such did not conduct any testing on the Strong School property beyond sampling of the on-site drinking water well. (Subsequent investigations by the Strong School itself discovered two leaking underground storage tanks on the property, formerly used to store petroleum products. The School is currently monitoring this area, but these contaminants are not related to the Superfund Site and do not appear to be commingled with contaminated groundwater coming from the Superfund Site.)

<u>Citizen Comment 22:</u> An individual suggested the use of microbes to break down contaminants in situ, and specifically cited the use of moderate temperature steam injection.

<u>Response to Citizen Comment 22:</u> EPA's Feasibility Study did evaluate a variety of in-situ technologies during the initial screening phase (see Tables 3.1-1, 3.2-1, and 3.3-1 in the Feasibility Study report). In general, most of the in-situ biological or thermal technologies were screened out, due to the limited effectiveness given the Site contaminants and/or specific Site conditions. Certain technologies were also screened out due to limited effectiveness to address Site-specific risks, or the potential to create additional risks to residents in the area.

<u>Citizen Comment 23:</u> An individual stated that all of the septic systems on Main Street should be updated, even if it had to be done by the community.

<u>Response to Citizen Comment 23:</u> Under the Superfund law, EPA does not have the authority to address this issue as part of the Superfund Site.

<u>Citizen Comment 24:</u> Two individuals requested a reduction in property tax due to the effects of the Site on property values.

<u>Response to Citizen Comment 24:</u> Under the Superfund law, EPA has no ability to address the economic impact of a Site on property values. Property taxes are levied by the Town of Durham pursuant to the Town's regulations, requirements, and discretion.

B. SUMMARY OF COMMENTS FROM THE CONNECTICUT DEPARTMENT OF PUBLIC HEALTH

The Connecticut Department of Public Health (CT DPH) submitted written comments in a letter dated August 12, 2005. Comments focused primarily on alternative water supply issues.

CT DPH agreed with EPA that the best option for the provision of public drinking water to 85 homes is the extension of the City of Middletown Water Department's (Middletown's) public water system, but identified several permitting requirements and exclusive service area issues that must be specifically addressed. CT DPH also notes that the Town of Durham is actively pursuing additional sources of public drinking water south of Allyn Brook to serve its own system, the Durham Center System. Specific issues raised by CT DPH are addressed below:

<u>CT DPH Comment 1:</u> "The [Durham Meadows Superfund Site] is within the Town of Durham's Exclusive Service Area. Therefore, Durham would have to either relinquish a portion of its exclusive service area to Middletown, or develop an agreement with

[Middletown] for the purchase of excess water pursuant to Connecticut General Statute (CGS) 22a-358."

Response to CT DPH Comment 1: This is an administrative item that must be addressed by the Town of Durham and the City of Middletown. EPA will facilitate coordination between these two municipalities.

CT DPH Comment 2: "Per CGS 22a-358, [Middletown] must be able to demonstrate that it has water reserves in excess of those required to maintain an abundant supply of water to the inhabitants of its service area, such system may sell such excess water to any other public water system upon approval of the Commissioner of Public Health. Such approval shall be given only after (1) the applicant has clearly established to the satisfaction of the commissioner that such abundant supplies are in existence and will continue to be in existence for ten years, and (2) the purchasing community water system being supplied has agreed to restrict water usage in the same manner as the applicant when necessary in accordance with the emergency contingency provisions of the applicant's water supply plan."

Response to CT DPH Comment 2: During development of the Feasibility Study, EPA's contractor, Metcalf & Eddy, conducted several telephone conversations with the City of Middletown's Water & Sewer Department in which Middletown indicated that adequate water supply was available to serve the Durham Meadows Superfund Site. The comment letter received by the City of Middletown's Water & Sewer Department would also seem to indicate that Middletown is prepared, from a supply perspective, to serve the Durham Meadows Superfund Site at a minimum. According to CT DPH's letter, Middletown would need to provide sufficient information to CT DPH to confirm adequate supply and satisfy the requirements outlined by CT DPH; the Town of Durham would also have to agree to any Middletown water restrictions as outlined by CT DPH. These administrative items must be addressed by the Town of Durham and the City of Middletown; EPA will facilitate coordination between these two municipalities.

CT DPH Comment 3: "If [Middletown] intends to sell water to Durham, they should perform an analysis to establish that abundant supplies are in existence and will continue to be in existence for the 10-year period between 2006 and 2016 to ensure compliance with CGS 22a-358."

Response to CT DPH Comment 3: As mentioned above, this is an administrative item for the City of Middletown; Middletown would need to provide this analysis to the satisfaction of CT DPH.

CT DPH Comment 4: "[Middletown] will be required to submit a Water Main Application for the proposed water main extension. Moreover, [CT DPH] recommends that the water main be sized to serve additional customers beyond the 85 residences in the Superfund area in the event additional contamination occurs beyond the present area of concern. Fire protection needs also be considered."

Response to CT DPH Comment 4: It is assumed that preparation of the Water Main Application would be completed during the design phase. Sizing infrastructure and design scope will require coordination between the Town of Durham, the City of Middletown, EPA and other state agencies, with a clear understanding of cost responsibilities.

While the Middletown Water Distribution System may also have adequate capacity to provide water service to other portions of town, as well as fire protection, the alternative analyzed in the Feasibility Study is limited to providing water service only to the Superfund Site for drinking water purposes.

With respect to fire protection, Appendix I of the Feasibility Study does provide a breakout of additional costs that would be required to provide fire protection, including greater capacity piping as well as the added cost for hydrants. An additional cost estimate is provided for including the Strong School, located at 191 Main Street, to the water line. While the Strong School was previously using an on-site well, filtered to remove groundwater contamination, as of August 2004, the Strong School uses wells at the Coginchaug Regional High School and the Korn Elementary School that are upgradient of the Durham Meadows Site. The additional capital costs for the Strong School hookup are approximately $70,000. Capital costs to provide the additional pipe capacity as well as fire hydrants necessary for fire protection, range from approximately $200,000 to $600,000. This range is a function of the potential fire flow demands.

CT DPH Comment 5: As stated above, CT DPH notes that the Town of Durham is in the process of developing a new drinking water source for the Durham Center Water System to serve approximately 30 customers. Based on an agreement reached with the Durham Fair Association earlier this year, the Durham Center Water System will connect two existing sand and gravel wells to a planned treatment station and storage facility that is expected to go on-line by the end of 2005. Combined pumping capacity of the two wells is expected to be in the range of 80 to 100 gallons per minute, pending the outcome of an updated yield test. The Fairground Wells are located approximately 1,500 feet west of Main Street (Route 17) and about 1,200 feet south along Main Street from the trichloroethylene isocontour boundary line shown on Figure 4.3-12 in EPA's July 2005 Proposed Plan.

Response to CT DPH Comment 5: EPA is aware that the Town of Durham and CT DPH are currently investigating the use of the Durham Fairground Wells to service the Durham Center Water System. The use of a well in the Town of Durham as an alternate water supply for the Superfund Site was evaluated in the Feasibility Study; this alternative was presented in EPA's July 2005 Proposed Plan and EPA specifically solicited comment on this alternative. At the time, adequate testing was not yet available regarding the potential use of these wells as an alternative to serve, not only the Durham Center Water System, but also the Superfund Site. EPA consequently presented a preferred alternative for a connection to the Middletown Water Distribution System.

EPA does recognize, however, that an in-town well may be a viable alternative. The alternative water supply portion of the remedy as outlined in the Record of Decision requires a connection from the City of Middletown Water Distribution System to be implemented in the Site-wide Groundwater Study Area. As a contingency measure, however, an alternate water supply via development of and connection to a new groundwater source is retained in the event connection to the City of Middletown Water Distribution System cannot be implemented for administrative or other reasons, or cannot be implemented in a timely manner.

<u>CT DPH Comment 6:</u> The Durham Fairground Wells are less than 1,000 feet south of Allyn Brook, and the straight-line distance from these wells to the inferred Site trichloroethylene isocontour line is approximately 1,200 feet. Since very little monitoring data currently exists for any contaminants associated with the Site south of Allyn Brook, CT DPH recommends that EPA consider placing monitoring wells on the south side of Allyn Brook or at other sites to ensure that contaminated groundwater is not migrating towards the Fairground wells and nearby homes south of the brook.

<u>Response to CT DPH Comment 6:</u> As currently envisioned, Alternative DP-6, Monitoring, is designed to use 8 new monitoring wells and 17 existing wells within the Site to monitor the source zone and dissolved plume groundwater. The monitoring well locations are shown on Figure 6.6-4 in the Feasibility Study. Several new monitoring wells are located generally south – southwest of the current groundwater plume boundary, and north of Allyn Brook. One monitoring well is planned for a location south of Allyn Brook. These proposed monitoring well locations assume that the boundary of the groundwater plume is generally as outlined on figures in the Feasibility Study. If it is determined that the boundary of the groundwater plume has migrated significantly farther south of its currently known boundary, or if the groundwater plume migrates in the future, additional monitoring wells will be required to better define the plume. The specific goal of this alternative is to ensure that contaminated groundwater does not migrate beyond its current boundary into areas that are not currently contaminated.

C. SUMMARY OF COMMENTS FROM THE CITY OF MIDDLETOWN WATER & SEWER DEPARTMENT

The City of Middletown Water & Sewer Department (Middletown) submitted written comments in a letter dated August 5, 2005. In its letter, Middletown generally supports the Water Department Service Extension, and states that the City is committed to assisting the Town of Durham, with the single caveat that current rate payers and the citizens of the City of Middletown be held harmless (i.e., cost neutral) for any extension of service to the Town of Durham. Given that assumption, Middletown provides a number of specific comments related to the cost estimate for Alternative AWS-2, Connection to the Middletown Water Distribution System, as presented in the Feasibility Study. Middletown also provides cost estimates and information for its preferred plan of action, which would include full fire protection and water service for the Town of Durham. Middletown's estimate of capital/construction cost ranges from approximately $7.084 million to $13.154 million.

EPA responds below to two separate issues. First, EPA responds to Middletown's cost estimates and suggested improvements to provide the water service extension as outlined in EPA's Feasibility Study and Proposed Plan, which is only to provide potable water to the area affected by the Durham Meadows Superfund Site. A second response follows for Middletown's preferred plan of action for full fire protection and expanded water service.

In summary, based on EPA's review of the comment letter, it appears that Middletown does not take issue with the unit costs or the required elements proposed in the Feasibility Study, with the exception of three additional items:

District Piping	$ 428,280 (ranges from $278,880 - $428,280)
Booster Pump Station	$ 450,000
Cherry Hill Water Tower	$ 760,000

The cost of these three items and the associated design, management and contingency costs, primarily accounts for the majority of the difference between the Middletown capital cost estimate of $7.084 million and EPA's capital cost estimate of $4.55 million. (Both capital cost estimates are for a six-inch water main to service the Superfund Site without fire protection.)

Middletown states that these three items provide the additional infrastructure required in order to allow the connection of the Durham Meadows Superfund Site to the Middletown water distribution system without impacting current rate payers or the citizens of the City of Middletown. The basis for the additional items comes from both the Fuss & O'Neill report, dated May 2000, and an updated review by the City of Middletown Water & Sewer Department staff. The Fuss & O'Neill report was originally commissioned by the Town of Durham when the Town was investigating a connection to the City of Middletown's water distribution system to address a number of areas affected by groundwater contamination, including but not limited to the Superfund Site.

The May 2000 Fuss & O'Neill report does indeed include these elements, however, this report evaluated the feasibility study for a water system extension that would include a number of areas within the Towns of Durham and the neighboring Town of Middlefield beyond just the Durham Meadows Superfund Site. The water system extension contemplated in that study would also provide fire protection to all service areas.

According to the May 2000 Fuss & O'Neill report, the average daily demand associated with all of the identified areas within the towns of Durham and Middlefield is approximately 187,000 gallons. The report recommends the installation of a 950,000 gallon Cherry Hill Water Storage Tank, and a booster pump station in order to fill the proposed tank, which appears to be sized to provide service to all areas identified in the study, as well as fire protection.

The Durham Meadows Superfund Site average daily demand (not including the Strong School, located at 191 Main Street) is approximately 40,000 gallons, or 21% of the total daily demand presented in the Fuss & O'Neill report. Additionally, section 7.1.3.4 (page 7-4) of the May 2000 Fuss & O'Neill report includes a presentation of the required infrastructure to provide water supply only to the Durham Meadows Superfund Site and the areas impacted by three gas stations located on Route 17. The Cherry Hill Water Storage Tank, a booster pump station, and district piping are not included. The capital cost estimate for this smaller service area is $4,080,000, which includes water mains sized to provide future fire protection at a fire flow of 3,500 gallons per minute. The EPA Feasibility Study estimate for an eight-inch main with fire protection includes a capital cost of approximately $4.8 million, which includes hydrants. In accordance with the U.S. Army Corps of Engineers/U.S. Environmental Protection Agency manual, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002), dated July 2000, the accuracy of cost estimates within a Feasibility Study is expected to be between -30 and +50 percent; the difference between these two capital cost estimates is within this appropriate range. The cost estimates in EPA's Feasibility Study are also developed for comparison purposes, and not intended to be final cost estimates.

EPA's conclusion at this time is that the district piping, the booster pump station, and the Cherry Hill Water Storage Tank are not required solely to provide potable water to the Durham Meadows Superfund Site. However, a detailed review, completed in conjunction with the City, of the existing water distribution system infrastructure in the area of the proposed connection may be required in order to determine any necessary improvements. The potential need for this review shall be discussed during the design phase. If it is determined during the design phase that one or more of these elements is required, it is expected that the additional costs will still fall within the appropriate cost estimate range of -30 and +50 percent.

Middletown's comment letter provides a second cost estimate for their preferred plan of action for full fire protection and expanded water service, the capital cost estimate of which is approximately $13.154 million. While Middletown acknowledges that "the charge of EPA is not to solve economic development and/or fire prevention issues in this central business area of the Town of Durham," it states further, "...it is essential that the EPA solution does not proceed in a vacuum of these other requirements."

Middletown's comment letter suggests a cooperative action plan between EPA, federal and state legislators, the Town of Durham, and the City of Middletown Water Department to provide a more comprehensive solution to a number of water service and fire protection problems within the Town of Durham. As part of this cooperative action plan, Middletown encourages EPA and the Town of Durham establish a Town of Durham Water Development Fund, in which funds will be contributed from EPA and the

Potentially Responsible Parties for the Durham Meadows Superfund Site. Middletown further suggests that supplemental funds be added from the State of Connecticut Petroleum Tank Fund, and that the Town of Durham look to federal legislators for assistance in providing additional funds to provide for improvements and upgrades needed for long-term fire protection to the Town of Durham's downtown area. Middletown notes that the extension of water, unlike sanitary sewer, will not impact development density or affect the rural nature of the town.

It is EPA's expectation that further discussions regarding the water service area will be required between EPA, the City of Middletown's Water & Sewer Department, and the Town of Durham. EPA is committed to working closely with these parties during the design of an alternate water supply, and also supports the expansion of these discussions if the parties determine that the scope of the water service should be broader than what is currently contemplated in EPA's Feasibility Study for the Superfund Site. The limit of EPA's authority, however, is to only provide a potable drinking water source to the Durham Meadows Superfund Site.

D. SUMMARY OF COMMENTS FROM THE CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION

The Connecticut Department of Environmental Protection (CT DEP) submitted written comments in a letter dated August 11, 2005. In this letter, the CT DEP generally supported EPA's cleanup proposal and concurs with the following bullets as presented in the Proposed Plan:

- Excavation and off-site disposal at and adjacent to the Merriam Manufacturing Company, in conjunction with soil vapor extraction (combination of Alternatives S-3 and SV-3).
- Excavation and off-site disposal of soil at the Durham Manufacturing Company property (Alternative DMC GW-5).
- Connection to the Middletown Water Distribution System to provide an alternative source of water to all residences currently affected by groundwater contamination and additional residences located near the contaminated area (Alternative AWS-2).
- Monitoring of the overall area of groundwater contamination to ensure no migration of groundwater beyond its current general boundary (Alternative DP-6), with a contingency to implement a groundwater extraction system for hydraulic containment if the contamination spreads (SZ-2).
- Implementation of a waiver of federal and state requirements that would normally require cleanup of the groundwater to meet drinking water standards, since it is not technically practicable to clean up the groundwater to such levels in a reasonable amount of time (included with combined Alternatives DP-6 and SZ-2).

Specific comments from CT DEP and EPA's responses are summarized below:

CT DEP Comment 1: CT DEP agrees that institutional controls should be included in the remedy. CT DEP states that Environmental Land Use Restrictions (ELURs) pursuant to Section 22a-133q-1 of the Regulations of Connecticut State Agencies are permanent and enforceable, and therefore considered by CT DEP to be the most reliable form of institutional control available to prevent future use of polluted groundwater, and prevent inappropriate future use of certain areas of the Site. CT DEP further states that, in some situations, the remedy will have to include ELURs to comply with the CT Remediation Standard Regulations (RSRs), which have been identified as applicable requirements (ARARs).

Response to CT DEP Comment 1: EPA agrees that institutional controls are required for the remedy, and have specifically mentioned the use of ELURs pursuant to CT RSRs for the different Study Areas. Where EPA determines that institutional controls should take the form of a restriction on the deed, including the MMC and DMC Study Areas, EPA will implement an ELUR.

EPA believes, however, that certain complicating factors may prevent ELURs from being implemented in all Study Areas, particularly the fact that only the owner of the property in question may grant and sign the ELUR. For the Site-wide Groundwater Study Area, it may also be impossible to reasonably request that every owner of residential property in the Study Area implement ELURs on their individual properties, especially given the need for subordination agreements from any entity holding an interest in these properties (e.g., banks holding mortgages and utilities). EPA therefore reserves the right to investigate other potential forms of an institutional control.

CT DEP Comment 2: CT DEP concurs with the need for further characterization to assess the potential for VOCs in shallow groundwater to migrate and pose a potential indoor air risk to areas beyond the MMC and DMC Study Areas. CT DEP states that this evaluation must include an investigation to determine the extent and degree of VOC contamination in the shallow groundwater (delineation of the VOC plume in shallow groundwater) and an evaluation of the concentrations of VOCs in soil vapor beneath any buildings overlying such shallow groundwater plume, including the soil vapor beneath the Durham Manufacturing Company building. CT DEP further states that since the groundwater at this Site has already been found by EPA to pose "actionable risk" due to the potential for volatilization from shallow groundwater, and the RSRs have been identified as applicable requirements (ARARs), the new data to be gathered need not be subject to another risk assessment by EPA. Instead, new data should be compared to the appropriate volatilization criteria contained in the RSRs (either residential or industrial/commercial) to determine if action (or additional action) is needed to address the threat posed by potential migration of unacceptable concentrations of VOCs into structures.

Response to CT DEP Comment 2: For the DMC Study Area, the Record of Decision requires further delineation of VOCs in soils and VOCs in overburden groundwater beneath the DMC facility building to occur during pre-design and/or remedial activities. If it is determined that contaminated soils or contaminants in overburden groundwater under the DMC facility building are posing an unacceptable risk to current workers inside the facility, additional measures shall be taken to address this exposure pathway.

EPA has not made any determination that there is a potential risk to human health posed by vapor migration to indoor air for any properties beyond the MMC and DMC Study Areas. The only shallow groundwater currently identified anywhere at the Durham Meadows Superfund Site is located at the DMC Study Area. Further delineation of shallow groundwater, and characterization of any such shallow groundwater, is indeed necessary before the agencies can evaluate this potential pathway. EPA cannot agree that the volatilization criteria pursuant to CT RSRs will apply as an ARAR to properties beyond the MMC and DMC Study Areas until such time that shallow groundwater or other data is collected, the delineation of any VOC plume in shallow groundwater has occurred, and EPA has made a formal determination that there is an unacceptable risk to human health being posed by the VOCs.

EPA is committed to working very closely with CT DEP and CT DPH during future characterization of this potential pathway.

CT DEP Comment 3: CT DEP states that, in accordance with EPA's November 2002 Draft Subsurface Vapor Intrusion Guidance, the groundwater at the Site poses an actionable risk to indoor air, and since CT RSRs have been identified as applicable ARARs for this Site, the remedy must provide for compliance with CT's more stringent volatilization criteria. Further, such criteria must apply to the full extent of the shallow groundwater plume, not just to the portion of the plume that currently exceeds EPA's acceptable risk range.

Response to CT DEP Comment 3: As stated in response 2, EPA has not made any determination that there is a potential risk to human health posed by vapor migration to indoor air for any properties beyond the MMC and DMC Study Areas. EPA does, however, remain committed to working with the state agencies during future characterization of areas potentially posing an indoor air risk, including delineation of shallow groundwater.

E. SUMMARY OF COMMENTS FROM THE DURHAM MANUFACTURING COMPANY

The Durham Manufacturing Company (DMC) submitted written comments in a letter dated August 11, 2005. The letter attached a memo from DMC's contractor, GZA Geoenvironmental, Inc. (GZA), dated August 10, 2005. The comments made by GZA on behalf of DMC are primarily of a technical nature. EPA has summarized these comments and its responses as follows:

DMC Comment 1: GZA states that EPA's Remedial Investigation Report (RI) "acknowledges that the [Merriam Manufacturing Company (MMC)] site is the primary source of the 1,4-dioxane in the Site-Wide Groundwater Study Area." GZA also states that 1,4-dioxane is only detected in three wells in the southern half of the Site, including one well at the DMC property, the Strong School well, and the well at 168 Main Street, the latter two of which are suspected source areas. Therefore, DMC should not be responsible for any cost considerations attributable to the presence of 1,4-dioxane in Site-wide groundwater with respect to the Point of Use Treatment alternative, or if the presence of 1,4-dioxane was used as a basis for preferring public water.

Response to DMC Comment 1: GZA incorrectly states that the RI acknowledges that MMC is the "primary" source of 1,4 dioxane in the Site-Wide Groundwater Study Area. On page 4-39, the RI states "the compound 1,4-dioxane is more prevalent at the MMC site than at DMC, coincident with [1,1,1-Trichloroethane (1,1,1-TCA)] concentrations."

Although the compound 1,4-dioxane was detected in only three of the wells on or downgradient of the DMC facility, this does not necessarily mean that it was not introduced into the groundwater at DMC. The data presented in the RI show that there are generally two separate and distinct plumes at Durham Meadows, the MMC plume and the DMC plume, as illustrated in Figures 4.3-18 and 4.3-21 for 1,4-dioxane. The compound 1,4-dioxane is generally associated with 1,1,1-TCA contamination, due to its use as a stabilizer additive. Both the MMC and DMC facilities used 1,1,1-TCA at various times. The compounds 1,1,1-TCA and 1,4-dioxane were detected in the groundwater at both the MMC and DMC sites as shown in Figures 4.3.16 and 4.3.20 of the RI.

There are no bedrock groundwater monitoring wells on the DMC site, between DMC and Strong School, or between Strong School and 168 Main Street. EPA conducted three sampling rounds for 1,4-dioxane near DMC, all within a 7 month timeframe (December 2003 – June 2004), making it difficult to conclude that 1,4-dioxane contamination is "limited" in either concentration and/or extent near DMC without additional sampling to account for seasonal fluctuations and provide a greater data set.

DMC Comment 2: GZA states their main concern with the RI, FS, and Proposed Plan for the DMC property relates to the exaggerated and unsubstantiated extent of DNAPL (Dense Non-Aqueous Phase Liquid) in overburden and bedrock. GZA states that the Conceptual Maximum Extent of DNAPL is not supported because it is based only on theoretical calculations and not on actual field observations

Response to DMC Comment 2: DNAPL is often not physically encountered at DNAPL sites, and in the absence of physical evidence, standard practice is to employ a lines of evidence approach. The following are excerpts from two recently published studies used as current references in the industry:

First reference. USEPA. 2003. The DNAPL Remediation Challenge: Is there a case for Source Depletion? EPA/600/R-03/143. December 2003.

> "EPA analyses suggest that DNAPL is present at approximately 60 percent of Superfund Sites where organic chemicals have been detected. However, the presence of DNAPLs is rarely observed directly, and must be inferred by comparing the maximum levels detected in soil or groundwater samples to the effective solubility in water or the residual saturation in soil of the DNAPL chemical of concern. It is probable, however that DNAPLs are present at many sites where DNAPL constituents have been detected even with maximum concentrations in samples taken from groundwater monitoring wells well below one percent of the effective aqueous solubility."

Second reference. Interstate Technology and Regulatory Council (ITRC). DNAPL Source Reduction: Facing the challenge. April 2002.

> "Thus, investigators usually do not find free-phase DNAPL in soil cores or accumulating in monitoring wells using conventional characterization methods. Based on this lack of observable DNAPL, is tempting to conclude that no DNAPL is present when in fact it may be present in substantial quantities at residual saturation."

EPA and its contractor, Metcalf & Eddy (M&E), are not aware of any field investigation of DNAPL using visual methods (e.g., Sudan IV red dye, jar shake test, fluorescence) having ever been performed at the Site. Section 6.5 of the RI report does identify direct observation of DNAPL as a data limitation and recommends future DNAPL investigation, however, it is noted that even if visual methods are applied, chances of observing DNAPL are still low.

Regardless, there is a substantial amount of data that supports the presence of DNAPL at DMC. The historic overburden groundwater concentrations at DMC are well above the 1% aqueous phase solubility, and the persistence of contamination in both overburden and bedrock groundwater is highly indicative of the presence of DNAPL. [See EPA Remedial Investigation Report, June 2005, Section 4.2.2.5, and EPA Technical Impracticability Evaluation Report, June 2005, Section 3.3.1.2.]

<u>DMC Comment 3:</u> GZA comments that EPA's "Technical Impracticability Evaluation Report (TI Report) … states that 'No samples from any water supply or bedrock monitoring wells anywhere on the Site have been found to have concentrations of solvents exceeding or even approaching one percent of the effective solubility.' (The one percent of effective solubility is one of the criteria for evaluating the potential for DNAPLs to be present.)"

Response to DMC Comment 3: The Remedial Investigation Report (RI) does state that concentrations well above 1% solubility concentrations are indeed present in the overburden at the DMC property.

GZA has taken statements from the RI Report (incorrectly identified as being from the Technical Impracticability Evaluation Report) out of context regarding the fact that no groundwater samples from bedrock monitoring or supply wells contained concentrations above the 1% solubility level. The RI statement simply acknowledges that the bedrock groundwater concentrations are below the 1% solubility criterion. However, the deep open hole intervals and complex fracture network, significant borehole dilution, as well as other factors related to DNAPL migration in fractured bedrock, will likely preclude the detection of concentrations close to 1% solubility. For this reason, the 1% criterion has limited applicability to existing bedrock wells.

The RI does present evidence supporting the presence of DNAPL in both the overburden and bedrock, such as: concentrations well above 1% solubility concentrations in the overburden at DMC, the bedrock plume attachment to the spill/release (source) areas, and the persistence of contamination for several years in both overburden and bedrock groundwater. [See EPA Remedial Investigation Report, June 2005, Section 4.2.2.5, and EPA Technical Impracticability Evaluation Report, June 2005, Section 3.3.1.2.]

DMC Comment 4: GZA comments, "While theoretically there may have been, at one time, some extremely limited areas (proximate to Monitor Well MW-2 and the original MW-6) in the overburden on the DMC property where DNAPLs may have existed, both of these areas have been subject to remediation (the former in the form of an aggressive and very successful multi-phase extraction system, and the latter by soil removal through trenching and gravity drainage of overburden groundwater into a drain system installed for this purpose). Available evidence suggests that it is doubtful that any but very small and discrete globules of DNAPL exist any where on the DMC property and certainly nothing resembling the extent depicted on the maps presented by the USEPA."

Response to DMC Comment 4: EPA's contractor M&E used an approach based on lines of evidence to evaluate the possible extent of DNAPL and considered other Site factors that may have exacerbated the DNAPL problem at the Site. In general, due to significant historic pumping from deep open-hole supply wells in the area, the fractured nature of the aquifers, and the possibility of sources at DMC, Strong School and 174 and 168 Main Street, it is conceivable that DNAPL could have migrated to the areas depicted within the zone of Conceptual Maximum Extent of DNAPL. [See EPA Remedial Investigation Report, June 2005, Sections 4.2.2.5, 4.3.2.3, and 6.4.2.2. See EPA Technical Impracticability Evaluation Report, June 2005, Sections 3.3.1.2, 3.3.1.3, and 3.6.]

GZA states that areas on the DMC property where DNAPLs may have been located were subject to successful remediation. In several letters and messages to DMC in February 2005, EPA repeatedly requested information regarding the on-site remediation systems that DMC claims to have implemented. Information regarding the performance of the multi-phase extraction system and the trench drain was never provided to EPA. Without confirmation of the performance of these systems, the Remedial Investigation and Feasibility Study Reports (RI/FS) were completed assuming that the systems could be successful as containment measures at best, but because of the complex hydrogeology (very tight, fractured till formation and fractured bedrock) and the passive nature of these remediation systems, significant source depletion would be unlikely.

GZA further states that "available evidence suggests that it is doubtful that any but very discrete globules of DNAPL exist any where on the DMC property." This evidence has not been presented to EPA. Data evaluated in the RI suggests that DNAPL could be more widespread than "discrete globules." Given the Site history and the recalcitrant nature of the chlorinated solvents released at the Site and the inherent limitations of the remediation technologies that may have been applied at DMC, in EPA's judgment, it is not likely that any of the current remediation systems cited by DMC would be successful in reducing DNAPL at the volume suspected to have been released to a few discrete globules in the timeframe that they have been operating, based on reports from DMC.

DMC Comment 5: GZA commented that if public water is provided to the Site-wide Groundwater Study Area, there is much less of a risk driver to compel remediation at the DMC property. GZA also states that the TI Report [EPA's Technical Impracticability Evaluation Report, dated June 2005] suggests that source area remediation will not significantly enhance the overall site remediation and that there are no technologies currently available to effectively remediate a DNAPL source zone in complex hydrogeologic environments in a reasonable time frame and at reasonable cost.

Response to DMC Comment 5: Even if public water is provided to the Site-wide Groundwater Study Area, the excavation at the DMC Study Area will provide important risk reduction benefits. The overburden groundwater presents a potential threat to a future construction worker. The soil excavation will mitigate this potential risk by reducing the levels of contamination in overburden groundwater. Compared to other alternatives, elimination of hot spot areas through excavation is the alternative that provides the greatest degree of overall protection of human health that is technically practicable at this study area. The excavation alternative also provides for a shorter timeframe for remedial action, which is desired to reduce the potential for human exposure.

Additionally, removal of the hot spot source zone will mitigate a potential threat to Site-wide groundwater. EPA acknowledges that sources within fractured bedrock beneath the overburden sources likely cannot be removed and has chosen to take no remedial action for the Site-wide Groundwater Study Area (beyond monitoring bedrock groundwater), with a contingency measure of groundwater extraction for containment purposes should groundwater contamination migrate. The removal of source zones will minimize the chances that the contaminated plume will migrate into areas that are not currently contaminated.

Excavation of the hot spot areas is consistent with EPA guidance recommending that source areas should be removed to the extent practicable. EPA's Technical Impracticability Evaluation Report (TI Report) concludes that if it is not practicable to restore groundwater to drinking water standards in a reasonable amount of time with existing technologies, a waiver of federal and state applicable or relevant and appropriate requirements (ARARs) that would normally require cleanup of groundwater to meet drinking water standards is warranted. A Technical Impracticability waiver, however, does not preclude the need for source zone depletion. Consistent with EPA's Guidance for Evaluating the Technical Impracticability of Groundwater Restoration, September, 1993, EPA expects sources of contamination to be removed or controlled to the extent practicable:

> "A demonstration that ground-water restoration is technically impracticable generally should be accompanied by a demonstration that contaminant sources have been, or will be, identified and removed or treated to the extent practicable."
>
> "The appropriate level of effort for source removal and remediation must be evaluated on a site-specific basis, considering the degree of risk reduction and any other potential benefits that would result from such an action."

The excavation source remedy at the DMC Study Area is consistent with EPA's National Contingency Plan, which is the regulation governing Superfund cleanups. Where groundwater ARARs are waived at a Superfund site due to technical impracticability, EPA's general expectations are to prevent further migration of the contaminated groundwater plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction measures as appropriate (pursuant to the National Contingency Plan, section 300.430(a)(1)(iii)(F)). These expectations should be evaluated along with the nine remedy selection criteria to determine the most appropriate remedial strategy for the site; one of the threshold criteria is protection of human health and the environment.

Excavation at the DMC Study Area will also remove any soils exceeding Pollutant Mobility Criteria (PMC) pursuant to Connecticut Remediation Standard Regulations (RSRs). These pollutant mobility criteria are designed to protect groundwater from contaminants leaching through contaminated soil.

Contrary to what GZA suggests, the TI Report does not state that source remediation will not enhance overall site remediation and that there are no technologies available to remediate a DNAPL source zone. The technologies discussed in the TI Report are in-situ technologies that were considered to potentially restore both overburden and bedrock groundwater to ARARs. The TI Report indicates that the success of these technologies in restoring aquifers and in source reduction would be limited by the complex hydrogeology and because the DNAPL may be inaccessible to them. While complete source zone restoration is not an expected outcome, remedial alternatives addressing source zones in unsaturated overburden at the MMC Study Area and saturated overburden at the DMC

Study Area were retained primarily because depletion of source zone within these areas could potentially decrease the mass flux of contaminants to overburden and bedrock groundwater. Excavation at the DMC Study Area would remove all soils and pooled and/or residual DNAPL residing within the soil, and therefore potentially result in significant source depletion.

DMC Comment 6: GZA states that excavation of large portions of the overburden materials on the DMC property would be ineffective, excessively costly in light of overall benefits to Site restoration, disruptive to ongoing business operations, and potentially damaging to the overall site in that actions could mobilize currently isolated contamination.

Response to DMC Comment 6: EPA's contractor M&E estimates that actual excavation would likely require 30 days of onsite work based on the proposed area of excavation (two times the estimated hot spot areas, approximately 5,000 cubic yards). This assumption includes a period of 10 days to set up and prepare for the excavation (such as erosion controls, excavation support, and utility locating); a period of 10 days to excavate the soils (assuming 500 cubic yards per day); and 10 days for backfill and restoration activities such as paving and reseeding vegetated areas. Disruptions could be minimized by maintaining access at all times to the parking and delivery areas and by carefully scheduling utility shut downs if needed. Traffic re-routing may be necessary during this period. EPA is committed to working very closely with the Durham Manufacturing Company to ensure as minimal disruption as possible to its ongoing business.

Although the costs of excavation are partly based on volume of material to be handled and utility/excavation support needs, a major cost is the anticipated disposal fee assuming the soil requires disposal as a RCRA waste (Resource Conservation and Recovery Act). If treatment of the soils can be demonstrated, and additional analytical data obtained, it may be possible to dispose of the soils for lower fees. Additional sampling of the soil will demonstrate exactly what volume of soil requires excavation. The cost of this excavation is reasonable given its risk reduction benefits as described in EPA's response to DMC Comment 5.

The excavation remedy will be designed with precautions to prevent mobilization of contaminants. Examples of such precautions include excavation in discrete lifts and continual visual observation and air monitoring during excavation so that if DNAPL is encountered, it can be removed prior to proceeding with deeper excavation. These precautions have been applied successfully at other sites to prevent mobilization of DNAPLs and other contaminants during excavation.

DMC Comment 7: GZA states that the DMC property should not be included in the Record of Decision and that a supplemental Record of Decision should be developed for the DMC site. GZA recommends that any decision consist of a flexible remedy and time frame which refers to ARARs that consist primarily of Connecticut's Remediation Standard Regulations. Any risk to a future construction worker can be readily mitigated through the imposition of a site-wide soil management and health and safety plan. Any perceived risk of inhalation exposure to future residents on site can be mitigated through institutional controls that provide for installation of vapor controls under any new residential structures built on DMC property or an Environmental Land Use Restriction prohibiting residential development.

Response to DMC Comment 7: As previously stated, in the Response to DMC Comment 5, as part of the excavation remedy, and as required by EPA's Technical Impracticability Guidance, excavation will remove source areas to the maximum extent practicable. The soil contamination at the DMC Study Area exceeds the Pollutant Mobility Criteria (PMC) established by the Connecticut Remediation Standard Regulations (RSRs). EPA's action will address these exceedances. It is also anticipated that an Environmental Land Use Restriction (ELUR) pursuant to Connecticut RSRs will be implemented to address potential future risk to both a construction worker and future residents. EPA believes that excavation of the source zones provides a significant risk reduction measure to mitigate potential human exposure and to eliminate a threat to Site-wide groundwater that should be implemented in addition to the ELUR. Given the information developed in the RI and the FS, there is no reason to develop a supplemental Record of Decision for the DMC Study Area.

DMC Comment 8: GZA states that there has been no spread of the groundwater plume and therefore no justification to increasing the number of affected potable supply wells from 35 to 85.

Response to DMC Comment 8: Some degree of dissolved plume containment within the Site-Wide Groundwater Study Area is likely achieved by the residential wells currently in use. Initially, pumping of these wells likely caused migration of the plumes from source areas causing them to be as widespread as currently shown in the RI. However, continued operation of the residential wells likely limits further spread of the plume beyond the wells. If some of the water supply wells closer to the MMC and DMC are shut off, while other more distant supply wells remain pumping, further spread of the plume could result. Thus, it is reasonable to extend the public water supply to wells that could potentially cause future spread of the plume.

In addition, while all of the private wells with groundwater contamination at or approaching drinking water standards (38 wells total) are currently being filtered and monitored under state order, a number of wells without filters have groundwater with trace amounts or low concentrations of contaminants that do not exceed drinking water standards. It is prudent to include these private wells.

Finally, protection of human health is of primary importance, and thus it is critical to ensure that all wells that could potentially be impacted by Site contaminants are included in the alternative water supply. While the groundwater plume location has generally been very stable, it is reasonable to include a buffer zone of residences located near the contaminated area to ensure that all drinking water wells that are currently or conceivably could be impacted by contamination emanating from the Site are included.

DMC Comment 9: GZA states that the assumptions for the Point of Use treatment alternative (carbon filtration and monitoring) are flawed. There is no justification for increasing the number of affected potable supply wells from 35 to 85. With the possible exception of a few wells which contain unusually high concentrations of VOCs, the frequency of carbon changes in the existing filtration systems is no greater than annually. There is no basis for expecting that carbon systems will require five changes per year. There is no justification for including metals treatment on an estimated ten wells in the southern portion of the Site. There is no evidence to suggest that there are metals associated with the Site-wide groundwater plume, and the majority of metals detected in potable supply wells are most likely attributable to plumbing in the systems.

Response to DMC Comment 9: The number of wells included in the Point of Use water supply is based primarily on the need to ensure protection of human health. It is critical to ensure that all wells that could potentially be impacted by Site contaminants are included in the alternative water supply. As previously stated, while the groundwater plume location has generally been very stable, it is reasonable to include a buffer zone of residences located near the contaminated area to ensure that all drinking water wells that are currently or conceivably could be impacted by contamination emanating from the Site are included. In addition, while all of the private wells with groundwater contamination at or approaching drinking water standards (38 wells total) are currently being filtered and monitored under state order, a number of wells without filters have groundwater with trace amounts or low concentrations of contaminants that do not exceed drinking water standards. It is prudent to include these private wells. The scope of the Point of Use water supply alternative matches the service area proposed for the other alternate water supply alternatives. This includes properties located on both sides of Maple Avenue.

Estimated carbon change frequency is based on conservative estimates of system performance in relation to a range of anticipated contaminant concentrations. This includes quarterly changes for the primary filter(s) in each system and annual changes in the back-up filters. Actual filter media change frequency will be a function of the characteristics of the influent contaminants. There are several wells in the area that contain breakdown products, most notably vinyl chloride in the southern half of the site, which cannot be as readily removed by carbon filters. As primary contaminants continue to degrade over time, it is prudent to assume that more frequent filter changeouts will be required for these breakdown products.

Metals, in exceedance of regulatory requirements have been detected in bedrock groundwater within the Site. Comprehensive sampling for metals has not been performed, but based on the available data, an estimate of the number of required treatment systems for metals has been included. Based on the extent of available metals data, it would be difficult to identify the source of metals contamination. However, it is clear that metals treatment would be necessary at some locations, and that some of the metals are not likely due to household plumbing (e.g., arsenic).

DMC Comment 10: GZA notes that a study commissioned by the Town of Durham to investigate the feasibility of connecting the Durham Meadows Superfund Site to the [City] of Middletown water system concluded that the cost to maintain the carbon filtration systems for 50 years would be approximately $3,580,000. The discovery of 1,4-dioxane in a limited number of potable supply wells cannot account for the difference between this estimate and the EPA estimate of $7.2 million.

Response to DMC Comment 10: The study commissioned by the Town of Durham that GZA references is a report authored by Fuss & O'Neill, dated December 2000, included as Appendix I of an Aquasource Feasibility Study also dated December 2000. (This December 2000 Fuss & O'Neill report should not be confused with the May 2000 Fuss & O'Neill report referenced earlier; although the reports are similar, the cost estimates presented in each are not identical.) The December 2000 Fuss & O'Neill report does present a present worth cost for carbon filtration systems of $3.58 million. This included only operation and maintenance costs for a total of 48 point of use treatment systems. Capital costs were not included in the cost analysis. The present worth cost was calculated applying a 25% contingency factor and using a 50 year time period with a 6% discount rate.

The FS included a present worth cost for AWS-4 Point of Use Treatment of approximately $7.2 million, including approximately $330,000 in capital costs. The cost analysis included point of use treatment installation, and operation and maintenance for 85 locations. In accordance with the U.S. Army Corps of Engineers/U.S. Environmental Protection Agency manual, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002), dated July 2000, the following contingencies and program cost components were included in the operation and maintenance costs:

- Cost Contingency: 30%
- Technical Support: 15%
- Project Management: 5%

The AWS-4 Point of Use Treatment cost analysis was also calculated using a 50 year time period and included a 7% discount rate. Although the presentation of operation and maintenance cost elements does not exactly match between the two evaluations, the difference in present worth costs between Alternative AWS-4 and the Fuss & O'Neill report is due to the number of wells (85 vs. 48), the capital cost element included in the FS that is not included in the 2000 Durham Study, and the difference in operation and maintenance contingency and program costs.

DMC Comment 11: GZA notes that a study commissioned by the Town of Durham to investigate the feasibility of connecting the Durham Meadows Superfund Site to the

[City] of Middletown water system concluded that the cost to connect the Superfund Site to the City of Middletown's water system (8-inch mains without fire protection) would be, in 2000, approximately $3,440,000, compared with EPA's estimate of $7.0 million.

<u>Response to DMC Comment 11:</u> The study referenced by GZA is the December 2000 report authored by Fuss & O'Neill as described in the previous response. (Again, this December 2000 Fuss & O'Neill report should not be confused with the May 2000 Fuss & O'Neill report referenced earlier; although the reports are similar, the cost estimates presented in each are not identical.) The December 2000 Fuss & O'Neill report referenced by GZA includes a capital cost of approximately $3.44 million to construct an eight-inch waterline, not including fire protection, to provide service to the Site.

EPA's Feasibility Study provides a variety of cost breakouts for Alternative AWS-2, Connection to Middletown Water Distribution System, with respect to fire protection. The EPA estimate of $7.0 million referenced by GZA is for a six-inch main without fire protection; this estimate includes a capital cost of $4.55 million, and then adds additional costs for operation and maintenance and other periodic costs incurred over 50 years. The EPA cost estimate to provide an eight-inch main with fire protection (including hydrants) includes a capital cost of $4.78 million, plus additional costs for operation and maintenance and other periodic costs incurred over 50 years.

A major difference in the capital cost estimates provided in the December 2000 Fuss & O'Neill and in EPA's Feasibility Study related to the contingency, engineering, project management and construction management factors applied to the base costs. As mentioned previously, in accordance with the U.S. Army Corps of Engineers/U.S. Environmental Protection Agency manual, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002), dated July 2000, the following contingencies and program cost components were included in the operation and maintenance costs:

- Cost Contingency: 30%
- Technical Support: 15%
- Project Management: 5%

Fuss & O'Neill applied similar factors, but in total, the contingency and program cost components were a smaller percentage than that used by EPA. Eliminating these cost factors from both the December 2000 Fuss & O'Neill estimate and the estimate in EPA's Feasibility Study results in base capital cost estimates that are much more similar ($2.548 million for the Fuss & O'Neill evaluation, and $2.909 million for EPA's six-inch waterline alternative). In addition, the accuracy of cost estimates within a Feasibility Study is expected to be between -30 and +50 percent [USACE/USEPA, 2000]. The difference between the base cost estimates ($2.548 million and $2.909 million, not including cost factors), as well as the total capital cost estimates ($3.44 million and $4.55 million, including all cost factors), is within this range.

ATTACHMENT A: Transcript of Public Hearing (July 28, 2005)

ATTACHMENT B: Written Comments Received During Public Comment Period (July 13, 2005 to August 12, 2005)

Attachment A

Transcript of Public Hearing (July 28, 2005)

UNITED STATES OF AMERICA

ENVIRONMENTAL PROTECTION AGENCY

BOSTON REGION

In the Matter of:

PUBLIC HEARING:

RE: DURHAM MEADOWS SUPERFUND SITE

Durham Public Library
7 Maple Avenue
Durham, Connecticut

Thursday
July 28, 2005

The above entitled matter came on for hearing, pursuant to Notice at 8:00 p.m.

BEFORE:

MARY JANE O'DONNELL, Section Chief
ANNI LOUGHLIN, Project Manager
JAMES MURPHY, Community Involvement Coordinator
EPA, Region 1
1 Congress St., Suite 1100
Boston, MA 02114-2023

I N D E X

P R O C E E D I N G S

(7:00 p.m.)

MS. O'DONNELL: My name is Mary Jane O'Donnell. As Anni mentioned, I'm a Section Chief with the Environmental Protection Agency in Boston and I will be the Hearing Officer for this part of the meeting.

Just a couple of introductory points. Anni's elaborated on how to comment, when to comment, add just a little bit on why to comment from my prospective.

I work on, beside sites in Connecticut, I also work on sites in Maine and Vermont, and I can't tell you how many sites get revisions or whatever with modifications we have made in terms of revenues and how we approach a site, based on public comment. So it's very important for us to get a diversity of prospectives. So if there is some hesitancy on your part in coming forward, I would strongly encourage you to come forward and make a comment.

Just as Anni mentioned, in terms of some ground rules, so to speak, I'd ask you to come forward, come to the podium, state your name, your association with the site. And as Anni mentioned, also, because this is a formal public hearing, we won't be responding to your comments and questions, but we certainly will be here after the formal hearing to try to do that.

So with that as background, I'm going to start on this side of the room, front to back, and then front to back on this side.

So is there anyone working on this side that would like to come forward and make a comment? Again, state your name, association with the site and your comment.

MS. BOORD: I'm Maryann Boord, the First Selectwoman of the Town of Durham.

The Board of Selectmen of the Town of Durham compliments the Environmental Protection Agency on its comprehensive proposed cleanup plan for the Durham Meadows Superfund Site. Excavation and off-site disposal of soil at and adjacent to the responsible parties is essential to effective cleanup, as well as to putting the residents' minds at ease once cleanup has been completed. Maximum attention should be given to minimizing the impact of cleanup activities on neighboring properties and residences. Also essential is future monitoring for possible plume migration.

While institutional controls should be implemented to protect current and future occupants, we request that you do not place excessive limitations on future use of the properties. Please keep in mind our rural character and our Main Street Historic District.

When you enter into negotiations with the responsible parties in a spirit of fair mindedness, we request that you seriously consider the financial contributions already made by the Durham Manufacturing Company. The board supports future connection to the Middletown Water Distribution System or another alternate source of public water. Please note that the Town of Durham has maintained open dialogue with Guy Russo, Director of Water & Sewer, for the City of Middletown, since that possibility was first considered many years ago.

The seriousness of the contamination and the, quote, inconvenience experienced by the residents in the affected areas these many years cannot be minimized; however, it appears there is hope on the horizon.

We thank you for your attention to our concerns for the future of our town and its water supply.

Sincerely, Maryann P. Board, First Selectwoman; Ernie A. Judson, Selectman; Renee J. Primus, Selectwoman.

MS. O'DONNELL: Thank you.

Next row, comments. Thank you.

MS. DODGE: My name is Allison Dodge. I'm here on behalf of Congresswoman Rosa Delauro, who is in Washington this evening, but asked me to read the statement for this evening's hearing.

I am pleased to have this opportunity to speak before the EPA and the Durham community, as you review the proposed remediation plan for the Durham Meadows Superfund

Site.

As we are all aware, their remediation plan for the site has been a long time coming. It is my hope that the EPA will work diligently to finalize a record of decision in a timely manner which fully addresses the needs of the properties and businesses which have been impacted by the contamination; and most importantly, protects the health and safety of the residents of Durham.

There are a number of steps which need to be taken in order to address soil and groundwater contamination of the Durham Meadows site. This has already been a lengthy process, and while I understand that there are statutory guidelines which must be adhered to, it is my hope that the EPA will issue a final record of decision as soon as it is feasibly possible within the limits of the law. Once a final record of decision has been issued, I would hope that the EPA will move quickly to alleviate the strain the superfund designation has put both on business and residential home owners in the area.

Upon review of the proposed cleanup plan, I believe that the direction in which the EPA is proceeding will effectively address necessary human health and environmental protections. It is my understanding that the EPA will be balancing these protections with future land use restrictions for the properties. Although it is expected that the Durham Manufacturing Company will continue to use the property for its current purposes, I believe that it is important for these restrictions -- that these restrictions do not indefinitely prohibit the redevelopment of the Merriam Manufacturing property.

Though I have not been contacted with any concerns regarding this proposed remediation plan, I urge the EPA to listen closely to any concerns which may be raised by local officials, residents, and most importantly, those individuals who are directly impacted by the selected remedy. I know that the affected residents have had to endure many years of hardship. Their unique prospective on this case must be given full consideration. These are the individuals who know this area and understand the needs of the town, its families and businesses.

I appreciate your time and attention to my comments. I look forward to the expeditious resolution of this matter.

MS. O'DONNELL: Thank you.

Next row.

Excuse me. Anyone else? Okay. I'd like to go front to back, if that's possible

MS. PRIMUS: I'm Renee Primus, a member of the Durham Board of Selectmen, and I also would like to give my support to the EPA for their proposed cleanup plan.

I compliment you on the use of data-driven conclusions to generate the proposed plan, and there are special considerations that I'd like to be given in the following four areas.

The first is that due to the extent of the contamination and the identified constraints, I believe that connecting to the Middletown public water system should be the highest priority of this plan.

I also believe that institutional controls over affected areas should be implemented appropriately for the protection of current and future occupants and neighbors.

And I request that maximum attention be given to minimizing the impact of the cleanup activities on neighboring properties and residents.

And, last, I'd like to request that the negotiations be fair minded, with special consideration to Durham Manufacturing Company, who has been actively servicing the properties of contaminated wells and is currently the only company servicing these contaminated wells.

Thank you.

MS. O'DONNELL: Thank you.

Would you like to leave that with the -- thanks.

MR. KALINOWSKI: My name is Raymond Kalinowski. I am currently the State Representative serving the Town of

Durham. I'm also a former First Selectman for the Town of Durham from 1997 to 2001. I am a 32-year resident of the town and I'm pretty keenly aware of the problem as it currently exists and I've had many dealings with EPA when I was First Selectman, and I recently was in contact with your Boston office regarding my written comments and my recommendations as to how we should proceed here in the future.

Early in my first term, I believe it was 1998, I made some contacts with public officials from the City of Middletown, which were very productive. I think the political operatives in Middletown were very receptive and I think the solution lies in bringing water from Middletown to Durham.

As was mentioned on the slides by Anni, they do have a sufficient capacity in Laurel Brook Reservoir for that particular water to come from. And I think with the proper funding in place, this would be the solution to the problem.

When Merriam Manufacturing burned down in 1998, we also found a need at that time for a possible fire flow capacity and the ability to fight fires in the area on Main Street, because that was a huge fire and we had to truck, shuttle water in from various locations nearby, and it was a very difficult time.

So with a proper water main constructed, coming Middletown to Durham, I think not only will it solve the water contamination problem, but have the ability to have fire flow capacity, also.

I would like to mention and I did mention this in my correspondence recently to EPA that the potential responsible parties -- namely, Middletown and Durham Manufacturing -- have different capacities of cooperation over the years. And Durham Manufacturing also deserves special mention because they always have been very cooperative, and I think that should be taken into account when the actual negotiations take place, and they should be viewed in that particular light.

I know there were consultations made in EPA in Washington, I believe last week, I don't know the results of that, but I think the ongoing process, and when this particular decision is finally reached, I think they can probably come to a fair and reasonable method of determining responsibility and what funding mechanism will be put in place to solve it.

As a State Representative, I will do my part in Hartford to get the parties together for further discussions on funding for this particular main, if indeed it does come to pass.

And so, again, I want to thank EPA for the presentation made tonight, and I'm also always available, along with our First Selectwoman and the next administration for further consultation.

Thank you.

MS. O'DONNELL: Thank you.

Comments on this side of the room. I'll change the sequence here. Okay, front to back, I guess, I won't change my sequence.

MR. PRAMELEE: My name is Richard Pramelee. I'm a resident of Durham, relatively new resident, I guess.

I wasn't aware of this meeting until I got home and saw it in the paper tonight at 6:30. And I have some very serious concerns about the source of water, and probably the biggest thing I learned here tonight was there's no source of funding, and I consider that a very significant component. Very significant.

It's hard to make a decision on which way we're going to go if we don't know where the money is coming from. I'm not interested in running anyone out of business. We have a very responsible member of the community, the Durham Company has been here a long time, they've acted in a very responsible manner.

Prior to this situation with the water, I know years back, when we had fires and ambulance needs, the payroll, the staff at the factory was diminished during the day, when they went out on these calls, and the Durham Company allowed this to go on. And they've done many other things probably that I don't even know about.

Apparently the other party has decided the remedy to their obligation would be to give us the property. I was overwhelmed with the gift. I don't need gifts like that.

I have some concerns about public health outside of what you apparently mentioned here tonight, and when Mr. Kellish, Dan and his brother both spoke, they're one of the few residences that I know of on Main Street that updated their septic systems. There's been very few others, to my knowledge. By observation, I know that theirs was done. And I think that this, before we start, we should address that issue, also, even if we have to do it as a community.

You mentioned shallow depths. You showed a cross-section, but you mentioned no depths, so I guess you're going to have to go back and look at the CD.

The town has bought properties over the years and the White Farm down here, when we purchased that property, we had federal money to buy that property with, and the stipulation was -- and I went over this with the selectmen when they were looking for sources of water.

The principal source of that money from the federal government was for future use of water. That's principally how we got the money. We wanted to buy the land. Okay? And we did. And there's restrictions on what we could do with it, even though we let farmers use the land, including the farmers that owned it prior. They had limitations on it. And when they were thinking about do something about water here, they seemed to make a big deal out of the fact that the local agency, the Conservation Commission, was going to let them do something over there.

Well, I don't think they really had any choice. That's ours. The federal government gave us money and that was a big pretense of what that money was to be used for.

The wells down there belong to the Town of Durham. That's on town property. You can call them Durham federal wells, you can call them anything you want. We own that property. I was there when that system was put in. Physically present.

I can tell you where the main ends up here by the house where the State Police Resident Trooper has his office. That's how close it comes. When I mentioned it to them, when you were looking for a source for water, they pooh-poohed me. Know what I mean? Or now I guess we're going to go there.

But as far as I can see, I don't want to be particularly intrusive and I don't like to see -- I'm in the construction business. I do it every day, on somewhat large scale, probably, to a certain degree. I don't want to see everything all dug off. I don't know what you're proposing. You're talking about cleaning up the soils on all these properties and I don't know how intrusive it is going to be to the property owners that are actively engaged in business. And, you know, if it's not going to completely cure the problem, and maybe the point of use is the real decision.

And, I don't -- Dan, I don't consider your comments sarcastic at all. I think if you've been waiting for 35 years, you deserve some answers.

And funding is very important. I personally am not too excited about getting tied-up with Middletown. We already have an agreement with the Connecticut Water Company and I'd like to see a proposal come forth from those people. It's a private sector company, they're very effective, they're very knowledgeable, they're very efficient. Municipalities are not. I've seen municipalities operate and they're not efficient, they're not very profitable, because they have deep pockets and just pass the taxes onto us.

And like I said, I don't want to see these companies run out of business. I know one party will act in a responsible manner. I can't address what the other party may do. But I would like to see the on-site disposal systems in the area are looked into, so that we're not just bringing clean water in while we still have some problems earlier.

And I think we ought to be fair to the businesses at hand you're addressing as responsible parties, because it's -- I believe it was at the time they weren't particularly out of compliance with anything at that time. So we can't make them, you know, liable in that sense. I believe they probably were living within the framework of what guidelines there were, if there were any. And there were probably none. Well, it was none when Durham Manufacturing started. And none when Merriam started, because they go back even farther. So they're not necessarily out of compliance when some of this was coming on.

You know, times change and all of sudden you're out of compliance, and I think we've got to be fair in the way we address things and not, if we want to point fingers and point blame, we ought to be able to say that at the time that this was going on, either they were or they were not in compliance. And I don't believe personally that they were particularly were out of compliance and I don't think there was anything in place. And at the time they were both built, there was nothing in place. So they weren't out of compliance.

So I think we should be fair with any comments of a negative nature that might come up, to the businesses, both of them.

But I'm very concerned about the money and I want to know where it's coming from. I am a taxpayer. I lived here for a while and I am concerned. And federal money is still my money. And by the same token, I'm not interested in running these companies out of business, but I want to know where the money is coming from. That is important.

Thank you.

MS. O'DONNELL: Anyone else on this side that would like to make a comment?

Next row.

MS. VIOLA: Good evening. My name is Donia Viola, and I live here in Durham, not on Main Street, but nonetheless very much involved and concerned about what is going on to residents here that, quite frankly, should have the luxury and affordability of clean water, whether it comes from a well or an outside source.

Relevant to this discussion, I would just like to start off and say that since the informational hearing held on July 15th this year, concern was raised by another woman resident and myself as to testing being done in the immediate of Strong School, because of the school's history as to having a bus depot there until the early Seventies, and an instructional program in automotive maintenance and repair, as well, when it was Durham High School.

I would hope there has been some kind of action taken to address this, because these might possibly have contributed to the pollution, also.

It's a negative situation. Moneys paid by Durham Manufacturing, I think also included a fine of $25,000. And I am aware that the company has helped with filters for properties affected, but the bottom line is the majority of the pollution seems to come from Durham Manufacturing and Merriam Manufacturing. They are the principal parties that have been identified, which caused this problem, and perhaps even Regional School District 13 with Strong School site.

I have talked again with Mrs. Delmyer, whose residence is on Route 17. Unfortunately, with her kennel business, I guess she wasn't able to make it tonight, because she did say she planned to attend if she could.

Well, her property abuts the village shops and her and her husband, Fred, also own substantial amount of property across the way from the Time Out Tavern abutting Route 77, and who were also approached by Aqua Source when they were in business here. But that, of course, went down the tubes because we took over our own water company to, suffice to say, address our serious issues.

I would hope that she be given consideration for the possible location of the well, which might serve and be substantial for the residents in need and those that are in with the plume effect.

Imagine the cost could be lower with the same results. Durham currently has, as I said, their own water company, Connecticut Water Company. And rather than have another water company, especially if there is another clean local source for clear and potable groundwater, I would encourage and support from our own natural resources within our own town borders.

Thank you for your time.

MS. O'DONNELL: Thank you.

MR. GRECCO: My name is Richard Grecco. I'm the local Chairman of the Chamber of Commerce in town here, I'm also a local businessman here.

Basically, I'm here in support for the Chamber to support Durham Manufacturing. They've been a very good corporate citizen and they've come forward and done everything possible to correct the cleanup site, and it will be a tragedy if we were to impose on them too much and drive them out of business.

Durham Manufacturing has been severely impacted by the process. They've spent, people have talked about how much money, $4 million already into this, and it's cost them 60 jobs to fulfill their requirements already. And with any more demands placed by the EPA, they possibly could go out of business.

Since they are, I believe, the largest taxpayer in town, that is a major concern to you people as taxpayers, also. They do want to compete in the business environment, they do want to go forward and add jobs, but under the current rules, they do need some help.

Also, the last thing I'd like to say is that they have done their fair share to help the town with the situation and I think a little bit more pressure should be put on Merriam.

Thank you very much.

MS. O'DONNELL: Thank you.

Next row.

MS. HOFER: Hello. My name is Renee Hofer, I live at 63 Maiden Lane, which is on the east side of Ball Brook, close to the Durham Manufacturing area.

I just wanted to stop in tonight and put in a couple of concerns or comments that I have. Based on my understanding from the presentation that we attended at the high school, we have a couple of givens regarding the fact that we have fractured bedrock and that this DNAPL is a bit unpredictable as far as how it travels through the bedrock.

Because I'm currently outside of the plumes, but very closely outside of the plumes, I think it's very important that we take into consideration how this remedy is going to impact the plumes and their location.

I have concerns regarding the impact of digging to produce this water system and bring it in and what impact that that is going to have on this DNAPL and the fractured bedrock.

I have serious concerns about the future development on the site or the sites surrounding it. Most particularly, not too far in the recent past, there have been some discussions regarding developing the property on the east side of Ball Brook, and I'm concerned as to how that would impact the bedrock, when you start digging and start adding traffic and additional pressures, what that will -- how that will impact that area and the health of the town, in general.

With regards to the water system going on there, one of the first questions, again going back to how this contamination of the plumes may spread, it was mentioned that if we turn off all the wells, which is what would happen when we put in this water system, again, how is that going to impact these plumes and the direction or the flow?

So moving forward from that point, if after you've gone and installed this new water system, whether it's to Middletown or to some other source, and that plume then spreads, how does this contingency plan or whatever work and how would that impact the situation that may have to extend that water system or to take care of those residents who might then be affected by it?

I also have some concerns regarding how the agreement with Middletown is going to be reached and how we are going to pay for it every year. I'm sure that Middletown is not going to provide us with water without an annual expense and annual cost that will extend forward from that time forward. Who pays for that, and do we happily do it, or is there some sort of remedy included in that?

The other additional point that I would like to make, I think it's very important to recognize that Durham Manufacturing has been a responsible citizen. We appreciate that. But I do think it's important to keep in mind that they are, in fact, responsible in an extent to it, and I hope that they will approach these negotiations and appreciate -- or take it in the same responsibility or same spirit of understanding that these are the costs have been impacted on us.

I purchased my property in 1997 and I wasn't a part of causing the problem, so I'm a little concerned about making sure that other people know that I'm not real happy about paying to clean it up.

I also agree with Mr. Grecco on the fact that I think more pressure should be put on Merriam Manufacturing or the estate of anyone involved on that, so that they will also take part in the costs.

And the last point is, is also to take into consideration, if we choose Middletown as a future water source, that how the development of that city will impact the future of the water supply. I mean, if Middletown continues to expand at its present rate or it continues to grow from that point, how will that impact the supply of water in the grand future?

Thank you very much, and I do appreciate having an opportunity to make the comment.

MS. O'DONNELL: Thank you.

Next row.

MR. O'NEAL: I'm Bill O'Neal, 271 Main Street.

After 35 years, I think it's time to end the what ifs and maybes and what abouts and all of this baloney.

Clearly, in terms of the groundwater problem, there is only practical solution and that is to connect with Middletown. Anything else is just a dodge, a phantom well here, a Connecticut Water Supply Company there, will do nothing more than prolong this problem, and after 35 years, it's really time to get on with it. There's only one solution.

Thank you.

MS. O'DONNELL: I guess now the next row.

MR. CURLEY: Hi, good evening. I'm Hugh Curley from 715 Haddan Quarter Road in Durham.

Previously I lived actually in the house immediately south of the Merriam Manufacturing site from 1983 to '85, when that was rented by Notre Dame Church as their meeting house.

Just a couple of things I did want to say before I raise questions about the concern over the financing, and I'll get to that in a second. But I am glad to see this is done at this point.

I've been involved in various points, from my involvement as Vice-President of the Middletown Chamber for years, and I am a business development specialist today, and that's why I'm concerned about the finance side.

The question of the water, I am in favor of trying to connect the water with Middletown. It does make the most sense, and it was actually really on the table since '93, that I remember, at one of the meetings with Hank Robinson, when he was First Selectman, back in that time. So it is time to get on with this.

The question of potential impact to the community that was brought forward in this study, I found to be light on recognizing the importance of Durham Manufacturing to the community itself. It makes no mention of one of the impacts could be an adverse one on that company, the company that does provide daytime responders for our fires. It does provide a lot of things and it is an integral part of our community, and that's really not recognized in here.

I'd like to see that somehow addressed, if there are any revisions to this. But I would like to see that somehow that is connected.

On that side of their impact, I guess one of the things that has impressed me more than -- and I think I had asked this questions at one of the superfund meetings or one of those meetings we've had with EPA over the years, is to how many sites have there been where a party stepped up to the table and had three or four different additions on to their facility while it was identified as a superfund site?

And the answer came back, as far as I know, there were none; that this company has committed to trying to do the right things along, and I think that's putting their money where their mouth was; that when they had options to move different places or options to do things, they recommitted and recommitted and recommitted to not only fixing the problem that they have, but also to continuing their expansion of their business within Durham.

So I guess I'd like to see more of that on the economic and social impact side and when we get to the reuse assessments, it is saying that it's expected that the property would be used that way, but that is something that is going to be contingent upon how financial negotiations are worked out. And I do hope that everything that Durham Manufacturing has put towards this so far will be counted towards that as part of their responsibility.

So thank you again for this opportunity.

MS. O'DONNELL: Next row.

Yes, sir.

MR. SAWYER: Hi. My name is Lee Sawyer, I reside at 267 Main Street.

I wanted to express my support for the proposed 80 U.S. 2, which is the connection to the Middletown Public Water System, but I also wanted to suggest that the EPA maintain an open dialogue with the community and with town leaders in order to facilitate a more extensive connection to the Middletown Water System extending beyond just those immediate Main Street locations that are affected by the plume.

In your impracticability waiver request, you state that it would be essentially impossible to actually clean up the groundwater to usable levels, which is the mandate of the superfund that -- the EPA Superfund Mandate.

Basically, the spirit of that mandate to restore those drinking -- the drinking usable levels could essentially be followed through upon by connecting those locations outside of the immediate plume to the water system that are -- we have properties outside of the plume that are still affected by pollution that would then have usable drinking water.

So I would encourage the EPA to be as generous as possible and look for resources to assist the town in connecting the residences outside of the plume to that system, as well, because that will probably be something that will need to be done down the road, anyway. And in doing so, make sure that we can maintain an open dialogue between the EPA, the community and the town leaders, because really, according to the mandate, the EPA is really only responsible for the super -- what's going on within the borders of the superfund site.

And there's a lot of us here who are asking for public water or to be connected to Middletown's Public Water System. That doesn't necessarily have a lot of relevance to the mandate of the EPA and the superfund site, but it can and it should. And I hope that we can continue to have a conversation about this and negotiate amongst the three parties, the community members, the community leaders and the EPA, including probably the Connecticut EPA to come up with a plan and some funding to make this happen.

Thank you.

MS. O'DONNELL: Yes, sir.

MR. KELLISH: I would have spoke earlier if I knew it didn't mean anything, so I'm just going to just touch base a little bit here.

My name is Richard Kellish. And, again, I am one that's for us going into Middletown and bringing the water down from Middletown.

So like I said before, if there's some young kids are drinking this water right now and taking a shower or anything, you know what happens to kids in a bathtub and a shower, could be drinking the water. And if it's got dioxin in it, there's no way you're going to get it out with the charcoal filters.

My house is on 227-227A Main Street, it's a rental property. I would like a few questions answered. I know you're not going to answer them tonight, but I would like to know who paid for Plymouth, Connecticut. Took them six years, they had trichloroethylene, I think somebody went bankrupt, and I heard that the state paid for it.

There's another one going on right now, another town. I don't if it's Harwinton or where it is, I understand the state is paying for it. There's no reason why the state or the environmental protection cannot pay for Durham.

If anybody could be mad at Durham Manufacturing, it could be me. The state told Durham Manufacturing to drill high-yield wells, to try to get trichloroethylene out of the wells. They pumped my well dry, they pumped Pigner's well dry, and it's cost me now $11,000 out of my pocket, because I had to go another 200 feet in my well, so I'm down 400 feet now, had to put new pumps in, I had to put an ultraviolet light in. So right now it's close to $11,000 out of my pocket. There's no reimbursement for that.

But I think it's time that we laid off these businesses. They're a manufacturer, employs a lot of people, brings a lot of money, pays a lot of taxes. They pay $4 million now.

I think it's time that -- we have taxpayers here. There's -- Jim McLaughlin just brought up something. There's something like $26 million a year going into the federal government from this town. It's about time they used some of that money and brought it to Durham.

I would like to thank the EPA, but now I think it's time, we've talked long enough, and it's time that you people sit down and make a decision. It's a very important decision. There's a lot of people in this town that could be drinking this bad water.

Now they talk about the wells down at the fairgrounds. We have MBTEs coming down Maple Avenue now. It's in Maple Avenue. Charcoal filters will not take MBTEs out of the water.

How long is it before they start going down into the fairgrounds if we do go into that wells? Has anybody thought of that? Is there any way MBTEs or dioxin can get down to the fairgrounds and go into those wells? And if it can, we're just wasting our money going that way. There's only one way to go. Yes, it's going to cost us money. We're going to have to pay for water.

Somebody asked -- I don't know if she's still here. Of course, you're going to have to pay for water. We own property over at Lake Beseck, we're paying for sewerage over there, but we don't have to worry about septic systems any more. So we're going to have to pay for water.

As far as Merriam Manufacturing goes, I think -- now I don't -- don't quote me, but they -- the state was supplying water to me on Main Street because the people will not drink the water now. Okay? Because they got sent the notice that there's a trace of dioxin in our well.

Well, if you people or you people got a letter saying there's a trace of dioxin in the well, would you ever drink that water again? Even though I have my filters and stuff in there, I am now supplying the water to my tenants. That's out of my pocket, because the state took over from Merriam and now they tell me that they will not supply the water any more, so I am supplying the water.

So I think that Merriam is, now, everything is being paid for by the state. I'm not positive. But that's what they told me, that they are taking care of what Merriam took care of.

Thank you very much.

MS. O'DONNELL: Yes, sir.

MR. McLAUGHLIN: My name is Jim McLaughlin and I live at 308 Main Street, in the first house north of the plume. So I do hope that whatever you decide, you decide to keep on testing houses outside the plume, because if I end up with the problem that some of my neighbors have, I'm going to be looking to you for a solution to it.

I would like to add, too, that Durham is kind of a special town and I don't think you could find a better corporate citizen then Durham Manufacturing. They didn't break any laws. The laws were made up after the damage was done. So I think you have to give them a whole lot of consideration because they're everything everybody said they were here. They're our biggest taxpayer, they're one of our best corporate citizens without question. Many of their employees leave their work the minute the siren goes off and they've done that for generations and I suspect they will do it soon.

I would suggest that you enter into negotiations. When you go into the negotiations on trying to find the money to solve this, you remember that what Dick Kelly said was just a quick calculation. There's 2600 households in

Durham with an average annual income of $75,000. And even if they get off with paying $10,000 a year in taxes, you're talking about $26 million a year. Take that over the last 15 years that this has been a problem, and I think there was enough money going down to Washington that maybe we could get some back from the EPA.

So I think when you sit down to negotiate, negotiate with the man that has the money in EPA and see what they can kick in to solve this problem.

Thank you very much.

MS. O'DONNELL: Thank you.

This side, the gentleman in the back.

MR. KELLISH: My name is Dan Kellish and I'm the other half of the ownership on the house on 227-227A Main Street.

And I know the EPA well, because I've spent a lot of time on the phone and a lot of frustration. I wanted to add one other thing, that the MBTE that's starting to go down Main Street was supported by environmental agencies in this country. There was an article recently where Valero, which is the largest refinery in the United States right now, they have a gas station up here, but they own over 5,000 stations, and they don't -- they're fit to be tied. They're one of the wealthiest refineries in the world. They were told they should use the MBTE because it was more efficient.

Well, a few years later they found out it was contaminating the groundwater. So here we're blaming industry, Durham Manufacturing, for something they didn't realize that they were doing wrong. I guess the EPA didn't know what they were doing, either, or these environmental groups that supported an additive that makes the fuel burn better, but when it gets down in the water, you cannot separate it from the water.

And we have another source of income for this sewer system, which sits right here where those gas stations are. You've got the one where the Durham station was, across the street. They say it's not part of the superfund. It doesn't have to be.

What I believe in this country, I constantly read the Wall Street Journal, a lot of Barons investment papers, and we have a country that's the greatest country on earth, and the reason it's succeeded is because industry, workers, the government is supposed to work together, not fight each other and go on endlessly.

And like I say, we've owned the house for -- or we've been involved in this for 24 years. And my brother cited our $11,000 expenditure for drilling the well deeper when Durham was told by the state that they had to pump 100 gallons a minute. Well, they created a plume, a reverse plume, there was no water at all.

So I tend to ramble, but basically I think it's time that we support the move by Middletown. I live in Berlin and in Berlin we have a public water supply, and it's a lot better than worrying every day about whether your well is going to get polluted. And that's what we got in Durham. It could get steadily much worse. And this dioxin is a chemical that can't be stopped with the filters.

And if anybody wants to see the filters we have in Durham, it's quite an elaborate system. And so -- and I also think that Merriam, they exist. They're still in Middletown. They're down in the North End of Middletown, down there. The state apparently can't find them. Well, there's a lot of people that I know know exactly where the company is still operating. So that's a big joke in itself.

So basically I think it's time to promote this system. Durham has suffered enough. And the future of this town, what everybody forgets is the economic value of getting a water supply. You don't have to -- all the property on Main Street is going to go up and the rest of it in Durham, because somebody here had mentioned that, how do you know how far this is going to spread?

MBTE mixes with water and it was discovered in Alaska in the logging camps that it was no good. A lot of the rural areas of America banned it before it got out of control, but the governmental agencies kept pushing it to save fuel and polluted -- they say in some areas of the country one-third of all the water is polluted by MBTE, an additive to make fuel burn better.

So nobody is really to blame. Our technology is moving forward and I'd love to see this thing get solved. I think it's possible.

And like Anni said, that it'd be two years before a decision was made or before we could get water. That's unacceptable. Why should it take two years? Let's just get going with the project. And I'm sure between all the political people like Ray and the Governor and the right negotiations, I think we can solve this problem and make Durham have a good future instead of an uncertain existence.

I thank the EPA for coming and putting up with me calling them, and I intend to continue to call, but that's all I have to say. But I think this is a solvable problem and it's time to do something.

I thank you.

MS. O'DONNELL: Thank you.

I saw a hand raised in the back.

MR. HANLEY: I'm Richard Hanley. I'm on the Durham Economic Development Commission. I am not speaking for the Commission tonight, but as a member. I live at 111 Johnson Lane.

I wanted to make a few comments regarding economic development in Durham. It's been a difficult process to try to balance development here, and tonight I think I find myself in a position of economic preservation. The talk of Durham Manufacturing being the largest employer in town is also the largest taxpayer in town. And in the time of corporate Enrons and scandals, to find a corporate citizen who has been, I think, as responsible as Durham Manufacturing, I think it would be a crime to place an undue burden on them because of the fact that they are one of the last set of deep pockets around.

I would hope that the EPA and the powers that will decide this matter will consider that in their final decision.

I also come here with a personal observation. One of the ladies here tonight mentioned where we rank in the listing of priorities. I would refer you back to the maps of the plumes. And in one of the plumes sits Strong School. Strong School sees every seventh and eighth grade student in this town in public school. I have a ten-year old who will be there in two years. So I would hope that that would raise the priority.

Finally, I think that if there is precedent for public water in Durham, I have a neighbor who has been here or his family has been here since -- many, many years. And

I believe that he can trace back that there was once a public water supply in Durham with wood staved pipes that was fed from Middletown. It was cleaned, I am told, by eels to keep the pipes clean. I would also hope that the EPA does not identify eels as being something that shouldn't be in the water supply.

Thank you.

MS. O'NEAL: Dian O'Neal, 271 Main Street.

I'd just like to reiterate the situation with the MBTE. MBTE was mandated by the federal government. We didn't have a choice. Unfortunately, in their wisdom, they forgot to test the tanks, the holding tanks. The MBTE leaked from all the tanks. This is a source, as Mr. Kellish said, should be investigated, and they do have the money.

Thank you.

MS. O'DONNELL: Thank you.

Any other comments? Yes, ma'am.

MS. KEAN: I'm Karen Kean. I live at 289 Main Street, directly north of Merriam Manufacturing's property. Merriam Manufacturing is no longer there.

I'm very concerned about the water situation, also. I have two carbon filters in my cellar and last spring or last fall, I think I talked to Mike Beskin when the word came down about the dioxin and asked him if I could have bottled water. He got back to me and said, no, that

that wasn't going to be paid for. So I buy my own bottled water, like Mr. Kellish does, I'm concerned about drinking it.

Everybody seems to think tonight that the best solution is Middletown. I don't know. This is the first time I've heard about White's Farm and the possible well there or Mrs. Domyer's water. I don't know if that's worth looking into to see if it would be less expensive than Middletown. Middletown is close. The other wells are in Durham. Would it be cheaper?

Mr. Kellish's point about the chemical coming down Main Street and then coming down onto Maple Avenue, that's a concern.

I also work in Strong School. I do drink the water there. I believe it's filtered. This is unusual, though, I mean, I drink the water there, but I don't drink the water at home. I have more faith in their carbon filters, I guess.

I'm concerned about the cost. I don't make nearly 77,000. I don't make anywhere near that. I support myself. I would hope there would be some funding coming from someplace. I like the idea about our taxes. Mr. Curley said maybe our taxes should be reduced. I think they should be reduced. That's a great idea, because our property values are going down with this water situation, at least

Attachment B

Written Comments Received During Public Comment Period (July 13, 2005 to August 12, 2005)

Deb Hoyt
<debhoyt@comcast.net>
07/21/2005 09:34 AM

To Anni Loughlin/R1/USEPA/US@EPA
cc
bcc
Subject Durham Resident Comment

Hi Anni,

Our home at 97 Maple Ave., Durham is one of the impacted properties re: the Durham Manufacturing superfund site. We purchased the property in 1993 from John Patterson, a family member of Durham Manufacturing owners, who built the house for his own family on property deeded to him as a wedding present from ancestors (ironic).

I thought that I'd share our perspective as impacted homeowners.

1. We purchased the house and continue to live here because we love the property, location, and quality of life in Durham despite the knowledge that there are serious issues with the well water. We feel this way because we have confidence and trust in the continual testing process and filter effectiveness. John Neigrich of Durham Manufacturing has been a positive interface between homeowners and the testing lab.

2. As a mother of 2 young boys, I have felt more comfortable and confident drinking and cooking with our own well water (due to the filter and "clean" lab results), than I would if I was a neighbor just outside the "zone" without a filter system. I actually prefer the taste and have more confidence in our well water than I do in some "public water" systems.

3. While we would like to see the contamination eliminated, we realize the complexity and cost involved. Our greatest concern is to continue to be able to have clean, contamination-free water. We would be in favor of having a public water supply built as an alternative/corrective solution to the use of well water.

4. Our long-range plans do include relocating out of the area and selling our home. A public water system would ensure peace of mind of a potential buyer and maintain our property value.

Thank you for your efforts in addressing this problem. My husband and I are planning to attend the public hearing on July 28 to learn more.

Deborah Hoyt
debhoyt@comcast.net

Town of Durham

OFFICE OF THE FIRST SELECTWOMAN

PRIDE in the Past,
FAITH in the future.

Maryann P. Boord
First Selectwoman

July 28, 2005

Anni Loughlin
EPA New England
1 Congress Street
Suite 1100 (HBT)
Boston, MA 02114-2023

Dear Anni,

The Board of Selectmen of the Town of Durham compliments the Environmental Protection Agency on its comprehensive Proposed Cleanup Plan for the Durham Meadows Superfund Site.

Excavation and off-site disposal of soil at and adjacent to the responsible parties is essential to effective cleanup as well as to putting the residents' minds at ease once cleanup has been completed. Maximum attention should be given to minimizing the impact of cleanup activities on neighboring properties and residents. Also essential is future monitoring for possible plume migration.

While institutional controls should be implemented to protect current and future occupants, we request that you do not place excessive limitations on future use of the properties. Please keep in mind our rural character and our Main Street Historic District.

When you enter into negotiations with the responsible parties in a spirit of fair-mindedness, we request that you seriously consider the financial contributions already made by the Durham Manufacturing Company.

The Board supports future connection to the Middletown Water Distribution System or another alternative source of public water. Please note that the Town of Durham has maintained open dialogue with Guy Russo, Director of Water and Sewer for the City of the Middletown, since that possibility was first considered many years ago.

The seriousness of the contamination and the "inconvenience" experienced by the residents in the affected areas these many years cannot be minimized. However, it appears there is hope on the horizon.

We thank you for your attention to our concerns for the future of our town and its water supply.

Sincerely,

Maryann P. Boord, First Selectwoman

Ernie A. Judson, Selectman

Renee J. Primus, Selectwoman

Statement of the Honorable Rosa L. DeLauro
EPA Hearing Durham Meadows Superfund Site
July 28, 2005

I am pleased to have this opportunity to speak before the EPA and the Durham community as you review the proposed remediation plan for the Durham Meadows Superfund Site. As we are all aware, the remediation plan for this site has been a long time coming. It is my hope that the EPA will work diligently to finalize a Record of Decision in a timely manner which fully addresses the needs of the properties and businesses which have been impacted by the contamination and, most importantly, protects the health and safety of the residents of Durham.

There are a number of steps which need to be taken in order to address soil and groundwater contamination of the Durham Meadows Site. This has already been a lengthy process and, while I understand that there are statutory guidelines which must be adhered to, it is my hope that the EPA will issue a Final Record of Decision as soon as it is feasibly possible within the limits of the law. Once a final Record of Decision has been issued, I would hope that the EPA will move quickly to alleviate the strains the Superfund designation has put both on business and residential home owners in the area.

Upon review of the proposed clean-up plan, I believe that the direction in which the EPA is proceeding will effectively address necessary human health and environmental protections. It is my understanding that the EPA will be balancing these protections with future land-use restrictions for the properties. While it is expected that the Durham Manufacturing Company will continue to use the property for its current purposes, I believe that it is important that these restrictions do not indefinitely prohibit the redevelopment of the Merriam Manufacturing property.

Though I have not been contacted with any concerns regarding this proposed remediation plan, I urge the EPA to listen closely to any concerns which may be raised by local officials, residents, and most importantly, those individuals who are directly impacted by the selected remedy. I know that the affected residents have had to endure many years of hardship. Their unique perspective on this case must be given full consideration. These are the individuals who know this area and understand the needs of the Town, its families and businesses.

I appreciate your time and attention to my comments. I look forward to the expeditious resolution of this matter.

Public Hearing: July 28, 2005

I support the EPA proposed Cleanup Plan. Special consideration should be given to the following:

- Due to identified constraints, obtaining a Technical Impracticability Waiver and connecting to the Middletown public water system should be the highest priorities of this plan.

- Institutional controls over affected areas should be implemented to the fullest extent as required to protect current and future occupants and neighbors.

- I request that maximum attention be given to minimizing the impact of clean-up activities on neighboring properties and residents.

- I request that negotiation activities be fair-minded with special consideration to DMC, who is the only company currently servicing properties of contaminated wells.

Signed

Renee Primus
Durham Selectman

Lisa Larsen
<llarsen35@yahoo.com>
08/04/2005 12:33 PM

To Anni Loughlin/R1/USEPA/US@EPA
cc
bcc
Subject Durham Superfund Site

History: This message has been replied to.

I am one of the residents in the Durham Superfund Site and I'm not very excited at the prospect of going on Middletown's water. The reason? I'm an independent soul and like having my own. My family has lived in this house since 1955 and I hate to see it go on "city water".

That said, It looks like the Middletown water will be coming our way anyway. I've read the report you all so carefully prepared and I really appreiate your work. Just a couple of questions.

1, How can Merriam Manufacturing just stop the water testing in the houses along the street? This was the outcome of a lawsuit and they are obligated to continue the services. Perhaps the fire changed things? Seems a shame when Durham MC keeps holdng up their end! Whine whine whine

2. I understand that the superfund will pay for bringing Middletown water down the street and pay for the hookups to each house. Will each resident then be responsible for monthly water payments to Middletown? If not, then that's great. I've always loved having my own water and not having to pay for it.

3.If we must pay, then Durham should get some kind of monies from Middletown don't you think?

4. Has Middletown been approached about this idea or is it too early?

5. Our house was on the very old(and tiny) aqueduct water system and then switched over to wells when the aqueduct was compromised. I understand that dioxane and his friends are definitely nasty.Has thought been given or study been done considering the long term health impact for people?

Thanks for listening to my concerns and questions.

Lisa Larsen, 246 Main St Durham 860-349-8236

City of Middletown
WATER & SEWER DEPARTMENT
82 Berlin Street
Middletown, CT 06457
TEL: (860) 343-8085
FAX: (860) 343-8091

August 5, 2005

Anni Louglin
EPA
New England
1 Congress Street
Suite 1100 (HBT)
Boston, MA 02114-2023

Re: Durham Meadows Super Fund Site, Durham, CT

Dear Ms. Loughlin:

I am providing you with these written comments regarding the City of Middletown Water Department Service Extension as recommended in the EPA Proposed Plan for the Durham Meadows Superfund Site. Let me first thank you and your staff at the EPA for their close liaison with the City of Middletown in the development of EPA's alternatives and options with regards to remedying the current problems in the Town of Durham, Connecticut. As I have stated to you, and publicly on behalf of the City of Middletown Water Department and our Water Pollution Control Authority, the City of Middletown remains prepared to assist the Town of Durham with the extension of the City of Middletown water service into Durham.

While the City of Middletown remains committed to assisting our sister community, to the south, the single caveat in doing so has always been the requirement that the current rate payers and the citizens of the City of Middletown be held harmless (cost neutral) for any extension of service to the Town of Durham. I, along with staff, have reviewed the Metcalf & Eddy EPA Proposed Plan for the extension of water to the Town of Durham and would like to offer several comments, not only on the proposed EPA Plan but some alternatives that we would strongly suggest that the EPA endorse.

Metcalf & Eddy Plan – EPA Option

In reviewing the work of Metcalf & Eddy, the City has identified some additional costs that have not been included within the initial capitalization of the plan which Metcalf & Eddy has detailed to the EPA. The first item, which needs to be drawn to the surface, is the need for additional water quantity in order to service the Town of Durham. In preparation of this report, I understand that Metcalf & Eddy did contact our staff regarding the hydraulic grade line (HGL) of the City of Middletown's system in close proximity to the Durham border. The correct answer to this question was 500 feet NGVD 29. While the City maintains sufficient head for the purposes of supplying the Town of Durham, there is insufficient flow available to supply the additional customers that would be added. This small section of Middletown, in the Talcott Ridge area, is serviced by two hydro-pneumatic pumps that pump on demand, much like a residential well system. Because of the size of these pumps, and the availability of district piping in Middletown, it would not be possible to supply Durham with the additional water required unless there was an upgrading to the hydro-pneumatic pump station and an improvement to district piping to the Durham town line.

Our preferred option in this matter has always been the establishment of the Cherry Hill Water Tower. The Cherry Hill Water Tower, along with district piping and improvements to the hydro-pneumatic pump station, to a full booster pump station, would allow for ample water quantity to service the expansion of the Middletown system in a southerly direction through the downtown area of the Town of Durham.

In our initial review, following the public hearing, we understood that the $7.0 million dollar number that was discussed at the initiation meeting on July 12, 2005 was a capitalization number. Further investigation into the Metcalf & Eddy report has indicated that this was a compilation of both capital and on-going O & M. And while at the initiation meeting, I did not raise the $7.0 million dollar number as a problem. It was only because I had anticipated that the $7.0 million dollars was a capital number which in fact included refurbishment of the pump station, district piping, and funding for the Cherry Hill Water Tower. I will state again clearly, these three items would be essential for the City of Middletown to supply the Town of Durham, in the quantity that is needed, without imposing an economic hardship to the citizens of the City of Middletown.

Fuss & O'Neill Plan - City of Middletown Option

Previous to the EPA's establishment of the proposed plan, the City of Middletown Water Department, cooperatively with the DEP and the Town of Durham, had worked extensively on developing preferred options for the expansion of water service to the

Town of Durham. The preferred option is captured in the codified documents which support the EPA Proposed Plan, and we believe it addresses all of Durham's current and long-term needs. The Fuss & O'Neill report recommended a rehabilitation of the current pump station, district piping, and the establishment of a Cherry Hill Water Tower on land currently owned by the City of Middletown Water Department. Additionally, the Fuss & O'Neill report detailed the extension of large diameter water mains to the Middletown Town Line and onward through the Main Street area of Durham, terminating at the intersection of Routes 17 and 79. The large diameter water mains would allow for transmission of water through the downtown area and would allow for fire protection to most all public buildings important to the residents of the Town of Durham.

The City of Middletown Water Department understands that the charge of EPA is not to solve economic development and/or fire prevention issues in this central business area of the Town of Durham. However, it is essential that the EPA solution does not proceed in a vacuum of these other requirements. Therefore, the City of Middletown is encouraging the EPA along with area legislators, both Federal and State, to consider the establishment of a Water Development Fund to which the EPA portion from the Potentially Responsibility Parties (PRP's) will be contributed in a full capitalization of the actual costs to achieve the EPA recommended solution.

Analysis

For the purposes of detailing the relative costs of each of these proposals, I have asked my staff to take the Metcalf & Eddy Proposal, on behalf of the EPA, and add to it a set aside based on our best engineering estimate for rehabilitation of the hydro-pneumatic pump station to a booster pump station. Also, the improvements to district piping towards the Durham Town Line and the establishment of a set aside for the Cherry Hill Water Tower. The attached worksheet (Table 1) captures these costs in tabular form and is the true cost of capitalization of this project, so as not to financially impact the residents of the City of Middletown. **The cost of this construction is estimated at $7,084,294.00. It is this cost that EPA should seek to provide water as it is recommending.**

On the Table 2, which is attached, I directed my staff to take the original Fuss & O'Neill estimate from the year 2000 and update the unit pricing based on the Metcalf & Eddy pricing, where available, and then for other units, which were not available, give a best estimate of construction for those items which are not detailed within the Metcalf & Eddy report. Additionally, and utilizing the same estimates, they have added to the Fuss

& O'Neill report the rehabilitation of the hydro-pneumatic pump station to a full booster pump station and improvements to district piping. I would note that the Fuss & O'Neill report did include contribution for the Cherry Hill Water Tower and also large diameter piping improvements from the proposed Cherry Hill Water Tank to the town line. **The total cost estimate based, on our review to complete the Fuss & O'Neill full redundant service area with ample fire protection for the Town of Durham, and also providing elements to the City of Middletown to keep this extension cost neutral to the residents of the City of Middletown, is $13,151,416.00.**

<u>Action Plan</u>

The City of Middletown Water Department is suggesting a cooperative action plan between EPA, Federal and State Legislators, the Town of Durham, and the City of Middletown Water Department. Noting that the difference between the true cost neutral impact to the City of Middletown of imposing the EPA Plan is $7,084,294.00 verses the Fuss & O'Neill-City of Middletown preferred plan for full fire protection/redundant water service for the Town of Durham is $13,151,416.00. **There is a funding gap which exists of $6,067,122.00.**

The City of Middletown is encouraging the Town of Durham and the EPA to establish a Town of Durham Water Development Fund, in which funds will be contributed from the EPA and the Potentially Responsible Parties (PRP's) for the Durham Meadows Superfund Site. It would be our strong recommendation that added to these funds would be supplemental funds, which should be made available from the State of Connecticut for Petroleum Tank Fund Sites, of which two exist in close proximity to the service area and along the route of the proposed water main extension, and that the Town of Durham look towards Federal legislators for assistance in providing additional funds to provide for the large diameter water main improvements, and fire hydrants and pressure reducing stations that would be necessary to provide long-term fire protection to the Durham downtown area.

Within my ten-years as Director of the Water and Sewer Department, I have looked on while the Merriam Manufacturing Plant has burned in the Durham downtown area, as well as the Time Out Tavern just this previous spring. As an outsider, but someone with life-long and intimate knowledge of the Town of Durham, it appears to make sense that the center core be offered fire protection for the long-term health and viability of the Town of Durham. The Main Street corridor houses almost all of the important public buildings of the town including schools, the public library, town hall, fire department, post office, and churches, as well as the numerous businesses which have given, and maintain, the bucolic character of Durham. I would note that the extension of water, unlike sanitary sewer, will not impact development density in Durham. Therefore, the extension of water, even in more ample quantities to address fire protection, will not increase the density of development in the Town of Durham and, therefore, will not affect the rural flavor and nature of this town.

I would like this response to serve as a call for action in the aggregation of funding for the Town of Durham, such that a long-term and vital solution can be sought for the downtown area of Durham for both potable water for its residents, impacted by the Superfund Site, and also for the Town of Durham to maintain their long-term viability by way of fire protection and enhanced business development.

I would like again to thank the EPA for allowing this opportunity for public comment and should the EPA have further inquiry of me or my staff regarding the development of our costs or the proposals and recommendations that have been made within this formal submittal, we remain ready to answer questions and expand on these ideas.

Sincerest regards always,

Guy P. Russo
Director of Water & Sewer Dept.

GPR:dmm
cc: Mayor Domenique S. Thornton
Senator Christopher Dodd
Senator Joseph Liberman
Congresswoman Rosa DeLauro, Third District
State Senator Eileen M. Dailey
State Senator Edward Myer
State Representative Ray Kalinowski
First Selectwoman Maryann Board
WPCA

Table 1
Metcalf & Eddy - EPA Preferred Option
Connection to Middletown Water Distribution System
6 inch Watermain without Fire Protection Option

Item Description	Units	Estimated Quantity	Unit Price	Totoal Estimated Price	Notes
Mobilization/Demobilization	LS	1	$20,000	$20,000	Allowance
Erosion and Sediment Control Systems	LS	1	$15,000	$15,000	Allowance
Maintenance & Protection of Traffic	LS	1	$100,000	$100,000	Allowance
Test Pits	EA	26	$250	$6,500	Estimate 2 per intersection
Rock Removal	CY	1,200	$60	$72,000	Assumes 20% of route @3 feet deep
6" DIP Water Main	L.F.	7,900	$63	$497,700	Includes excavation and backfill
6" DIP Water Main-Extension from Middletown	L.F.	7,500	$63	$472,500	Includes excavation and backfill
Wedge Blowoff	EA	3	$1,000	$3,000	Previous bid information
6" Gate Valve & Box	EA	54	$1,150	$62,100	Previous bid information
1" Copper Water Service Connection	EA	80	$815	$65,200	RS Means
2" Copper Water Service Connection	EA	5	$1,300	$6,500	RS Means
1" Supply from property line to house	L.F.	6,500	$28	$182,000	RS Means
2" Supply from property line to house	L.F.	650	$30	$19,500	RS Means
Potable Well Abandonment	EA	85	$1,800	$153,000	
Remove & Return point of use systems	EA	53	$350	$18,550	Allowance
1" Water meter	EA	80	$250	$20,000	2005 National Construction Estimator
2" Water meter	EA	5	$1,200	$6,000	2005 National Construction Estimator
Sidewalk Repairs	SY	4,000	$4	$16,000	2005 National Construction Estimator
Dewatering	LS	1	$15,000	$15,000	Allowance
Stream Crossing	EA	3	$12,000	$36,000	Allowance
Sawcutting Bituminous Pavement	LF	27,000	$2	$58,050	ConnDOT Pricing Information
Removal of Bituminous Pavement	SY	5,300	$2	$10,600	ConnDOT Pricing Information
Sawcutting Concrete Pavement	LF	14,100	$6	$86,715	ConnDOT Pricing Information
Removal of Concrete Pavement (Route 17)	SY	2,400	$5	$11,040	ConnDOT Pricing Information
Replacement of Concrete Pavement with Bituminous	SY	2,400	$54	$129,600	Assume 6" thick
Temporary Pavement Repair (Local Road)	SY	1,400	$15	$21,000	Previous bid information
Permanent Pavement Repair (Local Road)	SY	2,400	$24	$57,600	Previous bid information
Temporary Pavement Repair (State Road)	SY	2,400	$15	$36,000	Previous bid information
Permanent Pavement Repair (Mill & Overlay)	SY	23,000	$14	$322,000	Assume 3" Depth and 24' Width
Driveway Repair/Replacement	SY	2,700	$9	$23,220	
Pavement Markings	LF	18,000	$0.30	$5,400	
Turf Establishment	SY	24,800	$10	$248,000	Includes new topsoil
Uniform Police (State Road Work)	Day	220	$400	$88,000	Assumes 2 police for 30 days @$55/hr
Disinfection of water main	LS	1	$15,000	$15,000	Allowance
Pressure and leakage tests	LS	1	$10,000	$10,000	
District Piping	LS	1	$428,280	$428,280	Provided by City of Middletown
Booster Pump Station	LS	1	$450,000	$450,000	Provided by City of Middletown
Cherry Hill Water Tower	LS	1	$760,000	$760,000	Provided by City of Middletown

Subtotal			$4,547,055
Construction contingency (bid & scope)	30%	of capital cost estimate	$1,364,117
Subtotal (Remedy Implementation)			$5,911,172
Project Management	5%	of capital cost estimate	$295,559
Remedial Design	8%	of capital cost estimate	$472,894
Construction Management	6%	of capital cost estimate	$354,670
Institutional Controls	LS	1	$50,000
Total Capital Cost			**$7,084,294**

Table 2
Fuss & O'Neill - Middletown Water Department
Preferred Option

Item No:	Item Description	Units	Estimated Quantity	Fuss & O'Neill, Inc. March 8, 2000 Unit Price	Fuss & O'Neill, Inc. March 8, 2000 Estimated Price	City of Middletown August 3, 2005 Unit Price	City of Middletown August 3, 2005 Estimated Price
1	16" DIP Water Main	L.F.	14,000	$80	$1,120,000	$104	$1,453,942
2	12" DIP Water Main	L.F.	5,100	$60	$306,000	$98	$499,800
3	8" DIP Water Main	L.F.	26,000	$50	$1,300,000	$70	$1,820,000
4	6" DIP Water Main	L.F.	900	$45	$40,500	$63	$56,700
5	Fittings	LBS	100,000	$3	$250,000	$3	$324,541
6	6" Hydrants	EA	90	$1,800	$162,000	$2,337	$210,302
7	6" Gate Valve & Box	EA	90	$560	$50,400	$1,150	$103,500
8	8" Gate Valve & Box	EA	30	$800	$24,000	$1,400	$42,000
9	12" Gate Valve & Box	EA	5	$1,300	$6,500	$1,900	$9,500
10	16" Butterfly Valve & Box	EA	26	$2,300	$59,800	$2,986	$77,630
11	1" Copper Water Service Connection	L.F.	8,000	$25	$200,000	$32	$259,632
12	Direct Drill or Open Cut 1" Copper WSC	EA	60	$2,500	$150,000	$3,245	$194,724
13	1" Corporation	EA	325	$160	$52,000	$208	$67,504
14	1" Corporation Stop	EA	325	$160	$52,000	$208	$67,504
15	**Provide Water Serv. To Contam. Property**						
	a. Potable Well Abandonment	EA	75	$1,500	$112,500	$1,800	$135,000
	b. Remove & Return Filter Systems	EA	75	$250	$18,750	$350	$26,250
	c. Meter Setter, Jumper Prep & Connect	EA	75	$300	$22,500	$389	$29,209
	d. Check Valves & PRV's	EA	75	$200	$15,000	$260	$19,472
	e. 1" Copper WSC from Prop. Line to House	L.F.	6,000	$25	$150,000	$28	$168,000
16	Allowance for Sidewalk Replacement	S.F.	16,000	$4	$64,000	$5	$83,082
17	Temporary Pavement Repair	L.F.	34,000	$12	$408,000	$15	$510,000
18	Permanent Pavement Repair	L.F.	34,000	$14	$476,000	$24	$816,000
19	State Road Crossing (Pipe Only)	EA	8	$7,500	$60,000	$9,736	$77,890
20	Temporary Pavement Repair State Road	L.F.	500	$14	$7,000	$15	$7,500
21	Permanent Pavement Repair State Road	S.Y.	800	$45	$36,000	$58	$46,734
22	State Road Driveway Apron Overlay	S.Y.	5,000	$15	$75,000	$19	$97,362
23	Allowance for Rock Excavation	C.Y.	4,000	$35	$140,000	$60	$240,000
24	Maintenance & Protection of Traffic	LS	1	$250,000	$250,000	$324,541	$324,541
25	Uniformed Officers	DAY	500	$640	$320,000	$831	$415,412
26	16" PRV with Vault	EA	1	$30,000	$30,000	$38,945	$38,945
27	12" PRV with Vault	EA	1	$25,000	$25,000	$32,454	$32,454
28	Cherry Hill Water Storage Tank	LS	1	$760,000	$760,000	$760,000	$760,000
29	District Piping	LS	1			$278,880	$278,880
30	Booster Pump Station	LS	1			$450,000	$450,000

		Fuss & O'Neill Estimated Price	City of Middletown Estimated Price
Subtotal		$6,742,950	$9,744,012
Engineering/ Administration	25%	$1,685,738	$2,436,003
Contingency	10%	$674,295	$974,401
Total		**$9,102,983**	**$13,154,416**

8-10-05

Lorraine Etheridge
41 Partridge Ln.
Durham, CT 06422

Attn: Anne Loughlin
Ref.: Durham Meadow Superfund Site

In regards to the above, I strongly feel that consideration be given to other water supplies whether they are from the public or private sector.

Currently Connecticut Water Company is managing part of Durham's Water supply in that vicinity. Thank you in advance for reviewing my suggestion.

Very truly yours,
Lorraine Etheridge

PViola3453@aol.com
08/10/2005 05:39 PM

To Anni Loughlin/R1/USEPA/US@EPA
cc
bcc
Subject Fwd: Durham Meadows Superfund Site, Durham, CT

----- Message from PViola3453@aol.com on Wed, 3 Aug 2005 17:23:25 EDT -----

To: www.loughlin.anni@epa.gov

Subject: Durham Meadows Superfund Site, Durham, CT

Dear Anni,

Although I have already made public various comments for the record regarding the subject of the Durham Meadows Superfund Site at the formal hearing held
on July 28th of this year, I would like to hereby submit additional information which may be helpful before actual acceptance is decided for any proposed
plan to address this environmental issue. First, however, I would like to stress the importance of having the soil tested at the Strong School location because of the activity that took place there over the years when it was first Durham High School (the subject of auto maintenance and instruction in auto repair was part of the curriculum) and the site itself was the bus depot for many
years for Regional District #13 up until the early 70's. (Maggie Peterson of Maiden Lane is the name of the other woman, beside myself, who reported her concern about this situation at the preliminary hearing on July 12th, 2005.)

New remarks I would like to make are the following: I feel that there is a real possibility for the water supply needed to rectify the problem faced by the residents and businesses might be met from either one of the well sources in existence locally that currently serve the elderly housing (Trinity complex off Higganum Road) and the Main Street occupants and, perhaps, even part of Cherry Lane. I am aware that since Durham took over ownership for a water company here, and The Connecticut Water Company manages it, there have been extensive improvements made to the existing wells in order to adequately serve the
users. I admit that I do not know at this time if the monitoring done on the properties affected indicate a need for another source or whether it can be controlled with what is effectively in place. With that in mind now, I would offer the suggestion as to investigating the likelihood of an alternative source
within the town of Durham's borders in proximity to the contaminated area, but outside of it, of course. This way, the town once again would take the lead and have control over implementing the remedy and, with the oversight of not only your organization, the Federal Eniveronmental Protection Agency, The Connecticut Water Company and the health director, Dr. Brad Wilkenson, would be
able to achieve a satisfactory outcome. It may even mean a substantial savings
for the taxpayers, and those of us on fixed incomes would appreciate a lesser cost if that were a result!

I realize this is an opportunity to assist our neighbors who deserve a thorough analysis of everything that has gone on for a lot of years, and it must

be resolved within a reasonable time frame knowing that the studies on this are
now almost complete. Inasmuchas it appears there will be added consideration and action on a new or other item as a direct outcome of this communication and others offered, I am looking forward to a responsible and accountable solution.

In closing, I regret to say that I have once again contacted Mrs. Fred Dahlmayer (Margie) of New Haven Road, Durham, and in doing so, have learned that
she and her husband choose not to offer their land for a possible water source.
What she and I talked over in the past led to a misunderstanding on my part, and I apologize for causing any confusion.

Thank you for your continued interest in this project and, hopefully, the ultimate benefits for our community which will become obvious in the near future.

Sincerely,

Donia Viola
Durham
PViola3453@aol.com

PViola3453@aol.com
08/11/2005 11:08 AM

To Anni Loughlin/R1/USEPA/US@EPA
cc
bcc
Subject Durham Meadows Superfund Site, Durham, CT

History: This message has been replied to.

Dear Anni,

As mentioned in our telephone conversation of this morning, August 11, 2005, I am herewith forwarding additional comments I would like to register for the record pertinent to the subject of the Durham Meadows Superfund Site, Durham, CT.

Having given further consideration to the proposal submitted by the Environmental Protection Agency (hereafter known as EPA), I would like to ask for the cooperation of the EPA and all the Durham parties involved to seriously contemplate the possible use of the Wallingford reservoir which abuts Durham in the Tri-Mountain Road area. I am aware that the City of Wallingford would have to be approached, as would any other property owner even within the Town of Durham's borders in order to participate in the search for a safe, reasonable and, maybe, a more affordable solution. Without any comparisons for the work which needs to be done to effectively remedy and manage the pollution which has persisted and encumbered so many, I feel a fair outcome will not result. In order to achieve a satisfactory solution there is a real need to look beyond the only offer of having the City of Middletown deliver their water. Cost is also a huge factor and it is reasonable to expect a savings if there were other sources competing. Distance is another factor in engineering any plan since the measure of pipe, actual labor and construction all impact time and cost. I would naturally be more than willing to support a local source and keep the revenues distributed within my own town. Yet, another "outside" source, like Wallingford, or an "in-town" source may bring healthy competition with less spending necessary. Further, whenever the final decision is agreed upon, I trust that it will also be acceptable because of the quality of the water to be supplied and not just the quantity available.

The primary contributors to the contamination found on the Durham Meadows Superfund Site should be held fully accountable in making restitution for this problem. With the prospects of grants and even EPA funding, I feel that people might be fooled into thinking they are not actually paying for this remedial effort when, in fact, such monies are available due to the very taxes collected from them which make such grants and funding possible.

Thank you again for your attention to this correspondence and to recognizing all the concerns on this matter.

Sincerely,

Mrs. Donia Viola
Durham, CT

PViola3453@aol.com

Henry A. Robinson
First Selectman, Town of Durham, Connecticut, (1993 thru 1997)
546 R Haddam Quarter Road, Durham, CT 06422-1707
E-mail: Henry_A_Robinson@sbcglobal.net
Phone & Fax: 860.349.3232, Cell 860.985.7680

Anni Loughlin (HBT)
Remedial Project Manager
Durham Meadows Superfund Site
One Congress Street
Boston, MA, 02114

August 11, 2005

Dear Anni:

It's hard to believe that over 10 years has gone by since I was First Selectman and we worked together on trying to find a permanent solution to the Durham Meadows Superfund Site problems.

I am sorry I was not able to get to your public meeting but I am pleased to see that the EPA, with concurrence of the Connecticut DEP, have come to the conclusion that bringing public water into Durham from Middletown is the logical solution. I am only sorry that it took the "process" ten years and cost so many taxpayer and business dollars to get to the solution that common sense dictated ten years ago.

I have downloaded your presentation and find it supports your conclusions. I would like to remind you that Durham really has four (4) other areas that need to be addressed in the design of a public water system as well as the Superfund Site. They are:

1.) Water System Components –

Durham Heights -

There is a real need to bring public water to the Durham Height area, Austin Road, Edwards Road etc. The one-quarter acre lots that were developed prior to Durham Adopting Zoning and Subdivision regulations are marginal at best for supporting on site wells and septic systems. Public water would go a long way to mitigate future problems. Even if the local mains and residential connections are postponed until a future date, the system must be sized to accommodate their needs.

Durham Center Water System –

The flow requirements to incorporate the Durham Center water system into public water brought from Middletown should be a part of the design. While there are concerns that water main pressures from a gravity feed system from Middletown would over pressurize the plastic mains in the Durham Center Water System, I am sure that pressure regulators

First - Design and installation of storage tankage and water mains to provide water flows to cover the Superfund Requirements, fire flows, Durham Heights requirements, and the potential needs of the area adjacent to the closed Durham Middlefield landfill.

I would urge that the EPA work closely with local and state officials to identify grant moneys to cover this component of the system.

Second - The cost of hook ups to the water system for the public facilities, businesses and residences whose private water supplies have been polluted should be borne by Durham manufacturing and Merriam Manufacturing. Obviously each company would pay for the required soil remediation on their own properties. A special tax assessment would allow municipal bonding to be paid off by these companies over an extended period of time.

Third – Providing public water to the Durham Heights area is a local problem and could be financed by a combination of local bonding, private expenditures and special taxation. Similar financing could be used to incorporate the Durham Center Water System into the system, another local issue.

Summary –

Originally Durham looked to the EPA and the Superfund Program for help in defining and solving the water pollution problems on and adjacent to our Main Street. You have the opportunity to validate our faith in the fact that you are there to help us.

Your support in obtaining the funding for a complete solution is critical at this juncture. In the overall picture of Federal and State projects this is a minor one. To Durham it is an expenditure only rivaled by the costs of our school system and one of great importance to the health and welfare of our community.

I implore you to take Durham Manufacturing's exemplary corporate citizenship into consideration in allocating financial responsibility. They are a critical element in Durham's tax base. Their future corporate health and membership in our community is of key importance.

Sincerely,

Henry A. Robinson

Hank Robinson
<henry_a_robinson@sbcglob
al.net>

08/11/2005 02:43 PM

Please respond to
Henry_A_Robinson@sbcglobal
.net

To Anni Loughlin/R1/USEPA/US@EPA

cc

bcc

Subject Durham Meadows Superfund Site

Anni Loughlin
Remedial project Manager
Durham meadows Superfund Site
EPA
One Congress Street
Boston, MA 02114

Dear Anni:

Attached is a Word 2000 file containing my comments and recommendations relative to the Durham meadows Superfund Site.

Sincerely
Henry A. Robinson
First Selectman, Town of Durham (1993 through 1997)

Comments on Durham Meadows Superfund Site.doc

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

August 11, 2005

Ms. Mary Jane O'Donnell
EPA New England
1 Congress Street
Suite 1100 (HBT)
Boston MA 02114-2023

Subject: Comments on the Proposed Plan for the Durham Meadows NPL Site, Durham, CT

Dear Ms. O'Donnell,

The Connecticut Department of Environmental Protection has reviewed the July 2005 Proposed Cleanup Plan for the Durham Meadows Superfund Site, and offers the following general and specific comments:

In general, the CT DEP supports EPA's cleanup proposal, and concurs with the first five bullets of "The Cleanup Proposal At A Glance" heading on page 1 of the Proposed Plan, as described below:

- Excavation and offsite disposal of soil at and adjacent to the Merriam Manufacturing Company property, in conjunction with soil vapor extraction (combination of Alternatives S-3 and SV-3.)
- Excavation and offsite disposal of soil at the Durham Manufacturing Company property (Alternative DMC GW-5).
- Connection to the Middletown Water Distribution System to provide an alternative source of water to all residences currently affected by groundwater contamination and additional residences located near the contaminated area (Alternative AWS-2).
- Monitoring of the overall area of ground water contamination to ensure no migration of groundwater beyond its current general boundary (Alternative DP-6), with a contingency to implement a groundwater extraction system for hydraulic containment system if the contamination spreads (SZ-2).
- Implementation of a waiver of federal and state requirements that would normally require cleanup of the groundwater to meet drinking water standards, since it is not technically practicable to clean up the groundwater to such levels in a reasonable amount of time (included with combined Alternatives DP-6 and SZ-2).

Institutional Controls

DEP agrees that institutional controls should be included in this remedy. For the institutional controls (as described in the sixth bullet on page 1 of the July 2005 Proposed Plan), Environmental Land Use Restrictions (ELURs) pursuant to Section 22a-133q-1 of the Regulations of Connecticut State Agencies are permanent and enforceable, and are therefore considered by DEP to be the most reliable form of institutional control available to prevent future use of polluted groundwater, and prevent inappropriate future use of certain areas of the site. In some situations, the remedy will have to include ELURs to comply with the Remediation Standard Regulations, which have been identified as applicable requirements (ARARs).

Further Characterization

DEP also agrees that further characterization (as described in the last bullet on page 1 of the July 2005 Proposed Plan) is necessary to assess the potential for VOCs in shallow groundwater to migrate from groundwater into soil vapor and then into overlying structures, resulting in unacceptable risk in indoor air. Any further evaluation must include an investigation to determine the extent and degree of VOC contamination in the shallow groundwater (delineation of the VOC plume in shallow groundwater) and an evaluation of the concentrations of VOCs in soil vapor beneath any buildings overlying such shallow groundwater plume, including the soil vapor beneath the Durham Manufacturing Company building.

The groundwater at this site has already been found by EPA to pose "actionable risk" due to the potential for volatilization from shallow groundwater, and the RSRs have been identified as applicable requirements ARARs. Therefore, the new data gathered as a result of this further characterization effort should not be subjected to another risk assessment by EPA. When additional data has been gathered, the data must be compared to the appropriate volatilization criteria contained in the RSRs to determine if action (or additional action) is needed to address the threat posed by potential migration of unacceptable concentrations of VOCs into structures. Concentrations of VOCs in groundwater and VOCs in soil vapor beneath buildings over the shallow groundwater plume should be compared to the appropriate volatilization criteria (either residential or industrial/commercial) in the RSRs to determine if additional action should be taken.

Compliance With ARARs

In accordance with EPA's November 2002 Draft Subsurface Vapor Intrusion Guidance, the groundwater at the site poses an actionable risk to indoor air. As noted above, Connecticut's Remediation Standard Regulations have been identified as applicable ARARs for this site. Therefore the remedy selected for this site must provide for compliance with CT's more stringent volatilization criteria. Further, such criteria must apply to the full extent of the shallow GW plume, not just to the portion of the plume that currently exceeds EPA's acceptable risk range.

We want to thank you for the opportunity to comment on the proposed plan. We look forward to the implementation of this plan. If you have any questions on the content of this comment letter, please contact Christine Lacas at (860) 424-3766.

Sincerely,

Michael J. Harder

Michael J. Harder, Chief
Bureau of Waste Management
CT Department of Environmental Protection

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August 11, 2005

Ms. Anni Loughlin
U.S. Environmental Protection Agency
1 Congress Street
Suite 1100 (HBT)
Boston, MA 02114-2023

RE: **Durham Manufacturing**

Dear Anni,

The Durham Manufacturing Company (Durham) was understandably disappointed that the USEPA elected to withdraw from the AOC which allowed Durham to prepare the RI/FS. This is especially true after Durham spent a great amount of time and money to develop the RI/FS and was on track to provide the same to EPA on time.

Considering the past efforts that have been undertaken and expenses incurred by Durham, the company is no longer in a position to spend additional time or money participating in a new process or providing detailed comments on new documents.

Therefore, we have asked our environmental consultant to indicate some of it's most critical concerns. These will fall into several primary categories:

1. Public Water - to the extent public water is the preferred alternative, Durham does not wish to stand in the way of a public works project, but does wish to draw attention to certain issues. However, Durham believes that the technical and financial analysis related to and financial justification of the public water system alternative is flawed.

2. That the remedy analysis specifically related to The Durham Manufacturing Company site is both technically and financially flawed.

3. That the remedial approach to The Durham Manufacturing Company site should be guided by the Connecticut Remediation Standards Regulation and the alternatives provided therein.

This document and the attached submission by our consultant should not be construed as the willingness or the ability of The Durham Manufacturing Company to further participate in this process which has impacted Durham Manufacturing Company's competitive position in a global and local marketplace.

Thank you for your attention.

Sincerely,

Richard Patterson

Richard H. Patterson
President/CEO

cc: Earl W. Phillips, Jr. Esq., Robinson & Cole

RP/jlg

Encl.

GZA
GeoEnvironmental, Inc.

Engineers and Scientists

August 10, 2005
File No. 05.0043007.00

The Durham Manufacturing Company
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Attention: Mr. Richard Patterson

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Re: Comments on the Remedial Investigation/Feasibility Study
Durham Meadows Superfund Site
Durham, Connecticut

Dear Attorney Phillips:

At your request and in accordance with Durham Manufacturing Company's (DMC) limited resources, we have briefly reviewed the Remedial Investigation and Feasibility Study (RI/FS) for the Durham Meadows Superfund Site (DMSS), as well as the Proposed Plan issued by the United States Environmental Protection Agency (USEPA), dated July 2005, which presents their preferred remedies for the Merriam Manufacturing Company (MMC) property, the DMC property and the Site-Wide Groundwater Study Area. While we have not had time to read and examine the documents in detail, and do not have the time to conduct independent studies, equations and cost estimating, we nevertheless have some serious concerns about the technical basis for some of the conclusions reached by the USEPA and about the remedy selection. Our major concerns are presented below, but we would also appreciate the opportunity to study the documents in more detail and to conduct independent evaluations of the remedial alternatives to provide more concrete evidence concerning the flaws in the remedy selection.

MMC Property

In view of the limited time and resources available to review and comment on the stated documents, we have not spent much time on the MMC aspects of the RI/FS or remedy selection. However, we note that the RI acknowledges that the MMC site is the primary source of the 1,4 dioxane in the Site-Wide Groundwater Study Area. In fact, the occurrence of this compound in the southern half of the DMSS appears to be limited to: (1) the Strong School well (which has also been a suspected source area) which is no longer in use, (2) one well on the DMC property, which is not used for potable purposes, and (3) one well at 168 Main Street, which we contend may be due to activities on that property. To the extent that the cost of the Point of Use Treatment alternative is much higher than it would be if 1,4 dioxane were not present, we believe that DMC should not be liable for any cost considerations that may be attributable to the presence of 1,4 dioxane in the site-wide groundwater. Similarly, should USEPA consider using the presence of 1,4 dioxane as a basis for preferring public water, DMC should no be looked to for increased costs.

DMC Property

Our biggest concern with the RI, the FS and the Proposed Plan for the DMC property centers on the greatly exaggerated and unsubstantiated areas described as "Conceptual Maximum Extent of DNAPL [Dense Non-Aqueous Phase Liquid] Source Area in Overburden" and "Conceptual Maximum Extent of DNAPL Source Area in Bedrock" as shown on Figure 3.3-14 of the Proposed Plan. These areas are based on theoretical calculations and absolutely no field observations, as is readily and repeatedly stated in the source documents (the RI and FS). Especially as concerns the bedrock aquifer, the Draft Final Technical Impracticability Evaluation Report (TI Report) prepared by the USEPA's contractor Metcalf & Eddy states that "No samples from any water supply or bedrock monitoring wells anywhere on the Site have been found to have concentrations of solvents exceeding or even approaching one percent of the effective solubility." (The one percent of effective solubility is one of the criteria for evaluating the potential for DNAPLs to be present.) The report also states "Another factor specific to the Durham Meadows Superfund Site is the difficulty in locating DNAPL. Although converging lines of evidence suggest the presence of DNAPL source zones, DNAPL has never been observed at the site."

While theoretically there may have been, at one time, some extremely limited areas (proximate to Monitor Well MW-2 and the original MW-6) in the overburden on the DMC property where DNAPLs may have existed, both of these areas have been subject to remediation (the former in the form of an aggressive and very successful multi-phase extraction system, and the latter by soil removal through trenching and gravity drainage of overburden groundwater into a drain system installed for this purpose). Available evidence suggests that it is doubtful that any but very small and discrete globules of DNAPL exist any where on the DMC property and certainly nothing resembling the extent depicted on the maps presented by the USEPA. Despite this, it is clear that USEPA considers this to be an important aspect of remedy selection. on the other hand, the insistence on the widespread occurrence of DNAPL makes the remedy selection for the DMC property inconsistent with the TI Report.

The remedy preferred to reduce risk of exposure to contaminated groundwater in the Site-Wide Groundwater Study Area is to provide public water to the affected community. With the risk of exposure to the groundwater eliminated, there is much less of a risk driver to compel the remediation of a speculative source area in such an aggressive manner as excavation of large areas of the DMC plant property, as recommended in the Proposed Plan. Furthermore, the TI Report, suggests that source area remediation will not significantly enhance the overall site remediation. Specifically, the report states, "There are several factors specifically related to the Durham Meadows Superfund Site that would limit the effectiveness of remedial technologies, and potentially render the attempted remediation of a source zone and its associated dissolved-phase plume a futile endeavor."

This report also contains the following passage: "Also, there is very limited success reported for remediation of DNAPL using available technologies. In a USEPA publication titled *"The DNAPL Remediation Challenge: Is There a Case for Source Depletion?"* [USEPA, 2003] it is stated that "if the RAO in the source zone is complete restoration (i.e., background levels of the DNAPL constituents), or MCLs, it is unlikely that any of the technologies currently available will be successful, except in situations involving small spills of DNAPL in relatively homogeneous saturated zones." The Durham Meadows Superfund Site is an example of a site...which is not amenable to restoration in a reasonable time frame."

The TI Report concludes with the following: "In summary, there are no technologies currently available that are known to effectively remediate a DNAPL source zone in complex hydrogeologic environments to MCLs or background concentrations in a reasonable time frame and at **reasonable cost at this site**. While source zone remediation is impracticable in a reasonable time frame with available technologies, depletion of DNAPL mass is possible using available technologies and some technologies such as ISCO and electrical resistivity may be more effective than others. However, in a complex heterogeneous hydrogeologic environment (particularly fractured bedrock) where it is difficult to accurately locate DNAPL and where some of the DNAPL is likely inaccessible to available technologies, **there would be limited benefit realized by implementing a costly technology specifically for source zone depletion."** (Emphasis added).

Leaving aside the potential for severe, debilitating and damaging business disruptions associated with this aspect of USEPA's remedy, it is our considered opinion that the excavation of large portions of the overburden materials on the DMC property would be ineffective, as stated in USEPA's own documents; would be excessively costly in light of the overall benefits to the site restoration; would be extremely disruptive to the ongoing operations of this active facility; and, would be potentially damaging to the overall site in that the actions could mobilize currently isolated contamination.

It is clear that the USEPA supporting documents for the DMSS were hastily put together and that the remedy selection for the DMC site has not been fully developed or evaluated. Note that Metcalf & Eddy stated that they had not evaluated the effectiveness of the multi-phase extraction system. We believe that the DMC property should not (as drafted) be included in the Record of Decision for the DMSS, and that a supplemental Record of Decision should be developed for the DMC site.

If the DMC site must be included in the Record of Decision (though we can think of no technical basis for doing so at this time), it is only logical that the decision consist of a flexible remedy and time frame which refers to the Applicable and Relevant and Appropriate Requirements (ARARs) which consist primarily of Connecticut's Remediation Standard Regulations. Remedial Action Objectives would logically focus on reduction of risk. To the extent there is risk on the DMC site it is to the future construction worker. This risk can be readily mitigated through the imposition of a site-wide soil management and health and safety plan to be in effect for every excavation on the site.

There is also a perceived risk of inhalation exposure to future residents on the site. This risk can also be readily mitigated through institutional controls that provide for the installation of vapor controls under any new residential structures built on the DMC property. Such institutional controls can also consist of Environmental Land Use Restrictions prohibiting residential development.

Site-Wide Groundwater Study Area

DMC understands that providing public water to the portions of the Town of Durham that are included in the Durham Meadows Superfund Site is a long-term and permanent solution to the risks associated with exposure to contaminated groundwater throughout the DMSS and, for that matter, the Town of Durham. However, we believe that the supporting documentation to justify this solution to the problem is flawed and inaccurate. The extent of the contamination evident in the site-wide groundwater in the DMSS has been monitored since 1982 and in the intervening 23 years there has been no spread of the plume.

There is, therefore, no justification to increasing the number of affected potable supply wells from 35 to 85. Furthermore, actual operating data developed over the last 20 years has shown that, with the possible exception of a few wells which contain unusually high concentrations of volatile organic compounds, the frequency of carbon changes in the existing filtration systems is no greater than annually. There is no experiential or technical basis for expecting that the carbon systems will require five changes per year. In addition, the evaluation of the Point of Use alternative for the DMSS includes metals treatment for ten wells. There is absolutely no justification for this inclusion. None of the supporting documents suggest that there are metals associated with the site-wide groundwater plume nor has there been any attempt to link any individual site-related metals to the potable supply wells. The majority of metals detected in the potable supply wells are most likely attributable to the plumbing in the systems, not from occurrences in groundwater.

Frankly, the entire evaluation of, and therefore the cost projection for, the Point of Use option is greatly inflated. It appears obvious that this was done to make it (the Point of Use option) appear less cost competitive compared to the public water option. In addition, we note that a study commissioned by the Town of Durham to investigate the feasibility and cost of connecting the DMSS to the Town of Middletown water system concluded that the cost to maintain the carbon filtration systems for 50 years would be approximately $3,580,000. While the discovery of 1,4 dioxane in a limited number of potable supply wells would constitute an additional cost to this option, it cannot explain the difference between the prior study estimates and the USEPA estimate for the Proposed Plan of

$7,200,000. While DMC may not care to actively oppose provision of public water to the affected area, we believe that the USEPA's flawed evaluation of this alternative should be redone and that more realistic cost estimates be developed based on actual operating experience.

In addition, we note that a study commissioned by the Town of Durham to investigate the feasibility and cost of connecting the DMSS to the Town of Middletown water system (8-inch mains without fire protection) concluded that the cost would be, in 2000, approximately $3,440,000, compared with the USEPA estimate of $7,000,000.

Summary

After review of the documents provided to us by the USEPA we conclude the following:

- The occurrence of 1,4 dioxane in the DMSS site-wide groundwater is almost entirely attributable to the source area on the MMC site, and any cost considerations associated with this compound should not be borne by DMC.
- The suggested remedial action for the DMC site is excessive in scope and cost, would result in insufficient benefit to the site-wide groundwater quality in comparison to the cost, and would be extremely disruptive to this active manufacturing operation.
- The DMC property should not be included in the currently envisioned Record of Decision, but should be covered in a separate Record of Decision. In any event, any remedial action decisions for the DMC property be based on reduction of on site risks and be consistent with the Remediation Standard Regulations.
- The technical and financial evaluation of the remedial options for the site-wide groundwater are flawed and biased and should be re-evaluated prior to being finalized in the Record of Decision.

Thank you for the opportunity to comment on the documents supporting the Proposed Plan for the Record of Decision for the DMSS. Please feel free to call and discuss these comments with us at your convenience. As stated in this letter, we would appreciate the time to more fully study and comment on the documentation.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Robert Lamonica, LEP, CPG
Associate Principal

Kathleen A. Cyr, PE, LEP, PG
Consultant Reviewer

Cc
Earl Phillips
John Gowac

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JJFHoran@webtv.net (John Horan)

08/12/2005 11:06 AM

To Anni Loughlin/R1/USEPA/US@EPA

cc jjfhoran@webtv.net

bcc

Subject EPA plan for Durham, CT

The plan doesn't include use of microbes to break down the offending chemicals in
situ. Some years ago, I read of the use
of moderate temperature steam injection
around the plume of contaminants. The
story was of several orders of magnitude
of organic depletion within two years.

My attempts to resurrect the documentation were unsuccessful. Only recently did I uncover a promising site.
It was a large international conference on contamination mitigation. The 682 papers
and abstracts are contained in a CD for
$295. by Battelle Press Online Bookstore,
ISBN:1-57477-145-0. The contents are
surveyed on

http://www.battelle.org/bclscrpt/Bookstore/2004chlorinated.cfm

No. I haven't purchased it. I am not personally that deep into the subject.
Perhaps titles or authors may mean something to you. Or, you know of promising techniques that didn't actually
pan out. This isn't nanotech but merely
microbial use.

John Horan
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PUBLIC HEALTH
Keeping Connecticut Healthy

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August 12, 2005

Ms. Anni Loughlin
U.S. EPA New England
One Congress St., Suite 1100 (HBT)
Boston, MA. 02114-2023

RE: EPA's Proposed Plan – Durham Meadows Superfund Site

Dear Ms. Loughlin:

Thank you for the opportunity to provide comments on the proposed plan to provide public drinking water to the contaminated areas within the Town of Durham. We find that the best option for the provision of public drinking water to 85 homes is the extension of the City of Middletown Water Department's (MWD) public water system. An obstacle to the otherwise excellent solution is the issue of MWD having an abundant supply of water in existence for the next ten years as required in order for MWD to sell water to the town of Durham. The City of Middletown Water Department is presently moving to increase their public water system safe daily yield. With these planned increases, the MDW would have sufficient supplies to meet the projected water demands of the 85 homes within the Town of Durham.

The attached report outlines a number of permitting requirements and identifies exclusive services area issues that need to be specifically addressed between the MWD and the Town of Durham. The Drinking Water Section encourages the Town of Durham and MWD to discuss these concerns and work together to address these identified items. It is also recognized that the Town of Durham town center system is actively pursuing additional sources of public drinking water located south of Allyn Brook. It is envisioned that the Town of Durham Center System would eventually interconnect with the water system mains north of Allyn Brook to provide a cohesive public drinking water system throughout the developed corridor of the Town of Durham. This type of interconnected system would provide dual sources of supply for the Durham customers as well as fire protection.

Again, thank you for the opportunity to provide comments. We offer our technical assistance to your agency as it concerns the provision of public drinking water to Durham. Please do not hesitate to contact me directly concerning any of the above comments.

Sincerely,

Lori Mathieu

Lori J. Mathieu, Supervisor
Source Water Protection Unit
Drinking Water Section

cc: Dr. Gerald Iwan, Chief DWS
Honorable Maryann Board, First Selectman Town of Durham
Guy Russo, Director of Public Works Town of Middletown
Michael Hage, DWS Section Supervisor Compliance
Steve Messer, DWS
Betsey Wingfeld, DEP
Martin Beskind, DEP
Dr. Bradford Wilkinson, Acting Director of Health Middletown
Dr. Joseph A. Havlicek, Director of Health Durham

Subject: Review of USEPA Proposed Plan
Durham Meadows Superfund Site

From: Darrell B. Smith

Date: August 10, 2005

A review of USEPA's proposed plan dated July 2005 for the Durham Meadows Superfund Site in Durham, CT highlights the following preferred alternatives for addressing present and future environmental conditions and the provision of drinking water to residences in the affected area:

- Connection with the Middletown Water Department (MWD) for approximately 85 residences in the affected area. The homes to be connected include a buffer zone containing 50 homes beyond the current 35 residences with contaminated groundwater.
- Soil excavation with off-site disposal in and around the Merriam Manufacturing Company property including soil vapor extraction at the Merriam site;
- Soil excavation with off-site disposal at the Durham Manufacturing Company property;
- Continued monitoring of the overall affected area to ensure that the migration of contaminated groundwater beyond its current general boundary is not occurring;
- Implementation of a Technical Impracticability Waiver for the superfund site because the bedrock geology indicates that groundwater remediation in a reasonable timeframe is impracticable and because of current technological limitations;
- Establishment of institutional controls, such as by-laws, deed restrictions, or some other mechanism, that would prevent unrestricted future use of certain areas of the superfund site area or contaminated groundwater;
- Further characterization of areas posing potential indoor air risks with additional actions to be taken as deemed necessary.

Connection of the affected homes to the MWD system via a main extension appears to be a reasonable and prudent approach, however, it should be recognized that:

1. The superfund site is within the Town of Durham's Exclusive Service Area. Therefore, Durham would have to either relinquish a portion of its exclusive service area to Middletown or develop an agreement with the MWD for the purchase of excess water pursuant to Connecticut General Statute (CGS) 22a-358;
2. Per CGS 22a-358, MWD must be able to demonstrate that it has water reserves in excess of those required to maintain an abundant supply of water to the inhabitants of its service area, such system may sell such excess water to any other public water system upon approval of the Commissioner of Public Health. Such approval shall be given only after (1) the applicant has clearly established to the satisfaction of the commissioner that such abundant supplies are in existence and will continue to be in existence for ten years, and (2) the purchasing community water system being supplied has agreed to restrict water usage in the same manner as the applicant when necessary in accordance with the emergency contingency provisions of the applicant's water supply plan.
3. If MWD intends to sell water to Durham, they should perform an analysis to establish that abundant supplies are in existence and will continue to be in

existence for the 10-year period between 2006 and 2016 to ensure compliance with CGS 22a-358.

4. The MWD will be required to submit a Water Main Application for the proposed water main extension. Moreover, DWS recommends that the water main be sized to serve additional customers beyond the 85 residences in the superfund area in the event additional contamination occurs beyond the present area of concern. Fire protection needs also be considered .

It should also be recognized that the Town of Durham is in the process of developing a new drinking water source for the Durham Center Water System (DCW) to serve approximately 30 customers. Based on an agreement reached with the Durham Fair Association earlier this year, the DCW system will connect two existing sand and gravel wells to a planned treatment station and storage facility that is expected to go on-line by the end of 2005. Combined pumping capacity of the two wells is expected to be in the range of 80 to 100 gallons per minute (gpm) pending the outcome of an updated yield test. The Fairground Wells are located approximately 1,500 feet west of Main Street (RT 17) within the Durham Meadows and about 1,200 feet south along Main Street from the trichloroethylene isocontour boundary line shown on Figure 4.3-12 in the USEPA's July 2005 Proposed Plan.

It should be noted that the Fairground wells are also <1,000 feet south of Allyn Brook. Moreover, the straight-line distance from the Fairground wells to the inferred trichloroethylene isocontour line shown on Figure 4.3-12is approximately 1,200 feet. This isocontour line crosses Maple Avenue northeast of the Fairground wells near its intersection with Old Cemetery Road. Since very little monitoring data currently exists for the contaminants associated with the superfund sites south of Allyn Brook, the DWS recommends that the USEPA consider the placement of monitor wells on the south side of Allyn Brook, or at other more-appropriate sites, to ensure that contaminated groundwater is not migrating towards the Fairground wells and nearby homes south of the brook.

Appendix E
Glossary of Acronyms

Acronyms:

1,1-DCE	1,1-Dichloroethene
1,2-DCE	1,2-Dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
AOC	Administrative Order by Consent
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
cis-1,2-DCE	Cis-1,2-Dichloroethene
COC	Chemicals of Concern
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
CSF	Cancer Slope Factors
CT DEP	Connecticut Department of Environmental Protection
CT RSR	Connecticut Remediation Standard Regulations
DEC	Direct Exposure Criteria
1,1-DCE	1,1-Dichloroethene
1,2-DCE	1,2-Dichloroethene
DMC	Durham Manufacturing Company
DNAPL	Dense Non-aqueous Phase Liquid
EDI	Estimated Daily Intake
ELUR	Environmental Land Use Restriction
EPC	Exposure Point Concentration
EPA	United States Environmental Protection Agency
ETPH	Extractable Total Petroleum Hydrocarbons
FS	Feasibility Study
HI	Hazard Index
HQ	Hazard Quotient
K_{oc}	Organic Carbon Partition Coefficient
LB&G	Leggette, Brashears & Graham
M&E	Metcalf & Eddy
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MMC	Merriam Manufacturing Company
O&M	Operation and Maintenance
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene (or tetrachloroethylene or perchloroethylene)
ppb	Parts per billion
PMC	Pollutant Mobility Criteria
PND	Cooling Water Pond

PRP	Potentially Responsible Party
RAO	Response Action Objectives
RBG	Risk-Based Goals
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentrations
RfD	Reference Doses
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RME	Reasonable Maximum Exposure
RSR	Remediation Standard Regulations
SLERA	Screening-Level Ecological Risk Assessment
SPLP	Synthetic Precipitation Leaching Procedure
SWPC	Surface Water Protection Criteria
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
TCA	1,1,1-Trichloroethane
TCE	Trichloroethene (or trichloroethylene)
TRV	Toxicity Reference Value
UF	Uptake Factors
USGS	United States Geological Survey
UST	Underground Storage Tank
VC	Volatilization Criteria
VOC	Volatile Organic Compound

Appendix F
ARARs Tables

Table F-1
Chemical Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Federal	Groundwater	Safe Drinking Water Act (SDWA) Maximum Contaminant Levels	40 CFR §141.11-141.16	Relevant and Appropriate	Maximum Contaminant Levels (MCLs) have been promulgated for a number of common organic and inorganic chemicals. These levels regulate the concentration of these chemicals in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	Groundwater impacted by the Site is a current drinking water source, with private wells in use. Contaminants are present in groundwater in concentrations that exceed MCLs. Remedial action to provide an alternative water supply will be implemented with the goal of meeting MCLs. The presence of NAPL, however, makes it technically impracticable to reduce contaminant concentration in groundwater to MCLs in the "TI Zone" for Site-wide groundwater. The TI Zone is shown on Figure I-1 of the Record of Decision.
Federal	Groundwater and Soil	EPA Risk Reference Doses (RfDs)		To Be Considered	RfDs are dose levels developed in estimating non-carcinogenic effects of exposures to toxic substances.	Non-carcinogenic risks from exposure to Site contaminants of concern were evaluated and used to help determine the need for remedial action and develop preliminary remediation goals where necessary.

Table F-1
Chemical Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Federal	Groundwater and Soil	EPA Carcinogenicity Slope Factor		To Be Considered	Slope factors are developed by EPA from health effects assessments. Carcinogenic effects present the most up-to-date information on cancer risk potency. Potency factors are developed by EPA from Health Effects Assessments of evaluation by the Carcinogenic Assessment Group.	Risks due to carcinogens as assessed with slope factors were used to help determine the need for remedial action and develop preliminary remediation goals, where necessary.

Table F-1
Chemical Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
State	Groundwater	Connecticut Remediation Standards Regulations (RSRs)	RCSA §§22a-133k (Appendices C and D)	Applicable	These standards establish remediation standards for groundwater and surface water.	Contaminants are present in groundwater in concentrations that exceed RSRs applicable to GA areas. The presence of NAPL, makes it technically impracticable to meet RSRs in the "TI Zone" for Site-wide groundwater, and therefore, no active engineering remedy will be implemented. The TI Zone is shown on Figure I-1 of the Record of Decision. A monitoring well network will better define the outer extent of the TI Zone and confirm that the plume does not migrate to areas not currently affected by groundwater contamination. Excavation of soil from the most contaminated areas of the MMC and DMC Study Areas will eliminate an ongoing source of groundwater contamination.

Table F-1
Chemical Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
State	Soil	Connecticut Remediation Standards Regulations (RSRs)	RCSA §§22a-133k (Appendices A and B)	Varies	These standards establish remediation standards for soil.	Contaminants are present in Site soil in concentrations that exceed direct exposure ("DEC") and/or pollutant mobility criteria ("PMC"). At the MMC Study Area, the DECs and the PMCs are applicable The selected remedy for the MMC Study Area involves treatment of VOCs in soil and soil vapor by soil vapor extraction along with excavation of soil with remaining contamination (metals, PAHs, VOCs). At the DMC Study Area the DECs are not ARARs because there is no direct contact risk to soils. At the DMC Study Area the PMCs are neither applicable nor appropriate because there is no direct contact risk from soil and cleanup of the groundwater is technically impracticable. Excavation from the most contaminated areas of the DMC Study Area will remove all soils exceeding DECs and PMCs, however.

Table F-2
Location Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Federal				
USEPA Memorandum, "Policy on Floodplains and Wetland Assessments for CERCLA Actions"	Aug. 6, 1985	To Be Considered	The memorandum details situations that would require preparation of floodplains or wetlands assessments and the factors which should be considered in preparing an assessment for actions taken under 104 or 106 of CERCLA.	Design of excavation remedies for the MMC and DMC Study Areas will need to consider the potential for disturbance of the wetland or floodplains bordering the study areas to the east, and mitigate any disturbance accordingly. A habitat and floodplain assessment will be conducted as part of pre-remedial design studies to determine if resource areas are impacted.

Table F-2
Location Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Federal Clean Water Act (CWA) Regulations governing dredge and fill activities in wetlands—Section 404	33 USC 1344 40 CFR Part 230 33 CFR Parts 320-323	Applicable	Discharge of dredged or fill material is prohibited to wetlands or other US waters if there is a practical alternative which would have less adverse impact to the aquatic ecosystem, as long as the alternative does not have other significant impacts.	Design of excavation remedies for the MMC and DMC Study Areas will need to consider potential for disturbance of the wetland bordering the study areas to the east, and mitigate any disturbance accordingly. Filling of potential wetland areas to the east of the MMC Study Area is not anticipated. Any removal of contaminated wetland soil at the DMC Study Area will need to comply with the substantive requirements of the CWA permit process for discharge of fill material to a wetland. A habitat assessment will be conducted as part of pre-remedial design studies if resource areas are impacted. Due to the high levels of contamination, there may be no practicable alternative to disturbing wetlands. If wetlands disturbance occurs, compensatory measures will be required.
Fish and Wildlife Coordination Act	16 U.S.C. 661	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	If the construction of the water main extension or alternative water source has the potential to modify a stream or potentially affect fish or wildlife, the U.S. Fish and Wildlife Service will be consulted.

Table F-2
Location Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Floodplain Management Executive Order	E.O. 11988	Relevant and Appropriate	Federal agencies are required to avoid any action in floodplains if there is a practicable alternative.	Design of excavation remedies for the MMC and DMC Study Areas will need to consider the potential for disturbance of floodplains. Due to high levels of contamination, there may be no practicable alternative to taking action in floodplains. Any work in floodplains will comply with the substantive provisions of the Executive Order. Compensatory flood storage will be provided if necessary.

Table F-2
Location Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Protection of Wetlands Executive Order	E.O. 11990	Relevant and Appropriate	Federal agencies are required to avoid construction in wetlands is there is a practicable alternative.	Design of excavation alternatives for the MMC and DMC Study Areas will need to consider potential for disturbance of the wetland bordering the study areas to the east, and mitigate any disturbance accordingly. Filling of potential wetland areas to the east of the MMC Study Area is not anticipated. Any removal of contaminated wetland soil at the DMC Study Area will need to comply with the substantive requirements of the Executive Order. A habitat assessment will be conducted as part of pre-remedial design studies if resource areas are impacted. Due to the high levels of contamination, there may be no practicable alternative to disturbing wetlands. If wetlands disturbance occurs, compensatory measures will be required.

Table F-2
Location Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
National Historic Preservation Act and Regulations	16 USC 470f 36 CFG Part 800	Relevant and Appropriate if there is a potential for historic properties	Adoption of prudent and feasible measures to eliminate, minimize, and mitigate impacts on historic properties.	Prior to any disturbance or excavation, a review of potential impacts to historic properties will be conducted, including any engineering controls to mitigate indoor air risks in residences.
State				
Inland Wetland and Watercourses Act and Inland Wetlands and Watercourses Regulations	CGS §§22a-36 through 45 RCSA §§22a-39-1 to 15	Applicable	These statutes and regulations regulate any operation in or affecting an inland wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration or pollution of such wetlands. Consult local wetlands regulations for substantive requirements.	Design of excavation remedies for the MMC and DMC Study Areas will need to consider potential for disturbance of the wetland bordering the study areas to the east, and mitigate any disturbance accordingly. Filling of potential wetland areas to the east of the MMC Study Area is not anticipated. Any removal of contaminated wetland soil at the DMC Study Area will need to comply with the substantive requirements of this act. Local wetland regulations would be consulted for any alternative involving potential disturbance of the wetland east of the MMC and DMC study areas.

Table F-2
Location Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken to Attain ARAR
Flood Management Regulations	RCSA §§25-68h-1 through 25-68h-3	Applicable	These regulations govern activities in flood plains to minimize flood risk and prevent flood hazards.	Design of excavation remedies for the MMC and DMC Study Areas will need to consider the potential for disturbance of floodplains. Any work in flood plains will comply with the substantive provisions of the regulations. Compensatory flood storage will be provided if necessary.

Table F-3
Action Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken To Attain ARAR
Federal Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR 61	Relevant and Appropriate	Establishes point source standards for eight pollutants: mercury, asbestos, beryllium, vinyl chloride, benzene, arsenic, radionuclides, and Radon 222.	The SVE system will include emissions control in the form of vapor-phase granular activated carbon. Monitoring will be performed to verify effectiveness of carbon for removal of VOCs from the air.
Federal RCRA Air Emissions Standards for Process Vents	40 CFR 264 Subpart AA	Applicable if threshold levels are met.	These regulations specify air discharge levels for certain organic treatment processes (e.g. SVE systems).	The SVE system will include emissions control in the form of vapor-phase granular activated carbon. Monitoring will be performed to verify effectiveness of carbon for removal of VOCs from the air.
Federal RCRA Air Emission Standards for Equipment Leaks	40 CFR 264 subpart BB	Applicable if threshold levels are met.	Standards for air emissions for equipment that contains or contacts hazardous substances with organic concentrations of at least 10% by weight.	The SVE system will include emissions control in the form of vapor-phase granular activated carbon. Monitoring will be performed to verify effectiveness of carbon for removal of VOCs from the air.
Federal RCRA Air Emission Standards for Tanks	40 CFR 264 subpart CC	Relevant and Appropriate if threshold levels are met	Standards for air emissions from tanks that manage certain levels of hazardous substances.	The SVE system will include emissions control in the form of vapor-phase granular activated carbon. Monitoring will be performed to verify effectiveness of carbon for removal of VOCs from the air.

Table F-3
Action Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken To Attain ARAR
Clean Water Act NPDES Regulations (Stormwater Discharges)	40 CFR 122.26(c)(ii)(C) 40 CFR 122.44(k) 40CFR 125.100 - .104	Applicable	Discharges of stormwater associated with construction activities are required to implement measures, including best management practices, to control pollutants in stormwater discharges during and after construction activities.	Remedial construction (e.g., soil excavation, water main installation, SVE system installation) will be designed and implemented to comply with these requirements, such as best management practices.
Connecticut Soil Vapor Remediation Standards Regulations (RSRs)	RCSA §§22a-133k-3(c)	Applicable	These standards establish volitalization criteria to address volatile organic substances in groundwater and soil vapor.	For areas where data show the potential for an unacceptable indoor inhalation risk, remedial actions (e.g., sub-slab depressurization systems) will be applied, as needed, so as to comply with the substantive provisions of these regulations.
Proposed Revisions - Connecticut's Remediation Standard Regulations Volatilization Criteria, March 2003	Proposed Revisions to portions of RCSA §§22a-133k-1 through 3	To Be Considered	These revisions detail how volatilization criteria are calculated and how revised transport models, updated risk information, and volatilization criteria are applied. These proposed standards also establish revised target indoor air concentrations and revised volatilization criteria for groundwater and soil vapor for many volatile contaminants.	These proposed criteria were considered, in conjunction with the site-specific risk assessment that includes the vapor intrusion pathway, in evaluating the need for remedial action and in setting target cleanup levels for contaminants in Site groundwater. These standards are used to help develop target cleanup levels for the design of remedial alternatives for soil vapor. These standards will be considered in future evaluations of vapor intrusion.

Table F-3
Action Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken To Attain ARAR
Comparison Value Determination for 1,4-Dioxane in Drinking Water	CT Dept. of Public Health, Division of Environ-mental & Occupational Health Assessment March 2004	To Be Considered	This document establishes a drinking water comparison value of 20 ug/L for 1,4-dioxane. This interim value will be re-visited by USEPA's IRIS review of this compound.	This value was considered in evaluating the need for remedial action. Remedial action to provide an alternative water supply from Middletown will be implemented with the goal of attaining this value in drinking water.
Connecticut Air Pollution Control Regulations	RCSA 22a-174 Sections 3a, 18b, 20, 23, 29	Applicable	This section requires permits to construct and operate stationary sources of emissions, and requires those sources to meet specified standards. Pollution abatement controls may be required. Specific standards are listed for many pollutants. Active gas collection systems with emissions controls may be required.	The SVE system will include emissions control in the form of vapor-phase granular activated carbon. Monitoring will be performed to verify effectiveness of carbon for removal of VOCs from the air. The substantive requirements of the permit process would be met. Storage of VOCs will meet the provisions of Section 20 if a storage tank of 250 gallons or greater is used, or the VOC has a vapor pressure of 1.5 psi or greater.
Hazardous Waste Management: Generator & Handler Requirements- General Standards, Listing & Identification	RCSA 22a-449(c)100-101	Applicable	These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR §§260-261 are incorporated by reference. Chromium is not exempted from listing as a hazardous waste.	Wastes that may be generated during implementation of an alternative (e.g., spent carbon, recovered NAPL) will undergo testing for RCRA characteristics to determine appropriate the waste classification and disposal options.

Table F-3
Action Specific ARARs for Remedial Actions
Durham Meadows Superfund Site

Requirement	Citation	Status	Synopsis of Requirement	Action Taken To Attain ARAR
Hazardous Waste Management: Generator Standards	RCSA 22a-449(c)102	Applicable	This section establishes standards for various classes of generators. The standards of 40 CFR §262 are incorporated by reference. Storage requirements given at 40 CFR §265.15 are also included.	On-site storage of wastes determined to be RCRA hazardous (listed or characteristic) will comply with these requirements. This alternative applies to excavated solvent-contaminated soil and to treatment residuals determined to be RCRA hazardous.
Control of Noise	RCSA §22a- 69-1 to 69-7.4	Applicable	These regulations establish allowable noise levels; and would apply to construction activities at the site	All remedial construction activities will comply with these regulations.
CT Guidelines for Soil Erosion and Sediment Control (May 2002)	adopted pursuant to CGS 22a-328	To Be Considered	The Guidelines provide technical and administrative guidance for the development, adoption and implementation of erosion and sediment control program.	Remedial construction (e.g., soil excavation, water main installation, SVE system installation) will be designed and implemented to comply with these guidelines.

Appendix G
Administrative Record Index

Durham Meadows
NPL Site Administrative Record
Record of Decision (ROD)

Index

September 2005

Prepared by
EPA New England
Office of Site Remediation & Restoration

Introduction to the Collection

This is the Administrative Record for the Durham Meadows Superfund site, Durham, CT, Entire Site, Record of Decision (ROD), released September 2005. The file contains site-specific documents and a list of guidance documents used by EPA staff in selecting a response action at the site.

This file replaces the Proposed Plan for Record of Decision Administrative Record released in July 2005.

The administrative record file is available for review at:

Durham Public Library
7 Maple Avenue
Durham, CT 06422
(860) 349-9544 (phone)
(860) 349-9853 (fax)
http://www.lioninc.org/durham/

EPA New England Superfund Records & Information Center
1 Congress Street, Suite 1100 (HSC)
Boston, MA 02114 (by appointment)
617-918-1440 (phone)
617-918-1223 (fax)
http://www.epa.gov/region01/superfund/resource/records.htm

Questions about this administrative record file should be directed to the EPA New England site manager.

An administrative record file is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Instructions about PDF

The documents in this collection are available as a Portable Document Format (PDF) file. The PDF process maintains the look and presentation of the original document. To view PDF files, you will need Adobe Acrobat Reader software loaded on your computer. This software is available, free of charge, from Adobe Software [this is a link to http://www.adobe.com]. To ensure you will be able to see a PDF file in its entirety, please obtain the most recent version of the free Adobe Reader from the Adobe Web site.
(http://www.adobe.com/products/acrobat/readstep.html)

03: REMEDIAL INVESTIGATION (RI)

67293 **EVALUATION AND IN-DEPTH STUDY OF FRANK W STRING SCHOOL CONDITIONS (03/22/99 NOTIFICATION LETTER ATTACHED)**

Author: CHARLES J NAFIE & ASSOCIATES
Doc Date: 01/01/0001
Addressee: DURHAM (CT) TOWN OF
File Break: 03.01
Doc Type: REPORT

67269 **PRELIMINARY HEALTH ASSESSMENT**

Author: US AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR)
Doc Date: 06/01/1990
Addressee:
File Break: 03.09
Doc Type: REPORT

67277 **LETTER REGARDING 11/01/90 SAMPLING AND ANALYSIS RESULTS AT MERRIAM MANUFACTURING COMPANY (MAP AND SUMMARY TABLE ATTACHED)**

Author: CT DEPT OF ENVIRONMENTAL PROTECTION
Doc Date: 12/04/1990
Addressee:
File Break: 03.02
Doc Type: LETTER

67294 **DATA SUMMARY REPORT START INITIATIVE**

Author: METCALF AND EDDY, INC
Doc Date: 04/01/1994
Addressee: US EPA REGION 1
File Break: 03.04
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

67281 **WATER-RESOURCES INVESTIGATIONS REPORT - GEOHYDROLOGY AND WATER QUALITY OF DURHAM CENTER AREA, DURHAM, CONNECTICUT**

Author: US GEOLOGICAL SURVEY
Doc Date: 01/01/1995
Addressee:
File Break: 03.06
Doc Type: REPORT

67261 **HEALTH CONSULTATION**

Author: CT DEPT OF PUBLIC HEALTH
Doc Date: 04/19/1995
Addressee: US EPA REGION 1
File Break: 03.09
Doc Type: REPORT

67262 **HEALTH CONSULTATION**

Author: US AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR)
Doc Date: 09/29/1995
Addressee: US EPA REGION 1
File Break: 03.09
Doc Type: REPORT

67265 **DRAFT, WORK PLAN FOR CONDUCTING REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS)**

Author: LEGGETTE BRASHEARS & GRAHAM INC
Doc Date: 09/01/1997
Addressee: DURHAM MANUFACTURING CO
File Break: 03.07
Doc Type: WORK PLAN

03: REMEDIAL INVESTIGATION (RI)

67257 SAMPLING DATA FOR PUMP TEST AT DURHAM FAIRGROUNDS (LETTER AND 06/17/05 FAX TRANSMITTAL ATTACHED)

Author: HYDRO DYNAMIC ENGINEERING — **Doc Date:** 05/10/1999
Addressee: SIMA DRILLING CO INC — **File Break:** 03.01
Doc Type: SAMPLING & ANALYSIS DATA

67266 DRAFT DATA REPORT

Author: LEGGETTE BRASHEARS & GRAHAM INC — **Doc Date:** 08/01/1999
Addressee: DURHAM MANUFACTURING CO — **File Break:** 03.02
Doc Type: REPORT

67259 DRAFT, DURHAM WATER SYSTEM EXTENSION FEASIBILITY STUDY (FS)

Author: FUSS & ONEILL INC — **Doc Date:** 05/01/2000
Addressee: DURHAM (CT) TOWN OF — **File Break:** 03.01
Doc Type: REPORT

67283 DRAFT, PRELIMINARY WATER SYSTEM STUDY-DURHAM CENTER SYSTEM

Author: FUSS & ONEILL INC — **Doc Date:** 05/09/2002
Addressee: — **File Break:** 03.01
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

67270 **REQUEST FOR PUBLIC HEALTH REVIEW**

Author: US EPA REGION 1
Addressee: US AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR)
Doc Type: MEMO

Doc Date: 01/06/2003
File Break: 03.09

67278 **PLAN OF CONSERVATION AND DEVELOPMENT**

Author: DURHAM (CT) TOWN OF
Addressee:
Doc Type: REPORT

Doc Date: 03/01/2003
File Break: 03.01

233866 **DRAFT, REUSE ASSESSMENT**

Author: US EPA REGION 1
Addressee:
Doc Type: REPORT

Doc Date: 09/30/2003
File Break: 03.04

67282 **HEALTH ASSESSMENT - COMPARISON VALUE DETERMINATION FOR 1,4-DIOXANE IN DRINKING WATER**

Author: CT DEPT OF PUBLIC HEALTH
Addressee:
Doc Type: REPORT

Doc Date: 03/01/2004
File Break: 03.09

03: REMEDIAL INVESTIGATION (RI)

67267 **REMEDIAL INVESTIGATION (RI) REPORT**

Author: LEGGETTE BRASHEARS & GRAHAM INC
Doc Date: 01/01/2005
Addressee: DURHAM MANUFACTURING CO
File Break: 03.06
Doc Type: REPORT

67251 **2004 ANNUAL GROUND WATER AND SOIL VAPOR QUARTERLY MONITORING REPORT (03/17/05 TRANSMITTAL LETTER ATTACHED)**

Author: ADVANCED ENVIRONMENTAL INTERFACE INC
Doc Date: 02/01/2005
Addressee: REGIONAL SCHOOL DISTRICT #13 (DURHAM, CT)
File Break: 03.01
Doc Type: REPORT

67279 **DURHAM ZONING REGULATIONS**

Author: DURHAM (CT) TOWN OF
Doc Date: 02/01/2005
Addressee:
File Break: 03.01
Doc Type: REPORT

67284 **DRAFT FINAL BASELINE HUMAN HEALTH RISK ASSESSMENT REPORT**

Author: METCALF & EDDY
Doc Date: 06/01/2005
Addressee:
File Break: 03.09
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

67310 **DRAFT FINAL REMEDIAL INVESTIGATION (RI) REPORT, VOLUME 2**

Author: METCALF & EDDY
Addressee:
Doc Type: REPORT
Doc Date: 06/01/2005
File Break: 03.06

67311 **DRAFT FINAL TECHNICAL IMPRACTICABILITY EVALUATION REPORT**

Author: METCALF & EDDY
Addressee: US EPA REGION 1
Doc Type: REPORT
Doc Date: 06/01/2005
File Break: 04.06

67312 **DRAFT FINAL REMEDIAL INVESTIGATION (RI) REPORT, VOLUME 1**

Author: METCALF & EDDY
Addressee:
Doc Type: REPORT
Doc Date: 06/01/2005
File Break: 03.06

67316 **GROUND WATER USE AND VALUE DETERMINATION (07/06/05 TRANSMITTAL LETTER, 07/05/05 CONCLUSIONS AND RECOMMENDATIONS, MAPS ATTACHED)**

Author: CT DEPT OF ENVIRONMENTAL PROTECTION
Addressee:
Doc Type: REPORT
Doc Date: 06/30/2005
File Break: 03.04

03: REMEDIAL INVESTIGATION (RI)

67325 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Author: US EPA REGION 1
Doc Date: 06/30/2005
Addressee:
File Break: 03.10
Doc Type: REPORT

236700 FINAL REPORT INDOOR AIR SAMPLING STUDY, MAY 2005, APPENDIX A, LABORATORY ANALYTICAL REPORT

Author: US EPA REGION 1
Doc Date: 06/30/2005
Addressee:
File Break: 03.04
Doc Type: REPORT

238274 DRAFT FINAL REMEDIAL INVESTIGATION REPORT, APPENDIX D-3, ADDENDUM, WATER SUPPLY WELL DATA

Author: METCALF & EDDY
Doc Date: 09/21/2005
Addressee: US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

238275 CLARIFICATION REGARDING APPENDIX D-3 ADDENDUM TO THE DRAFT FINAL REMEDIAL INVESTIGATION REPORT

Author: ANNI LOUGHLIN US EPA REGION 1
Doc Date: 09/27/2005
Addressee:
File Break: 03.06
Doc Type: MEMO

04: FEASIBILITY STUDY (FS)

67323 **WORK PLAN AMENDMENT AND COST TO COMPLETE ANALYSIS FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) OVERSIGHT**

Author: METCALF & EDDY
Addressee:
Doc Type: REPORT
Doc Date: 04/01/2003
File Break: 04.07

67322 **SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN (QAPP)) FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)**

Author: METCALF & EDDY
Addressee:
Doc Type: REPORT
Doc Date: 06/01/2004
File Break: 04.04

67313 **DRAFT FINAL FEASIBILITY STUDY (FS) REPORT**

Author: METCALF & EDDY
Addressee:
Doc Type: REPORT
Doc Date: 06/01/2005
File Break: 04.06

67309 **MEMO REGARDING DETAILED EVALUATION OF COMBINATIONS OF SPECIFIC REMEDIAL ALTERNATIVES (TABLES ATTACHED)**

Author: METCALF & EDDY
Addressee: US EPA REGION 1
Doc Type: MEMO
Doc Date: 06/29/2005
File Break: 04.02

04: FEASIBILITY STUDY (FS)

67326 **PROPOSED PLAN**

Author: US EPA REGION 1
Addressee:
Doc Type: REPORT
Doc Date: 07/01/2005
File Break: 04.09

237193 **TRANSMITTAL OF PROPOSED PLAN ON CD-ROM**

Author: ANNI LOUGHLIN US EPA REGION 1
Addressee: RICHARD H PATTERSON DURHAM MANUFACTURING CO
Doc Type: LETTER
Doc Date: 07/13/2005
File Break: 04.01

237194 **TRANSMITTAL OF PROPOSED PLAN ON CD-ROM**

Author: ANNI LOUGHLIN US EPA REGION 1
Addressee: CAROLYN ADAMS ALLAN E ADAMS, ESTATE OF
MERRIAM MANUFACTURING CO
Doc Type: LETTER
Doc Date: 07/13/2005
File Break: 04.01

05: RECORD OF DECISION (ROD)

237251 **E-MAIL CONTAINING COMMENTS ON THE PROPOSED PLAN**

Author: DEBORAH R HOYT DURHAM (CT) RESIDENT
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Type: LETTER
Doc Date: 07/21/2005
File Break: 05.03

237248 **COMMENTS MADE AT THE MEETING ON THE PROPOSED PLAN**

Author: ROSA DELAURO US HOUSE OF REPRESENTATIVES
Addressee:
Doc Type: PUBLIC MEETING RECORD
Doc Date: 07/28/2005
File Break: 05.03

237249 **COMMENTS ON THE PROPOSED PLAN**

Author: RENEE PRIMUS DURHAM (CT) TOWN OF
Addressee:
Doc Type: PUBLIC MEETING RECORD
Doc Date: 07/28/2005
File Break: 05.03

05: RECORD OF DECISION (ROD)

237250 COMMENTS ON THE PROPOSED PLAN

Author: MARYANN P BOORD DURHAM (CT) TOWN OF
Addressee: ERNIE A JUDSON DURHAM (CT) TOWN OF
RENEE PRIMUS DURHAM (CT) TOWN OF
ANNI LOUGHLIN US EPA REGION 1
Doc Type: LETTER

Doc Date: 07/28/2005
File Break: 05.03

237247 E-MAIL CONTAINING COMMENTS ON THE PROPOSED PLAN

Author: LISA LARSEN DURHAM (CT) RESIDENT
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Type: MEMO

Doc Date: 08/04/2005
File Break: 05.03

237246 COMMENTS ON THE PROPOSED PLAN

Author: GUY P RUSSO MIDDLETOWN (CT) CITY OF
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Type: LETTER

Doc Date: 08/05/2005
File Break: 05.03

05: RECORD OF DECISION (ROD)

237236 COMMENTS ON THE RI/FS AND PROPOSED PLAN

Author: KATHLEEN A CYR GZA GEOENVIRONMENTAL INC
Addressee: RICHARD LAMONICA GZA GEOENVIRONMENTAL INC
RICHARD H PATTERSON DURHAM MANUFACTURING CO
Doc Date: 08/10/2005
File Break: 05.03
Doc Type: LETTER

237237 COMMENTS ON THE PROPOSED PLAN

Author: LORRAINE ETHERIDGE DURHAM (CT) RESIDENT
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Date: 08/10/2005
File Break: 05.03
Doc Type: LETTER

237239 COMMENTS ON THE PROPOSED PLAN

Author: DARRELL B SMITH
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Date: 08/10/2005
File Break: 05.03
Doc Type: MEMO

05: RECORD OF DECISION (ROD)

237245 **E-MAIL CONTAINING COMMENTS ON THE PROPOSED PLAN**

Author: DONIA VIOLA DURHAM (CT) TOWN OF
Doc Date: 08/10/2005
Addressee: ANNI LOUGHLIN US EPA REGION 1
File Break: 05.03
Doc Type: MEMO

237235 **COMMENTS ON THE PROPOSED PLAN**

Author: RICHARD H PATTERSON DURHAM MANUFACTURING CO
Doc Date: 08/11/2005
Addressee: ANNI LOUGHLIN US EPA REGION 1
File Break: 05.03
Doc Type: LETTER

237240 **COMMENTS ON THE PROPOSED PLAN**

Author: HENRY A ROBINSON DURHAM (CT) TOWN OF
Doc Date: 08/11/2005
Addressee: ANNI LOUGHLIN US EPA REGION 1
File Break: 05.03
Doc Type: LETTER

237241 **E-MAIL TRANSMITTING ELECTRONIC VERSION OF COMMENTS ON THE PROPOSED PLAN**

Author: HENRY A ROBINSON DURHAM (CT) TOWN OF
Doc Date: 08/11/2005
Addressee: ANNI LOUGHLIN US EPA REGION 1
File Break: 05.03
Doc Type: LETTER

05: RECORD OF DECISION (ROD)

237242 STATE'S COMMENTS ON THE PROPOSED PLAN

Author: MICHAEL J HARDER CT DEPT OF ENVIRONMENTAL PROTECTION
Addressee: MARY JANE ODONNELL US EPA REGION 1
Doc Type: LETTER
Doc Date: 08/11/2005
File Break: 05.03

237244 E-MAIL CONTAINING ADDITIONAL COMMENTS ON THE PROPOSED PLAN

Author: DONIA VIOLA DURHAM (CT) TOWN OF
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Type: MEMO
Doc Date: 08/11/2005
File Break: 05.03

237238 COMMENTS ON THE PROPOSED PLAN

Author: LORI MATHIEU CT DEPT OF PUBLIC HEALTH
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Type: LETTER
Doc Date: 08/12/2005
File Break: 05.03

237243 E-MAIL CONTAINING COMMENTS ON THE PROPOSED PLAN

Author: JOHN J HORAN DURHAM (CT) TOWN OF
Addressee: ANNI LOUGHLIN US EPA REGION 1
Doc Type: MEMO
Doc Date: 08/12/2005
File Break: 05.03

05: RECORD OF DECISION (ROD)

238284 **RECORD OF DECISION**

Author: US EPA REGION 1
Addressee:
Doc Date: 09/30/2005
File Break: 05.04

Doc Type: REPORT
Doc Type: RECORD OF DECISION

10: ENFORCEMENT/NEGOTIATION

7309 **ADMINISTRATIVE ORDER BY CONSENT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND OTHER WORK. DOCKET NO. I-97-1033**

Author: US EPA REGION 1
Addressee:
Doc Date: 06/30/1997
File Break: 10.07

Doc Type: LITIGATION

11: POTENTIALLY RESPONSIBLE PARTY

67263 **SUMMARY OF GROUND-WATER QUALITY INVESTIGATION**

Author: LEGGETTE BRASHEARS & GRAHAM INC
Addressee: DURHAM MANUFACTURING CO
Doc Date: 10/01/1982
File Break: 11.09

Doc Type: REPORT

11: POTENTIALLY RESPONSIBLE PARTY

67272 **GROUND-WATER INVESTIGATION**

Author: ROUX ASSOCIATES
Addressee: MERRIAM MANUFACTURING CO
Doc Date: 01/01/1983
File Break: 11.09
Doc Type: REPORT

67264 **SUMMARY OF SUBSURFACE INVESTIGATIONS DURING 1982-1993 AT DURHAM MANUFACTURING COMPANY (06/30/92 LETTER WITH APPENDICES ATTACHED)**

Author: LEGGETTE BRASHEARS & GRAHAM INC
Addressee: DURHAM MANUFACTURING CO
Doc Date: 01/07/1984
File Break: 11.09
Doc Type: REPORT

67273 **DRAFT, SITE INVESTIGATION (SI) REPORT**

Author: ROUX ASSOCIATES
Addressee: MERRIAM MANUFACTURING CO
Doc Date: 09/23/1988
File Break: 11.09
Doc Type: REPORT

67274 **PHASE 2 SITE INVESTIGATION (SI) REPORT, VOLUME 1**

Author: ROUX ASSOCIATES
Addressee: MERRIAM MANUFACTURING CO
Doc Date: 01/22/1990
File Break: 11.09
Doc Type: REPORT

11: POTENTIALLY RESPONSIBLE PARTY

67275 **PHASE 2 SITE INVESTIGATION (SI) REPORT, VOLUME 2-APPENDICES**

Author: ROUX ASSOCIATES
Addressee: MERRIAM MANUFACTURING CO
Doc Date: 01/22/1990
File Break: 11.09
Doc Type: REPORT

67276 **ADDENDUM TO PHASE 2 SITE INVESTIGATION (SI) REPORT**

Author: ROUX ASSOCIATES
Addressee: MERRIAM MANUFACTURING CO
Doc Date: 06/20/1990
File Break: 11.09
Doc Type: REPORT

67285 **SOIL GAS SURVEY REPORT**

Author: ROUX ASSOCIATES
Addressee: MERRIAM MANUFACTURING CO
Doc Date: 10/17/1990
File Break: 11.09
Doc Type: REPORT

67260 **SAMPLING RESULTS FROM MERRIAM MANUFACTURING PROPERTY (09/10/92 TRANSMITTAL LETTER ATTACHED)**

Author: MERRIAM MANUFACTURING CO
Addressee: DURHAM (CT) TOWN OF
Doc Date: 09/01/1992
File Break: 11.09
Doc Type: SAMPLING & ANALYSIS DATA

11: POTENTIALLY RESPONSIBLE PARTY

67271 **104E INFORMATION REQUEST RESPONSE (PARTIAL RESPONSES ATTACHED)**

Author: ROBINSON & COLE LLP
Doc Date: 01/07/1994
Addressee: US EPA REGION 1
File Break: 11.09
Doc Type: LETTER

13: COMMUNITY RELATIONS

67320 **NOTIFICATION OF PUBLIC INFORMATION MEETING FOR PROPOSED CLEANUP PLAN**

Author: US EPA REGION 1
Doc Date: 01/01/0001
Addressee:
File Break: 13.03
Doc Type: PRESS RELEASE

67321 **MEETING FLYER ANNOUNCEMENT OF PUBLIC INFORMATION MEETING FOR PROPOSED CLEANUP PLAN**

Author: US EPA REGION 1
Doc Date: 01/01/0001
Addressee:
File Break: 13.03
Doc Type: PRESS RELEASE

13: COMMUNITY RELATIONS

67258 **FACT SHEET**

Author: US EPA REGION 1
Addressee:
Doc Type: FACT SHEET
Doc Date: 01/01/1998
File Break: 13.03

67254 **COMMUNITY UPDATE: 1,4 - DIOXANE**

Author: US EPA REGION 1
Addressee:
Doc Type: FACT SHEET
Doc Date: 03/01/2004
File Break: 13.03

67255 **COMMUNITY UPDATE: EPA TO BEGIN WORK AT FORMER LOCATION OF MERRIAM MANUFACTURING COMPANY**

Author: US EPA REGION 1
Addressee:
Doc Type: FACT SHEET
Doc Date: 05/01/2004
File Break: 13.03

67253 **COMMUNITY UPDATE: 1,4 - DIOXANE**

Author: US EPA REGION 1
Addressee:
Doc Type: FACT SHEET
Doc Date: 06/01/2004
File Break: 13.03

13: COMMUNITY RELATIONS

67256 **FACT SHEET (08/15/95 TRANSMITTAL MEMO AND 04/1993 ATSDR FACT SHEET ATTACHED)**

Author: CT DEPT OF PUBLIC HEALTH
Doc Date: 08/01/2004
Addressee:
File Break: 13.03
Doc Type: FACT SHEET

67252 **COMMUNITY UPDATE: EPA TO EVALUATE SOIL GAS AND INDOOR AIR**

Author: US EPA REGION 1
Doc Date: 04/01/2005
Addressee:
File Break: 13.03
Doc Type: FACT SHEET

233373 **TRANSMITTAL OF RECORD OF DECISION (ROD) PROPOSED PLAN ADMINISTRATIVE RECORD FILE TO TOWN REPOSITORY**

Author: US EPA REGION 1
Doc Date: 07/01/2005
Addressee: DURHAM (CT) PUBLIC LIBRARY
File Break: 13.01
Doc Type: LETTER

237192 **TRANSMITTAL OF DOCUMENTS FOR THE PUBLIC INFORMATION REPOSITORY**

Author: ANNI LOUGHLIN US EPA REGION 1
Doc Date: 07/01/2005
Addressee: VALERIE KILMARTIN DURHAM (CT) PUBLIC LIBRARY
File Break: 13.01
Doc Type: LETTER

13: COMMUNITY RELATIONS

67319 **PRESS RELEASE: COMPREHENSIVE CLEANUP PLAN PROPOSED**

Author: US EPA REGION 1
Addressee:
Doc Type: PRESS RELEASE
Doc Date: 07/07/2005
File Break: 13.03

237208 **COMPREHENSIVE CLEANUP PLAN PROPOSED FOR DURHAM MEADOWS SUPERFUND SITE**

Author: US EPA REGION 1
Addressee:
Doc Type: PRESS RELEASE
Doc Date: 07/07/2005
File Break: 13.03

237212 **NOTICE OF PUBLIC MEETING IN MIDDLETOWN PRESS**

Author: US EPA REGION 1
Addressee:
Doc Type: PUBLIC MEETING RECORD
Doc Date: 07/09/2005
File Break: 13.03

237213 **NOTICE OF PUBLIC MEETING**

Author: US EPA REGION 1
Addressee:
Doc Type: PUBLIC MEETING RECORD
Doc Date: 07/09/2005
File Break: 13.04

13: COMMUNITY RELATIONS

237207 **EPA PLAN GOES PUBLIC**

Author: AMY L ZITKA MIDDLETOWN PRESS
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/10/2005
File Break: 13.03

237211 **PUBLIC MEETING HANDOUT**

Author: US EPA REGION 1
Addressee:
Doc Type: PUBLIC MEETING RECORD
Doc Date: 07/12/2005
File Break: 13.04

237206 **EPA: CLEANUP COSTLY; OFFICIALS OUTLINE OPTIONS FOR SUPERFUND SITE**

Author: PETER DOWNS HARTFORD COURANT
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/13/2005
File Break: 13.03

237203 **SELECTMEN TO PONDER GIFT OF CONTAMINATED LAND**

Author: AMY L ZITKA MIDDLETOWN PRESS
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/15/2005
File Break: 13.03

13: COMMUNITY RELATIONS

237204 LAND GIFT STUMPS TOWN

Author: BENJAMIN ALEXANDER-BLOCH HARTFORD COURANT
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/15/2005
File Break: 13.03

237205 EPA OUTLINES PLAN FOR WATER CLEANUP

Author: ROB GLIDDEN TOWN TIMES
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/15/2005
File Break: 13.03

237201 DURHAM OFFICIALS REJECT PROPERTY GIFT

Author: AMY L ZITKA MIDDLETOWN PRESS
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/16/2005
File Break: 13.03

237202 LAND OFFER TURNED DOWN; SELECTMEN SAW TOO MANY RISKS

Author: BENJAMIN ALEXANDER-BLOCH HARTFORD COURANT
Addressee:
Doc Type: NEWS CLIPPING
Doc Date: 07/16/2005
File Break: 13.03

13: COMMUNITY RELATIONS

237200 **TOWN OF DURHAM BEQUEATHED 281 MAIN STREET**

Author: MARYANN P BOORD DURHAM (CT) TOWN OF
Doc Date: 07/21/2005
Addressee:
File Break: 13.03
Doc Type: NEWS CLIPPING

237199 **EPA TO HOLD PUBLIC HEARING ON CLEAN-UP PLAN FOR THE DURHAM MEADOWS SUPERFUND SITE IN DURHAM, CT**

Author: JODIE RIZZUTO US EPA REGION 1
Doc Date: 07/26/2005
Addressee:
File Break: 13.03
Doc Type: PRESS RELEASE

237209 **PUBLIC HEARING TRANSCRIPT**

Author: US EPA REGION 1
Doc Date: 07/28/2005
Addressee:
File Break: 13.04
Doc Type: PUBLIC MEETING RECORD

237210 **PUBLIC HEARING HANDOUT**

Author: US EPA REGION 1
Doc Date: 07/28/2005
Addressee:
File Break: 13.04
Doc Type: PUBLIC MEETING RECORD

13: COMMUNITY RELATIONS

237196 **CORRECTION TO 7/15/2005 REPORT ON PUBLIC COMMENT PROCESS**

Author: TOWN TIMES
Doc Date: 07/29/2005
Addressee:
File Break: 13.03
Doc Type: NEWS CLIPPING

237197 **EPA GETS INPUT ON MEADOWS CLEAN-UP PLAN**

Author: AMY L ZITKA MIDDLETOWN PRESS
Doc Date: 07/29/2005
Addressee:
File Break: 13.03
Doc Type: NEWS CLIPPING

237198 **AID FOR POLLUTION WORK SOUGHT**

Author: PETER DOWNS HARTFORD COURANT
Doc Date: 07/29/2005
Addressee:
File Break: 13.03
Doc Type: NEWS CLIPPING

237195 **PUBLIC HEARING ATTENDEES ASK: 'WHERE'S THE MONEY?'**

Author: ROB GLIDDEN TOWN TIMES
Doc Date: 08/04/2005
Addressee:
File Break: 13.03
Doc Type: NEWS CLIPPING

14: CONGRESSIONAL RELATIONS

237228 **EPA TAKEOVER OF REMEDIAL INVESTIGATION AND FEASIBILITY STUDY**

Author: MARY SANDERSON US EPA REGION 1
Doc Date: 02/04/2005
Addressee: RICHARD H PATTERSON DURHAM MANUFACTURING CO
File Break: 14.01
Doc Type: LETTER

237252 **RESPONSE TO AN E-MAIL DATED 2/9/05, CONCERNING EPA'S TAKING OVER THE RI**

Author: MARY SANDERSON US EPA REGION 1
Doc Date: 02/15/2005
Addressee: RICHARD H PATTERSON DURHAM MANUFACTURING CO
File Break: 14.01
Doc Type: LETTER

237227 **DOCUMENTATION OF WHAT EPA HAS RECEIVED FROM DURHAM MANUFACTURING AND IT'S CONTRACTOR IN RESPONSE TO A REQUEST FOR INFORMATION DATED 2/24/05**

Author: MARY SANDERSON US EPA REGION 1
Doc Date: 03/04/2005
Addressee: RICHARD H PATTERSON DURHAM MANUFACTURING CO
File Break: 14.01
Doc Type: LETTER

237226 **PROPOSALS TO ACCELERATE THE CLEANUP PROCESS AND PROVIDE A MORE EQUITABLE SOLUTION**

Author: RAYMOND C KALINOWSKI CT HOUSE OF REPRESENTATIVES
Doc Date: 04/11/2005
Addressee: ROBERT W VARNEY US EPA REGION 1
File Break: 14.01
Doc Type: LETTER

14: CONGRESSIONAL RELATIONS

237224 **BACKGROUND ON THE DURHAM MEADOWS SITE AND PROPOSED SOLUTIONS**

Author: LARRY MCHUGH MIDDLESEX COUNTY (CT) CHAMBER OF COMMERC
Addressee: ROBERT W VARNEY US EPA REGION 1
Doc Type: LETTER
Doc Date: 04/25/2005
File Break: 14.01

237225 **RESPONSE TO SPECIFIC PROPOSALS IN 4/11/05 LETTER CONCERNING DURHAM MEADOWS SITE**

Author: ROBERT W VARNEY US EPA REGION 1
Addressee: RAYMOND C KALINOWSKI CT HOUSE OF REPRESENTATIVES
Doc Type: LETTER
Doc Date: 04/28/2005
File Break: 14.01

237222 **REQUEST FOR EPA REVIEW OF THE DURHAM MEADOWS CASE**

Author: ROSA DELAURO US HOUSE OF REPRESENTATIVES
Addressee: CHRISTOPHER J DODD US SENATE
JOSEPH I LIEBERMAN US SENATE
ROB SIMMONS US CONGRESS
STEPHEN L JOHNSON US EPA - HEADQUARTERS
Doc Type: LETTER
Doc Date: 05/12/2005
File Break: 14.01

14: CONGRESSIONAL RELATIONS

237223 **BACKGROUND ON THE DURHAM MEADOWS SITE AND RESPONSE TO PROPOSED SOLUTIONS**

Author: ROBERT W VARNEY US EPA REGION 1
Doc Date: 05/18/2005
Addressee: LARRY MCHUGH MIDDLESEX COUNTY (CT) CHAMBER OF COMMERC
File Break: 14.01
Doc Type: LETTER

237218 **RESPONSE TO 5/12/05 LETTER TO EPA ADMINISTRATOR STEPHEN JOHNSON REGARDING DURHAM MANUFACTURING AND DURHAM MEADOWS ISSUES**

Author: ROBERT W VARNEY US EPA REGION 1
Doc Date: 06/01/2005
Addressee: CHRISTOPHER J DODD US SENATE
File Break: 14.01
Doc Type: LETTER

237219 **RESPONSE TO 5/12/05 LETTER TO EPA ADMINISTRATOR STEPHEN JOHNSON REGARDING DURHAM MANUFACTURING AND DURHAM MEADOWS ISSUES**

Author: ROBERT W VARNEY US EPA REGION 1
Doc Date: 06/01/2005
Addressee: JOSEPH I LIEBERMAN US SENATE
File Break: 14.01
Doc Type: LETTER

237220 **RESPONSE TO 5/12/05 LETTER TO EPA ADMINISTRATOR STEPHEN JOHNSON REGARDING DURHAM MANUFACTURING AND DURHAM MEADOWS ISSUES**

Author: ROBERT W VARNEY US EPA REGION 1
Doc Date: 06/01/2005
Addressee: ROB SIMMONS US CONGRESS
File Break: 14.01
Doc Type: LETTER

14: CONGRESSIONAL RELATIONS

237221 **RESPONSE TO 5/12/05 LETTER TO EPA ADMINISTRATOR STEPHEN JOHNSON REGARDING DURHAM MANUFACTURING AND DURHAM MEADOWS ISSUES**

Author: ROBERT W VARNEY US EPA REGION 1
Addressee: ROSA DELAURO US HOUSE OF REPRESENTATIVES
Doc Date: 06/01/2005
File Break: 14.01
Doc Type: LETTER

237217 **REQUEST FOR EPA ATTENDANCE AT A MEETING TO DISCUSS DURHAM ON-GOING CLEANUP**

Author: ROSA DELAURO US HOUSE OF REPRESENTATIVES
Addressee: CHRISTOPHER J DODD US SENATE
JOSEPH I LIEBERMAN US SENATE
ROB SIMMONS US CONGRESS
STEPHEN L JOHNSON US EPA - HEADQUARTERS
Doc Date: 07/15/2005
File Break: 14.01
Doc Type: LETTER

237233 **EXPRESSION OF THANKS FOR MEETING ON 7/21/05 TO DISCUSS DURHAM MANUFACTURING COMPANY ISSUES**

Author: ROSA DELAURO US HOUSE OF REPRESENTATIVES
Addressee: CHRISTOPHER J DODD US SENATE
JOSEPH I LIEBERMAN US SENATE
ROB SIMMONS US CONGRESS
STEPHEN L JOHNSON US EPA - HEADQUARTERS
Doc Date: 07/28/2005
File Break: 14.01
Doc Type: LETTER

14: CONGRESSIONAL RELATIONS

237229 **RESPONSE TO LETTER OF 7/28/05, GIVING A HISTORY OF EPA'S DEALINGS WITH DURHAM MANUFACTURING COMPANY, AND A LIST OF ENCLOSURES**

Author: SUSAN STUDLIEN US EPA REGION 1 - OFFICE OF SITE REMEDIATION & RESTORATION **Doc Date:** 08/02/2005

Addressee: CHRISTOPHER J DODD US SENATE **File Break:** 14.01

Doc Type: LETTER

237230 **RESPONSE TO LETTER OF 7/28/05, GIVING A HISTORY OF EPA'S DEALINGS WITH DURHAM MANUFACTURING COMPANY, AND A LIST OF ENCLOSURES**

Author: SUSAN STUDLIEN US EPA REGION 1 - OFFICE OF SITE REMEDIATION & RESTORATION **Doc Date:** 08/02/2005

Addressee: ROSA DELAURO US HOUSE OF REPRESENTATIVES **File Break:** 14.01

Doc Type: LETTER

237231 **RESPONSE TO LETTER OF 7/28/05, GIVING A HISTORY OF EPA'S DEALINGS WITH DURHAM MANUFACTURING COMPANY, AND A LIST OF ENCLOSURES**

Author: SUSAN STUDLIEN US EPA REGION 1 - OFFICE OF SITE REMEDIATION & RESTORATION **Doc Date:** 08/02/2005

Addressee: JOSEPH I LIEBERMAN US SENATE **File Break:** 14.01

Doc Type: LETTER

237232 **RESPONSE TO LETTER OF 7/28/05, GIVING A HISTORY OF EPA'S DEALINGS WITH DURHAM MANUFACTURING COMPANY, AND A LIST OF ENCLOSURES**

Author: SUSAN STUDLIEN US EPA REGION 1 - OFFICE OF SITE REMEDIATION & RESTORATION **Doc Date:** 08/02/2005

Addressee: ROB SIMMONS US CONGRESS **File Break:** 14.01

Doc Type: LETTER

16: NATURAL RESOURCE TRUSTEE

237214 **NOTIFICATION OF PROPOSED PLAN**

Author: ANNI LOUGHLIN US EPA REGION 1
Addressee: KENNETH FINKELSTEIN US NATIONAL OCEANIC ATMOSPHERIC ADMINISTRATION
Doc Type: LETTER
Doc Date: 07/12/2005
File Break: 16.04

237215 **NOTIFICATION OF PROPOSED PLAN**

Author: ANNI LOUGHLIN US EPA REGION 1
Addressee: GINA MCCARTHY CT DEPT OF ENVIRONMENTAL PROTECTION
Doc Type: LETTER
Doc Date: 07/12/2005
File Break: 16.04

237216 **NOTIFICATION OF PROPOSED PLAN**

Author: ANNI LOUGHLIN US EPA REGION 1
Addressee: ANDREW RADDANT US DEPT OF THE INTERIOR
Doc Type: LETTER
Doc Date: 07/12/2005
File Break: 16.04

17: SITE MANAGEMENT RECORDS

67298 **SOIL SURVEY OF MIDDLESEX COUNTY, CONNECTICUT**

Author: CONNECTICUT AGRICULTURAL EXPERIMENT STATION
Addressee: STORR AGRICULTURAL EXPERIMENT STATION
US DEPT OF AGRICULTURE SOIL CONSERVATION SERVICE
Doc Type: REPORT

Doc Date: 01/01/0001
File Break: 17.08

238277 **GUIDANCE FOR EVALUATING THE TECHNICAL IMPRACTICABILITY OF GROUND-WATER RESTORATION**

Author: US EPA - OFFICE OF SOLID WASTE & EMERGENCY RESPONSE
Addressee:
Doc Type: REPORT

Doc Date: 09/01/1993
File Break: 17.07

67280 **STUDY OF UNDERGROUND WATER RESOURCES OF CONNECTICUT**

Author: US GEOLOGICAL SURVEY
Addressee:
Doc Type: REPORT

Doc Date: 01/01/1999
File Break: 17.07

67268 **CLIMATOGRAPHY OF CONNECTICUT - MONTHLY STATION NORMALS OF TEMPERATURE, PRECIPITATION, AND HEATING AND COOLING DEGREE DAYS FROM 1971-2000**

Author: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Addressee:
Doc Type: REPORT

Doc Date: 02/01/2002
File Break: 17.08

17: SITE MANAGEMENT RECORDS

67295 **MONTHLY STATION NORMALS OF TEMPERATURE, PRECIPITATION, AND HEATING AND COOLING DEGREE DAYS, 1971-200**

Author: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Doc Date: 02/01/2002
Addressee:
File Break: 17.08
Doc Type: REPORT

20: RECORDS MANAGEMENT

67327 **ADMINISTRATIVE RECORD (AR) INDEX FOR PROPOSED PLAN**

Author: US EPA REGION I
Doc Date: 07/01/2005
Addressee:
File Break: 20.01
Doc Type: INDEX

Number of Documents in Collection:121

The following documents were used in making the Decision and are included in the Administrative Record, but are not releasable to the public due to Privacy Act

236700	FINAL REPORT INDOOR AIR SAMPLING STUDY, MAY 2005				
Author:	US EPA REGION 1	Doc Date:	06/30/2005	#of Pages:	236
Addressee:		File Break:	03.04		

Doc Type: Report

Appendix A of this report is available under its own entry.

INDEX OF GUIDANCE

U.S. Army Corps of Engineers / U.S. Environmental Protection Agency (USACE/USEPA). 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. EPA 540-R-00-002. July 2000.

U.S. Environmental Protection Agency (USEPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. USEPA Office of Solid Waste and Emergency Response, Washington, D.C. Interim Final, October 1988.

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U. S. Environmental Protection Agency (USEPA). 1989. *Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*. 1989.

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U.S. Environmental Protection Agency (USEPA). 1991. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual. Supplemental Guidance. "Standard Default Exposure Factors"*. Interim Final. 9285.6-3. March 25, 1991.

U.S. Environmental Protection Agency (USEPA). 1991. *Role of Baseline Risk Assessment in Superfund Remedy Selection Decisions*. Office of Solid Waste and Emergency Response. Washington, D.C. OSWER Directive 9355.0-30. Memo from Don R. Clay. April 22, 1991.

U.S. Environmental Protection Agency (USEPA). 1991. *Design and Construction of RCRA/CERCLA Final Covers*. U.S. Environmental Protection Agency, Office of Emergency Research and Development, Washington, D.C. EPA/625/4-91/025. May 1991.

U.S. Environmental Protection Agency (USEPA). 1991. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual. Part B, Development of Risk-Based Preliminary Remediation Goals*. Interim Final. 9285.7-01B. December 1991.

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U.S. Environmental Protection Agency (USEPA). 1993. *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons*. Office of Research and Development. Washington, DC. EPA/600/R-93/089. July 1993.

U.S. Environmental Protection Agency (USEPA). 1993. *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration - Interim Final*. Office of Solid Waste and Emergency Response, Washington D.C. Directive 9234.2-25. September 1993.

U.S. Environmental Protection Agency (USEPA). 1993. *Presumptive Remedies: Policy and Procedures*. Office of Solid Waste and Emergency Response, Washington D.C. Directive 9355.0-47FS. September 1993.

U.S. Environmental Protection Agency (USEPA). 1993. *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils.* Office of Solid Waste and Emergency Response, Washington D.C. Directive 9355.0-48FS. September 1993.

U.S. Environmental Protection Agency (USEPA). 1994. *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children.* Office of Solid Waste and Emergency Response. Washington, D.C. EPA/540/R-93/081. February 1994.

U.S. Environmental Protection Agency (USEPA). 1994. *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.* Office of Solid Waste and Emergency Response, Washington D.C. OSWER Directive 9355.4-12. July 1994.

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U.S. Environmental Protection Agency (USEPA). 1997. *Presumptive Remedy: Supplemental Bulletin Multi-Phase Extraction (MPE) Technology for VOCs in Soil and Groundwater.* Office of Solid Waste and Emergency Response, Washington D.C. EPA 540-F-97-004. April 1997.

U.S. Environmental Protection Agency (USEPA). 1997. *Health Effects Assessment Summary Tables, FY-1997 Annual (HEAST).* Office of Health and Environmental Assessment. Environmental Assessment and Criteria Office and Office of Solid Waste and Emergency Response. Washington, D.C. July 1997.

U.S. Environmental Protection Agency (USEPA). 1997. *Exposure Factors Handbook.* Office of Research and Development. Washington, D.C. August 1997.

U.S. Environmental Protection Agency (USEPA). 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater.* Office of Research and Development, Washington D.C. EPA/600/R-98/128. September 1998.

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Appendix H
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