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Second Five-Year Review Report
for

Teledyne Wah Chang Albany
Superfund Site
Millersburg, Oregon

January 2003

Prepared by EPA Region 10, Seattle, Washington

Approved by:

JAN 7, 2003

Michael F. Gearheard, Director
Environmental Cleanup Office
EPA Region 10

Date

Appendix A Figures and Tables

Executive Summary

EPA conducted a 2nd Five-Year Review for the Teledyne Wah Chang Site in Albany Oregon. Site remediation was conducted in Three Operable Units.

Operable Unit 1 - Sludge Ponds (1989 ROD)

Lime sludges with a radium component were excavated from ponds on the site and disposed of in an off-site landfill cell built for the material. The remediation took place in 1991.

Operable Unit 2 - Groundwater and Sediment (1994 ROD)

Groundwater treatment systems were constructed throughout the site to treat contaminated groundwater, and prevent contaminated groundwater from leaving the site. The treatment systems were constructed between 1999 and 2003. Institutional controls were implemented to prevent consumption of groundwater.

Sediment with PCBs above 1 ppm was excavated from Truax Creek. Excavation took place in 1997. Following excavation, five years of monitoring was conducted. The monitoring was completed in 2002.

Operable Unit 3 - Surface and Subsurface Soil (1995 ROD)

Soil with radium concentrations which would result in surface gamma emissions greater than 20 µrem/hour above background was excavated and disposed off-site. Excavation was completed in 1998. Institutional controls were implemented to require radon controls to be placed on future buildings where radon could exceed EPA risk based levels.

The site received construction completion status in September 2002.

This assessment of the site found that the remedial actions had been implemented in accordance with the RODs and modifications made to the RODs in subsequent Explanations of Significant Differences (ESDs). The remedy is functioning as designed, and operation and maintenance is proceeding in accordance with approved plans.

The assessment reached the following protectiveness conclusions:

Operable Unit 1 - Sludge Ponds: The remedy is protective

Operable Unit 2 - Groundwater and Sediment: Sediments: The remedy for sediments is protective. Groundwater: The remedy is considered protective because the cleanup levels are still within EPA's risk range, and there is no current or potential exposure.

Operable Unit 3 - Surface and Subsurface Soil: The remedy is protective in the short term because contaminated soils have been removed from the site, and surface gamma exposure has been eliminated. However, in order for the remedy to remain protective in the long-term, institutional controls must be placed on the Soil Amendment Area, and safety requirements in the soil ESD must be made enforceable.

Site Statement of Protectiveness: Because the remedial actions at all of the site operable units are protective, the remedy is protective of human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site Name (from WasteLAN): Teledyne Wah Chang				
EPA ID (from WasteLAN): ORD050955848				
Region: 10	**State:** OR	**City/County:Millersburg, Linn County**		

SITE STATUS

NPL Status:	Final XX	Deleted	Other (specify)	
Remediation Status (choose all that apply)		Under Construction	Operating xxx	Complete xxx
Multiple OUs?* YES xx NO		**Construction Completion date:** 9 / 27 / 02		
Has site been put into reuse?		YES *** xxx		NO

REVIEW STATUS

Lead Agency:	EPA xx	State	Tribe	Other Federal Agency
Author name: Kevin Rochlin				
Author Title: Remedial Project Manager			**Author Affiliation:** U.S. EPA, Region 10	
Review Period:** 06/ 12/ 2002 to 12/ 20/ 2002				
Date(s) of site inspection: 06 /12 / 2002				
Type of Review:	Post-SARA xx Pre-SARA NPL- Removal only Non-NPL Remedial Action Site NPL State/Tribe-lead Regional Discretion			
Review Number:	1(first)	2 (second) xxx	3 (third)	Other (Specify)
Triggering Action:	Actual RA onsite Construction at OU # 1, Sludge Ponds			

Triggering Action Date (from WasteLAN): 07 / 12/ 1991

Due Date (five years after triggering action date): 12 / 29/ 2002

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

*** [Site is an operating facility]

1 Introduction

1.1 Purpose of the Five-Year Review

Region 10 of the Environmental Protection Agency (EPA) has conducted a 2nd Five-Year Review of the **Teledyne Wah Chang Albany Superfund Site** (Wah Chang Site or Site), and prepared this report consistent with the requirements of Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended in Section 300.430(f)(4)(ii) of the National Contingency Plan (NCP).

The NCP states:

> If a remedial action is selected that results in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial actions.

Some of the remedial actions at the Site have resulted in contaminants remaining on the site above levels allowing unlimited use. Thus, a review is required. The purpose of this five-year review is to determine whether the remedy at the site is protective of human health and the environment. Methods, findings, and conclusions of this review are documented in this report.

This 2nd five-year review was conducted pursuant to the Office of Solid Waste and Emergency Response Directives 9355.7-03B-P. The review took place between June and December 2002. It was conducted by the EPA site manager for the site with the assistance of the State of Oregon Department of Environmental Quality. The current EPA site manager has been managing the site since 1995.

The remedial actions at Wah Chang were selected in three Records of Decision (RODs).

Operable Unit 1 - Sludge Ponds (1989)
Operable Unit 2 - Groundwater and Sediment (1994)
Operable Unit 3 - Surface and Subsurface Soil (1995)

The five-year review process was triggered by the start of the remedial action for Operable Unit 1 - Sludge Ponds (described later in this document) in July 1991. The first review was conducted in December 1997. This is the second five-year review for the site.

2 Site Location and Description

The Teledyne Wah Chang Albany Site is an operating zirconium manufacturing plant located in Millersburg, Oregon, an industrial-based community two miles north of downtown Albany (Figure 1). The Site is approximately 20 miles south of Salem, 65

miles south of Portland, 60 miles east of the Pacific Ocean, and adjacent to the Willamette River. Portions of the Wah Chang Site are within the river's 100-year and 500-year flood plains.

The Wah Chang plant is bounded on the east by Old Salem Road and Interstate 5 (I-5). The land east of the plant is used mainly for residential and commercial purposes. The land west of the Willamette River, which forms the western boundary of the plant, is used for agriculture. The land surrounding the Farm Ponds Area to the north of the Main Plant is also used for agricultural purposes. The site is bisected by Truax Creek, and bordered to the north by Murder Creek.

The city of Albany had a population of approximately 29,000 in 1990; Millersburg had a population of about 700 people. The Wah Chang Site is located within an area that is zoned for heavy industry.

Note that following a 1997 merger, the name of the plant was changed from Teledyne Wah Chang Albany to Wah Chang Albany. Thus, although the official site name remains Teledyne Wah Chang Albany, the designated abbreviation is Wah Chang.

2.1 Topography

Wah Chang is located within the broad and relatively flat Willamette Valley which was formed by the Willamette River as it meandered back and forth between the Coast Range mountains to the west and the Cascade Mountains to the east. The ground surface in the vicinity of Wah Chang slopes westward toward the river with a gradient of approximately 11 feet per mile.

2.2 Land Use

The Wah Chang Superfund Site covers the 110 acre Main Plant and the 115 acre Farm Ponds Area located 3/4 mile north of the Main Plant (Figure 1). The Main Plant is organized into the following areas: the Extraction Area (south of Truax Creek), the Fabrication Area (north of Truax Creek), and a Solids Storage Area (west of the Burlington Northern Railroad). The Farm Ponds Area contained the plant's wastewater treatment ponds, four 2-1/2 acre solids storage ponds which have now been closed, and the 50-acre Soil Amendment Area. The Soil Amendment Area has been primarily used in the past for agriculture.

2.3 Site History

Teledyne Wah Chang operations at the Wah Chang Site began in 1956 when, under contract with the U.S. Atomic Energy Commission, Wah Chang Corporation reopened the U.S. Bureau of Mines Zirconium Metal Sponge Pilot Plant. Construction of new facilities, at the location of the existing plant, began in 1957. These facilities were established primarily for the production of zirconium and hafnium sponge; however, tantalum and niobium pilot facilities were also included. Melting and fabrication

operations were added in 1959. Wah Chang was established in 1967 after Teledyne Industries, Inc., purchased the Wah Chang Corporation of New York. In 1971, the plant became a separate corporation, Teledyne Wah Chang Albany.

Beginning in 1957, waste materials from Wah Chang's processes were placed in unlined ponds on the facility. Examples of unlined ponds used for disposal of waste sludges and other materials in the past include the V-2 Pond, Schmidt Lake, and the Lower River Solids Pond (LRSP) (Figure 2). From 1972 until 1978 chlorinator residues from Wah Chang's sand chlorinator process were placed in a separate pile north of Schmidt Lake. This practice was discontinued in 1978, when the contents of the pile were removed and transported off Site to a permitted low level radioactive waste disposal facility (Figure 2).

Solid residues generated during the development and operation of nonferrous metals manufacturing processes at the plant site were placed in a resource and recovery pile. The major material placed in the pile was magnesium chloride. From 1983 through 1988 Wah Chang recovered material from this pile to produce magnesium oxide for use in its ongoing processes (Figure 2).

The unlined sludge ponds on the site had attracted the attention of regulatory agencies (U.S. Environmental Protection Agency (EPA) and Oregon Department of Environmental Quality (ODEQ)) and the public for many years, particularly because of the presence of radioactive materials, which was first confirmed by the Oregon State Health Division in 1977. Waste sludges (lime solids) generated prior to 1979 were contained in the LRSP, Schmidt Lake, Arrowhead Lake, and the V2 Pond. Much of the public concern has focused on the LRSP and Schmidt Lake because of their proximity to the Willamette River.

Under an Oregon Department of Environmental Quality permit, some of the solids generated prior to 1976 were used as a beneficial soil amendment on land in the Farm Ponds Area (the Soil Amendment Area). In 1978 Wah Chang changed its production process which reduced the amount of radioactive material in the lime solids allowing them to be disposed as solid waste.

Concerns that the unlined sludge ponds were located in the Willamette River floodplain, and that hazardous materials from the sludge ponds would migrate to soil, surface water, and groundwater, led to the Wah Chang facility being proposed for inclusion on the National Priorities List (NPL) in December of 1982. The Wah Chang Site was placed on the NPL in October 1983.

2.4 Radioactive Materials Handling

In March 1978, a Naturally Occurring Radioactive Materials (NORM) license issued by the Oregon Health Division was granted to Wah Chang to transfer, receive, possess and use zircon sands and industrial byproducts containing licensable concentrations of radioactive material. Wah Chang currently disposes of its radioactive waste material at

the U.S. Ecology Low Level Radioactive Waste Site located on the Hanford Reservation in Washington.

2.5 Contaminants of Concern

Contaminants of concern at the site are as follows:

Surface and subsurface soils on the site were found to be contaminated with radionuclides (resulting in potential risk from gamma radiation emissions) and PCBs. Radium contamination in some areas could result in radon gas in future buildings accumulating at concentrations greater than 4pCi/liter (the cleanup standard in the ROD).

Sludges previously accumulated at the site were found to be contaminated with radionuclides.

Sediments were found to be contaminated with PCBs.

Groundwater was found to be contaminated with radionuclides and Volatile Organic Compounds (VOCs) including trichloroethylene (TCE), 1,1 dichloroethylene, 1,1 dichloroethane, and vinyl chloride.

3 Remedial Actions at the Site

3.1 Operable Unit 1 - Sludge Ponds

A Record of Decision (ROD) for an Interim Response Action at the Sludge Ponds was signed by EPA on December 28, 1989. The major components of the selected remedy consisted of:

Excavation and removal of the sludges from the sludge ponds (Schmidt Lake and the Lower River Solids Pond).

Partial solidification of the sludge with a solidification agent such as Portland cement.

Construction of a monocell at an off-site permitted solid waste facility.

Transportation of the solidified sludge to the off-site facility and disposal in the monocell.

Long-term operation and maintenance (O&M) of the off-site monocell.

On February 14, 1991, EPA issued a Unilateral Order to Wah Chang for design and implementation of the selected remedy for the operable unit. In June of 1991, construction of the off-site monocell at the Finley Buttes Landfill in Boardman, Oregon

was completed. Excavation and removal of the sludges began in July of 1991 and were completed in November 1991. Approximately 100,000 cubic yards of solids (including cement) were transported to the monocell at Finley Buttes. Cover construction and grass seeding of the monocell was completed in April 1992. On June 30, 1993, EPA issued a Certification of Completion for the Sludge Ponds Operable Unit Remedial action to Wah Chang.

3.1.1 Additional Remedial Activity Performed under amendment to the RI/FS Consent Order

3.1.1.1 Supplementary Removal Action at Schmidt Lake

In 1991, EPA received information that radioactive materials had been buried in Schmidt Lake in the 1970's in drums located below the sludges that had been the subject of the Operable Unit 1 remedial action. Based on this information, EPA requested that Wah Chang conduct additional geophysical investigations in this area. In 1992, pursuant to the additional work provision of the RI/FS Consent Order with EPA, Wah Chang conducted an electromagnetic survey in this area. The electromagnetic survey identified potential additional source materials in and around Schmidt Lake. These source materials included several corroded metal drums containing sands with elevated amounts of thorium and uranium, and an underground storage tank containing liquid petroleum product.

In December 1992, as part of an action referred to as the Schmidt Lake Excavation Project (SLEP), 2,016 cubic yards of materials containing zircon sands with elevated levels of thorium and uranium were removed from Schmidt Lake and transported by Wah Chang to the U.S. Ecology low-level radioactive waste site in Washington for disposal.

3.1.1.2 Soil Removal in Fabrication Area

In December 1991, during the installation of a soil boring adjacent to the Emergency Services Building in the Fabrication Area of the Main Plant (Boring B91-5), a floating nonaqueous oil layer containing 8 percent PCBs was detected. Groundwater in the vicinity of this boring contained up to 22,500 parts per billion (ppb) PCBs. Additional sampling identified an area of soil, approximately 30 feet by 30 feet, as a probable source/receptor for the PCB-contaminated oil.

In order to prevent further degradation of water quality resulting from the oil layer, in November 1992 Wah Chang initiated a removal action in the area. After approval by EPA, Wah Chang excavated approximately 230 cubic yards of PCB-contaminated soil and disposed the soil at an off-site permitted landfill. The source of the oil layer was not identified.

3.2 Operable Unit 2 - Groundwater and Sediments

On June 10, 1994, EPA selected the Final Remedial Action for Groundwater and Sediments. This ROD presented the selected remedial action for surface water, groundwater and sediments at the Site. The major components of the selected remedy are listed below.

For Contaminated Groundwater:

Remediation of groundwater via groundwater extraction in the Feed Makeup area and at areas on Site where contaminant concentrations exceed lifetime cancer risk levels of 10^{-4} and/or substantially exceed noncancer hazard index (HI) of 1 for worker exposure. Extraction shall continue until contaminant concentrations in groundwater throughout the Site are reduced to below SDWA MCLs, non-zero MCLGs, or cancer risk levels of 10^{-6} and noncancer risk HI < 1 for worker exposure, or until EPA in consultation with ODEQ determines that continued groundwater extraction would not be expected to result in additional cost effective reduction in contaminant concentrations at the Site. Contaminated groundwater in exceedance of SDWA MCLs, non-zero MCLGs, or cancer risk levels of 10^{-6} and noncancer risk HI > 1 for residential use, where no EPA or State standards exist for residential use, shall be prevented from migrating off the plant site, or beyond the current boundary of the groundwater contaminant plume at the Farm Ponds Area.

Discharge of extracted groundwater to Teledyne Wah Chang Albany's wastewater treatment plant. Pretreatment of groundwater to comply with CWA requirements prior to discharge to the wastewater treatment plant.

Treatment or removal of subsurface source material near the Feed Makeup Building on the Main Plant.

For Contaminated Sediments

Slope erosion protection consisting of a geotextile covered by riprap placed along the banks of Truax Creek to prevent contaminated fill material from entering the creek.

Removal of approximately 3,600 cubic yards of contaminated sediments from the surface water bodies adjacent to, or flowing through the Site. Additional ecological characterization prior to removal to determine potential impacts of sediment removal to the local ecosystem and to provide mechanisms to mitigate those impacts.

Site-Wide Actions

Deed restrictions and institutional controls on land and groundwater use for both the Main Plant and Farm Ponds area. The objective of this component of the remedy is to ensure that the property and groundwater are used only for purposes appropriate to the cleanup levels achieved.

Environmental evaluations of currently uncharacterized potential contaminant source areas, as needed to ensure achievement of groundwater RAOs. The objective of this component of the remedy is to ensure that contaminant source areas do not adversely impact the remedy.

Long-term on-site and off-site groundwater, surface water, and sediment monitoring which shall include at a minimum the monitoring of on-site wells which are in exceedance of MCLs and non-zero MCLGs, cancer risk levels of 10^{-6}, and noncancer risk HI > 1 for residential exposure.

Review of selected remedy at least once every five years to ensure protection of human health and the environment.

3.3 Explanation of Significant Differences to Groundwater and Sediment Remedy

During the preparation of the Scope of Work for implementation of this remedy, the following changes were made to the selected remedial action, and outlined in an Explanation of Significant Differences issued October 8, 1996:

For Contaminated Groundwater

EPA dropped the requirement for groundwater extraction at and outside the plant boundaries on the northern and western perimeters. Dropping the perimeter requirements is contingent on a number of conditions described in the Explanation of Significant Differences (EPA 1997). In addition, the site cleanup levels must still be met within the ROD's 15 year time frame, the groundwater discharge into adjacent water bodies must not violate Federal and State water quality standards, and the remedy must still be protective of both public health and the environment.

EPA made the remediation requirements for the Farm Ponds Area consistent with the rest of the site. Within the Farm Ponds Area, remediation will take place through extraction of hot spots. However, the plume in the Farm Ponds must be kept from significantly expanding. Compliance with this requirement will be demonstrated by existing groundwater data, and data collected pursuant to the remedial action indicating that contaminant levels (and total excess cancer risk and/or hazard indices) in wells in the Farm Ponds area are not increasing, or are

declining, and /or other site data or information indicate that natural attenuation is effectively reducing contaminant levels. For consistency with the rest of the site, EPA has changed the point of compliance to the property boundaries in the Farm Ponds Area.

For Contaminated Sediments

A review of the RI/FS sediment data indicated that not all of the areas identified in the ROD exceeded the sediment action level. Areas not exceeding the 1 ppm total PCBs action level will not be remediated.

The areas not exceeding the sediment action which will not be remediated are the following:

Conser Slough: The highest concentration was 0.5 ppm total PCBs. Murder Creek at MTC-2: The highest concentration was 0.79 ppm total PCBs.

The areas exceeding the action level identified in the ROD were in Truax Creek and the Murder and Truax Creek confluence.

3.4 Operable Unit 3 - Surface and Subsurface Soil

On September 27, 1995, EPA selected the Final Remedial Action for Surface and Subsurface Soil. The major components of the selected remedy consisted of:

Excavation of contaminated material exceeding the gamma radiation action level of 20 µrem/hour above background levels;

Transportation of the excavated material to an appropriate off-site facility for disposal;

For areas of the Site where modeling indicates that radon concentrations in future buildings could exceed 4 pCi/liter, institutional controls requiring that future buildings be constructed using radon resistant construction methods; –

Requirement that information on areas of subsurface PCB and radio nuclide contamination which do not pose a risk if they are not disturbed, be incorporated into the Wah Chang facilities maintenance plan, and be made available to future Site purchasers or regulatory agencies; – ?

Because the determination that action is not required for certain areas of the Site is based on scenarios which do not allow unrestricted use, should excavation occur as part of future development of the Wah Chang Main Plant or the Soil Amendment Area, excavated material must be properly handled and disposed of in accordance with Federal and State laws; and

Institutional controls requiring that land use remain consistent with current industrial zoning.

During the preparation of the Scope of Work for implementation of this remedy, the following change was made to the selected remedial action:

> Actual radon measurement of radon emanating from the soil may be taken during building design and used to determine whether the EPA radon standard is exceeded. If the standards are not exceeded, radon resistant technology would not be required. The requirement for radon sampling following construction still applies. If the building radon concentration exceeded the radon standard in effect at the time, the building would have to be retrofitted with controls to reduce radon levels below the EPA target level or promulgated standard.

3.5 ROD Cleanup Goals and ARARs

The cleanup goals in the three RODs are listed below.

Surface soils

The cleanup standard for soil is based on reaching a gamma radiation level of 20 µrem/hour over background levels.

For areas of the Site where modeling indicated that radon concentrations in future buildings could exceed 4 pCi/liter, institutional controls will be implemented which require that future buildings be constructed using radon resistant construction methods.

Sediments

The sediment cleanup standard is 1 ppm for PCBs (based on protection of aquatic organisms).

Groundwater

The performance standards for groundwater, unless otherwise modified, are the cleanup levels specified in the ROD. These performance standards are MCLs, nonzero MCLGs, and state standards, unless there are no such standards. Where no state standard, MCL, or nonzero MCLG exist, the performance standards shall be 1) for the Main Plant, cancer risk levels of 10^{-6} and noncancer risk HI <1 for worker exposure, and 2) for the Farm Ponds, cancer risk levels of 10^{-6} and noncancer risk HI <1 for residential exposure.

A listing of ARARs can be found in the RODs for the site. A review of the cleanup goals and ARARs for the soils, sediment, and groundwater remedies at the site made as part of this Five-Year Review has determined that they are still protective.

4 Remedy Implementation Status

Since the last review, the Operable Unit 2: groundwater and sediment remedies, and the Operable Unit 3: surface and subsurface soil remedies have been implemented. The soils and sediment remedies have been completed.

4.1 Operable Unit 2: Groundwater and Sediments

EPA, ODEQ, and Wah Chang negotiated a Consent Decree for Wah Chang's performance of the groundwater, sediments, and soil remedial actions. Negotiations were concluded in October 1996. Entry of the Consent Decree which triggered the start date for Wah Chang to begin the Remedial Designs for cleanup was April 7, 1997. Information on system operations can be found in the Fabrication Area First Semi-Annual Remedial Action Progress Report (February 2002), and South Extraction Area 1st Annual Monitoring Report (December 2001).

4.1.1 Groundwater

4.1.1.1 Treatment system construction

Groundwater remedy implementation began in 1999. Eight groundwater extraction and treatment systems were constructed to meet the requirements of the groundwater ROD (see Figure 3). No additional systems are planned. However, the effectiveness of the systems will be further evaluated in the future as described later. The systems are described in Table 1.

4.1.1.2 Analysis of Groundwater Treatment System Effectiveness

The major site areas where groundwater is being treated and current system effectiveness are described below.

Fabrication Area

Based on January 2002 water level data, capture zones were estimated. The cumulative system parameters are shown in Table 2. The capture zones indicate that the groundwater system is successful in capturing the groundwater hot spots with the exception of an area north of FW-6 in the upper NW corner of the site (See Figure 4). Because of the geology in this area, and persistent drought conditions, the extraction well in this area yielded less than 0.1 gpm, and therefore a treatment system was not constructed. This area will need to be reevaluated in 2003 to determine whether additional work is needed. It is too early to determine the long term influence of the extraction systems on groundwater quality.

Extraction Area

South Extraction Area

The intent of groundwater treatment in the South Extraction Area is to prevent groundwater above cleanup levels from leaving the site. There are no hot spots in this area. The cumulative system parameters are shown in Table 3. The system is doing an adequate job of containing the contaminant plume (See Figure 5). A three year system evaluation of this area as described in the ROD will be conducted in 2003.

Feed Makeup Area

The purpose of the treatment system in the Feed Makeup Area is to remediate groundwater which is highly contaminated with metals and radium at very low pH. The system went online in the summer of 2002. The system is operating as designed, but it is too early to judge system effectiveness in remediating the groundwater.

4.1.2 Sediment Remediation

The construction work for the sediment excavation of Truax Creek was completed in 1997. Contaminated sediments in Truax Creek were excavated and the creek bank was covered with a geotextile and riprap. Sediment samples taken as part of the remediation showed that the depth and extent of sediment contamination was greater than expected in length of the creek running through the site. As a result, the length of the creek between the plant boundaries was remediated. Five years of post remedy sediment sampling were completed in 2002. During 5 years of post remediation sampling, only two samples were above the PCBs remedial action cleanup standard of 1 ppm PCBs. The samples were downstream of the remediation site: TC 5.5 - 1998 sample (deep) at 1.2 ppm, and TC-6 - 2001 sample at 1.5 ppm. This is out of a total of 52 sediment samples collected over five years. EPA does not consider these exceedances to be significant, and therefore the Truax Creek sediment remediation was approved by EPA in December 2002.

4.1.3 Site-wide Actions

The following actions have been implemented by Wah Chang in compliance with the requirements of the groundwater ROD:

Deed restrictions were placed on the Wah Chang property requiring that it remain industrial, and on the Wah Chang and adjacent property on the western perimeter to preclude groundwater use for drinking water.

Groundwater, surface water, and sediment monitoring has been implemented.

Deed restrictions were placed on land owned by Linn County in the vicinity of Old Salem Road, and on the Burlington Northern Railroad right of way which parallels the western site boundary. ?

Environmental evaluations of currently uncharacterized potential contaminant source areas, as needed to ensure achievement of groundwater RAOs are submitted every two years. No issues have been identified in these reports.

4.2 Operable Unit 3: Surface and Subsurface Soils

4.2.1 Remedial Action for Soil

Schmidt Lake

On August 26, 1998, Wah Chang excavated between 12 and 15 cubic yards of soil from Schmidt Lake. All areas exceeding the site action level of 20 µrem/hour above background were excavated and transported off-site for disposal. The area was left as it was pending potential reuse of the area.

Sand Unloading Area

The RI/FS identified a relatively small area where surface gamma radiation levels exceeded the cleanup standard of 20 µrem/hour above background. The elevated gamma radiation levels in the area were expected to be emanating from spilled zircon sands (raw materials for the zirconium process) containing a naturally occurring radium-226 component. The underlying assumption for the selection of the excavation remedy was that the RI/FS identified the location and extent of all on-site areas where surface and near surface gamma emitting material was present. As described below, during the excavation of this area, it was determined that although sand was present on the ground surface, it was not the primary source for all of the gamma emissions.

The remedial action was conducted in October 1997. Excavation was stopped when the northwestern edge of the material appeared to extend beneath a concrete slab in front of the mobile maintenance shop, and under the shop itself, and when the northernmost end of excavation would have interfered with on-site traffic with no evidence that the limit of contamination had been reached. In the areas excavated, gamma emitting material was found within 2 feet of the surface. A confirmation surface gamma survey showed that within the excavated area, levels were below the cleanup standard of 20 µrem/hour above background. The amount excavated was 1890 cubic feet, twice the ROD estimate.

While some of the gamma emissions in the area resulted from spilled sands on the ground surface, there was a significant quantity of buried material. Four primary types of material were identified in the excavation area: black sand, reddish brown sand, green sand, and gray materials containing rock like "clinkers" (a waste from the former carbide process emitting significantly elevated levels of gamma radiation).

A subsequent review by Wah Chang of gamma survey and radionuclide sampling information, collected during past excavation projects in the vicinity of the Sand

Unloading Area, was done in an attempt to determine the areal extent of contamination. Radionuclide contaminated material, which could exceed cleanup levels if uncovered, was found 200 feet to the north, 200 feet to the northeast, and 200 feet to the east of the area. The material found was identified as carbide waste, a process waste with a high radium-226 concentration, that had previously been disposed on the site.

Most of the Sand Unloading Area is now overlain by Wah Chang's new co-generation (COGen) Plant, a natural gas, electric generating plant. The plant is built on a 14" concrete slab, which acts as an effective gamma blocking barrier.

Because of the large volume of material potentially left on-site, the remedy was amended as described in Section 4.2.2.

Front Parking Lot Area

Black sand, a low level radioactive rutile sand (natural mineral form of Titanium Dioxide) was identified for removal in the RI/FS, and was removed during the soil remedial action. A 1 to 6 inch layer of black sand was identified 6 to 12 inches below the Front Parking Lot's gravel surface. The layer of black sand covered native soil. Although the areas where surface gamma readings exceeded the cleanup level were excavated, visual observations and anecdotal evidence suggest that the entire Front Parking Lot is underlain by this material except where it was excavated for the Building S-147 concrete foundation. Samples of the sand indicate that radium-226 levels could cause radon concentrations in future buildings to exceed the radium-226 action level of 4 pCi/liter (the current risk based level identified in the ROD), and so the area has been added to the plant site locations requiring future buildings to be constructed with radon resistant construction methods.

Soil Amendment Area

The institutional controls in the Soil Amendment Area have not yet been implemented. An implementation plan has been developed.

4.2.2 Changes to the Surface and Subsurface Soil ROD

Following Soil Cleanup, EPA amended the Soil remedy with a September 28, 2001, ESD calling for the following:

> Final site closure for radionuclides will be conducted pursuant to Wah Chang's Oregon Radioactive Materials License (Broad Scope Naturally Occurring Radioactive Material License) and the Energy Facility Siting Council (EFSC) Administrative Rules (Chapter 345, Division 50).
>
> On-site surface gamma emissions will be controlled through in-place management of contamination. Prior to site decommissioning under Oregon Health Services and EFSC, surface gamma emissions must be kept below

cleanup levels through in-place management under an EPA and ODEQ approved management plan, and additional excavation of contamination performed as part of on-going excavation occurring during on-site construction.

If the site is not decommissioned under Oregon Health Services and EFSC to EPA's cleanup requirements, radiation management shall be a condition of property transfer to ensure that these controls remain protective. Any partial or complete property transfer shall be conditioned on implementation and maintenance of an appropriate EPA/DEQ approved radiation management program.

Excavation and either creating engineered berms (capped areas of soil with use and maintenance restrictions) or off-site disposal is an acceptable remedy for the Soil Amendment Area if institutional controls cannot be implemented.

The scope of work and Consent Decree with Wah Chang will need to be amended to incorporate those requirements that they must implement. Ongoing monitoring and prevention of any gamma exposure is conducted by the Wah Chang safety program personnel. There is no current exposure on the site.

5 Progress Since Last Review

The following statements are from the 1997 review for the site:

VI. Cleanup Goal Attainment

With the exception of the area in Schmidt Lake which will be remediated during the implementation of the Operable Unit 3 soil remedy, the cleanup goals for Operable Unit 1 Sludge Ponds have been attained. For Operable Unit 2, the creek sediments have been remediated, but 5 years of monitoring will be required to determine whether cleanup goals have been met. The groundwater remedy has not been implemented. For Operable Unit 3, Institutional controls for radon restriction have been implemented on the Main Plant. Controls have as yet not been placed on the Soil Amendment Area. The cleanup goals for soil have not yet been met. This remedial action is still ongoing.

VII. Recommendations

All aspects of the remedial action for the site have not been implemented. The remedial actions specified in the RODs for the site need to be implemented for the site to be protective of public health and the environment.

VIII. Statement of Protectiveness

The remedy at this time is not protective of human health and the environment. All facets of the remedy have not yet been implemented. Implementation of the

remedy will ensure that the site does not pose a threat to public health and the environment.

Since the 1st review in 1997, the remedies for groundwater, sediments, and soil have been implemented. The cleanup goals for sediment has been met. No additional soil remediation is planned by EPA, although it is expected that additional soil remediation will take place during site decommissioning pursuant to Wah Chang's Oregon Radioactive Materials License, and the Energy Facility Siting Council Administrative Rules, as described in Section 4.2.2.

6 2nd Five-Year Review Process

6.1 Activities

The 2nd five-year review process consisted of a site inspection held on June 12, 2002, and review of the data associated with the performance of the remedial action, and monitoring data for the sediments and groundwater. There has been minimal community interest for this site. (Because it had never been used, the library has returned the administrative record to the EPA.) Therefore there were no community interviews conducted. A newspaper notice will be placed in the Albany Herald to announce the completion and availability of this review.

6.2 Data Review

The results of data reviews are summarized in Section 4. The information was obtained from the Surface and Subsurface Soil Remedial Design/Remedial Action Status Report (July 1998), 2002 Truax Creek Sediment Remedial Action Confirmational Sampling Report, (September 2002), Fabrication Remedial Action Progress Report January to June 2002 (July 2002), South Extraction Area 1st Annual Monitoring Report (December 2001), and monthly progress reports submitted by Wah Chang.

6.3 Site Inspection

A Site inspection was conducted on June 12, 2002. The purpose of the inspection was to review the implementation of the remedy, and assess the protectiveness of the reemdy, including the presence of fencing to restrict access, and to prevent unauthorized access to treatment systems. Wah Chang implements onsite restrictions as part of site operations. The site is fenced and access is controlled. The groundwater treatment systems are all installed in "sheds" for protection. The shed floors are lined to prevent loss of contaminated water in case of system breach. Wells are flush mounted or protected by bollards. No issues were identified.

The Soil Amendment Area is still a grassy field with no evidence of planned construction.

7 Technical Assessment

7.1 Question A: Is the remedy functioning as intended by the decision documents?

The remedial actions as described in the three RODs for the site have been implemented and are functioning as designed. A construction completion for the site was issued in September 2002. No additional work is currently planned for soil and sediments by EPA. As described in Section 4.2.2, final site closure for radionuclides will be conducted pursuant to Wah Chang's Oregon Radioactive Materials License, and the Energy Facility Siting Council Administrative Rules. This work will be conducted under the oversight of the Oregon Health Services Division. Until this occurs, site safety is ensured by Wah Chang radiation management programs.

The groundwater remedy has been implemented and is currently in operation and maintenance. Institutional controls are in place to prevent onsite and offsite use of contaminated groundwater, and to ensure that the site remains industrial.

Opportunities for optimization of the groundwater treatment systems have not been explored. The systems will be evaluated during the three year evaluations called for in the Groundwater ROD. The institutional controls placed on the site and adjacent properties to the west of the site ensure that the remedy remains protective until cleanup of the groundwater is completed.

The institutional controls for radon control have not yet been implemented in the Soil Amendment Area. This area is currently being used for agriculture.

The site controls required in the September 2001 Soil ESD need to be incorporated into the Consent Decree for long-term protectiveness. These site controls are already being implemented as part of the Wah Chang ongoing safety program. In the short term, the remedy is protective. These two requirements must be enforceable through legal documents for the remedy to be protective in the long-term.

Conclusion: The remedy is functioning as intended by the decision documents.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial objectives (RAOs) used at the time of remedy selection still valid?

Changes to site conditions, exposure assumptions, and RAOs

There have been no changes in the physical conditions at the site that would affect the protectiveness of the remedy. There are no changes in the exposure assumptions, and remedial objectives used in making the remedy decisions.

Changes in toxicity data, cleanup levels, and other contaminant characteristics

There is an updated human health risk summary for 1,1-dichloroethylene (1,1-DCE) completed by EPA's Integrated Risk Information System (IRIS). The new assessment withdraws the cancer slope factor and inhalation unit risk, which were included on IRIS in 1987, because the weight of evidence for cancer is considered too limited to support quantitative dose-response assessments. Thus, EPA has determined that 1,1 DCE is not a carcinogen. This compound is one of the contaminants of concern in the Fabrication area and is the risk driver for some wells. The MCL for 1,1 DCE has not been changed. Because the MCL is the cleanup standard for the site, the standard does not change. However, because a risk level of 10^{-4} is used to define a hot spots, some hot spot areas may be reclassified as not being hot spots. Never-the-less, because the goal is to reach the MCL, pumping may still be required in these redefined areas in order to reach the cleanup goal.

EPA is also developing human health assessment documents for trichloroethylene (TCE) and perchloroethylene (PCE). The effects of any adopted changes will be examined in 2003.

Conclusion: There has been a change in the toxicity assumption for 1,1 DCE. It does not change the groundwater cleanup standard for 1, 1 DCE as the MCL has not changed.

7.3 Question C: Has any information come to light that could question the protectiveness of this remedy?

There are no new ecological risks that have come to light since remedy implementation, no natural disasters have impacted the remedy, and there is no additional information which raises questions about the remedy. Based on current information, no information calls into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

According to the data reviewed and the site inspection, the remedy is functioning as intended by the RODs as modified by the ESDs. There have been no changes to the physical conditions of the site that would affect the protectiveness of the remedy. The sediment remediation is completed. The soil remediation has been completed, however, additional soils cleanup will be required under the Wah Chang NORM License decommissioning at plant closure. The groundwater treatment systems have been constructed and groundwater treatment is ongoing. The effectiveness of the systems will be evaluated during the three year evaluations required in the Groundwaer ROD. There is no other information that calls into question the protectiveness of the remedy.

Issues

Institutional Controls have not been placed on the Soil Amendment Area

Toxicity for 1,1 DCE one of the groundwater contaminants has changed. It is no longer a carcinogen. However the MCL has not changed.

Toxicity for TCE one of the groundwater contaminants is under review.

Requirements in 2001 Soil ESD have not been made enforceable in an amendment to the Consent Decree.

Recommendations and Follow-up Actions

Place institutional controls on the Soil Amendment Area. EPA and ODEQ shall conduct negotiations with the city of Millersburg implements radon control requirements.

Determine whether the change to 1,1 DCE toxicity impacts groundwater pumping strategy. Monitor TCE toxicity developments, and any other contaminants of concern as they come under review.

Prepare SOW and amend CD to incorporate requirements outlined in the in 2001 Soil ESD

Perform 3 year evaluations on groundwater systems.

Protectiveness Statements

Operable Unit 1 - Sludge Ponds (ROD 1989)

The remedy is protective

Operable Unit 2 - Groundwater and Sediment (ROD 1994)

Sediments: The remedy for sediments is protective.

Groundwater: The remedy is considered protective because the cleanup levels are still within EPA's risk range, and there is no current or potential exposure.

Operable Unit 3 - Surface and Subsurface Soil (ROD 1995)

The remedy is protective in the short term because contaminated soils have been removed from the site, and surface gamma exposure has been eliminated. However, in order for the remedy to remain protective in the long-term, institutional controls must be placed on the Soil Amendment Area, and safety requirements in the soil ESD must be made enforceable.

Other Comments: None

8 Issues

List of Issues		
Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Institutional Controls have not been placed on the Soil Amendment Area	N	Y
Toxicity for 1,1 DCE has changed. Toxicity for TCE is under review.	N	Y (may affect)
Requirements in 2001 Soil ESD have not been made enforceable in an amendment to the CD	N	Y

9 Recommendations and Follow-up Actions

List of Recommendations and Follow-up Actions					
Issue/action	**Party Responsible**	**Oversight Agency**	**Milestone Date**	**Affects Protectiveness**	
				current	future
Place Institutional Controls on the Soil Amendment Area	EPA/State conduct negotiations city of Millersburg implements requirements	EPA/ ODEQ	6/30/2003	N	Y
Monitor TCE toxicity developments, and any other contaminants of concern as they come under review Incorporate revised toxicity values for 1,1 DCE into groundwater remedy as appropriate	EPA, State, Wah Chang	EPA/ ODEQ	Ongoing	N	Y

Prepare SOW and amend CD to incorporate requirements in 2001 Soil ESD	EPA/State conduct negotiations Wah Chang implements requirements	EPA/ ODEQ	6/30/2003	N	Y
Perform 3 year evaluations on groundwater system Implement any necessary changes	Wah Chang	EPA/ ODEQ	3 years from implementation of individual systems - 2003-2005	N N	N Y

10 Protectiveness Statements

10.1 Operable Unit 1 - Sludge Ponds (ROD 1989)

The remedy is protective

10.2 Operable Unit 2 - Groundwater and Sediment (ROD 1994)

Sediments: The remedy for sediments is protective.

Groundwater: The remedy is considered protective because the cleanup levels are still within EPA's risk range, and there is no current or potential exposure.

10.3 Operable Unit 3 - Surface and Subsurface Soil (ROD 1995)

The remedy is protective in the short term because contaminated soils have been removed from the site, and surface gamma exposure has been eliminated. However, in order for the remedy to remain protective in the long-term, institutional controls must be placed on the Soil Amendment Area, and safety requirements in the soil ESD must be made enforceable.

10.4 Site Statement of Protectiveness

Because the remedial actions at all of the site operable units are protective, the remedy is protective of human health and the environment.

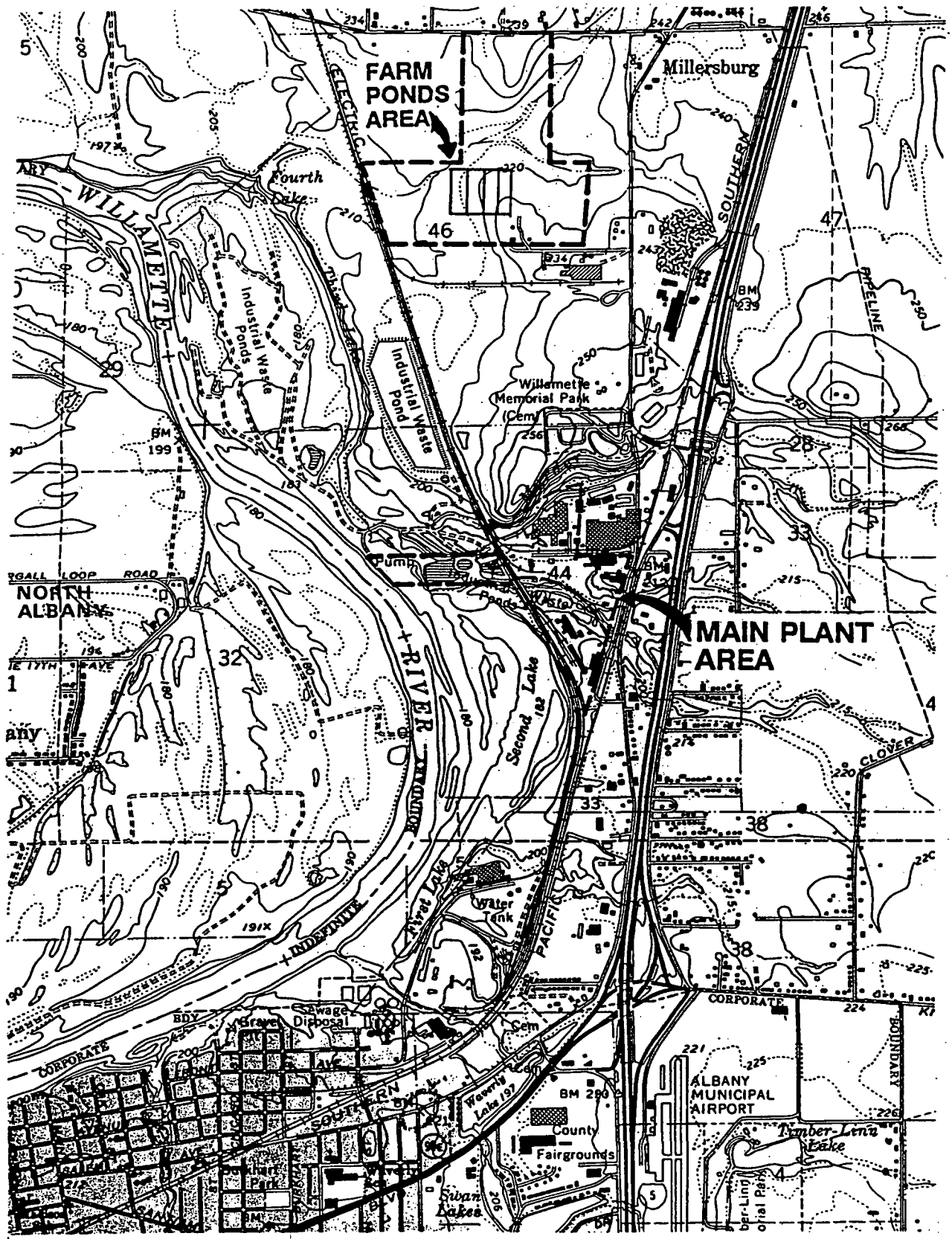
11 Next Review

The next statutory review will be in the year 2007. At that time, it is expected that all remedy components will have been implemented. The remedial actions selected for this site use industrial cleanup standards and institutional controls as part of the

remedy. Hazardous substances will remain at the site above levels that allow for unlimited use and unrestricted exposure. Therefore, the five-year reviews will continue.

Appendix A Figures and Tables

Figure 1 Site Location Map



Source: USGS 1:24,000 Albany, Oregon

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SCALE

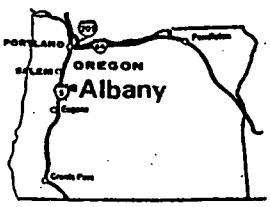

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Figure 1
Site Location Map

TELEDYNE WAH CHANG ALBANY
ALBANY, OREGON

CH2M HILL

Figure 2 Site Feature Map

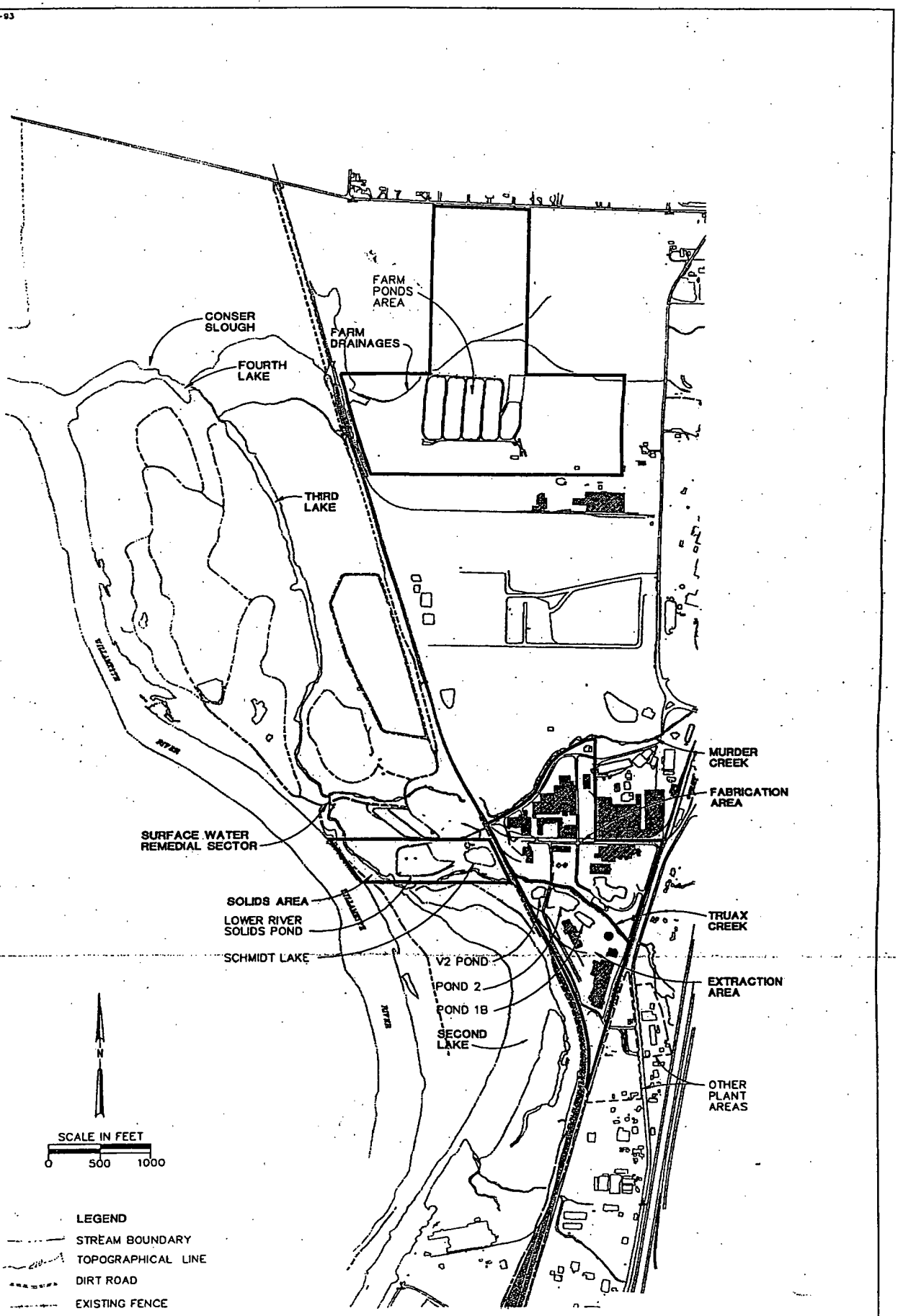

Figure 2
Site Feature Map

FIGURE 2-2

J:\WAHCHANG\CV022B06\RF\806RFF14.DWG

CH2MHILL

Figure 3 Locations of Groundwater Treatment Systems

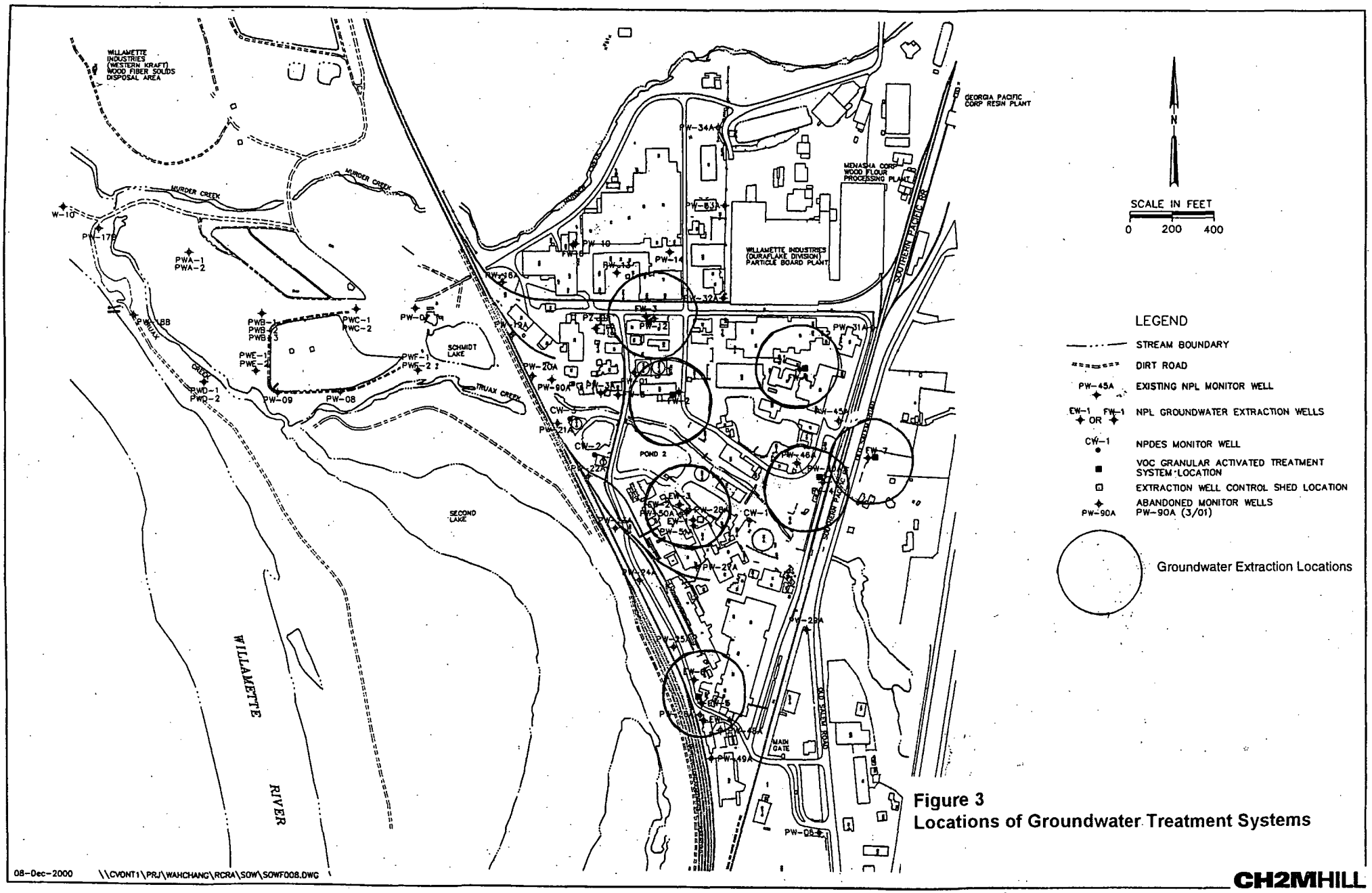

Figure 3
Locations of Groundwater Treatment Systems

CH2MHILL

Figure 4 Fabrication Area Capture Zone

LEGEND

- STREAM BOUNDARY
- 210 TOPOGRAPHICAL LINE
- DIRT ROAD
- EXISTING FENCE
- PW-75A 190.28 EXISTING ONSITE MONITOR WELL LOCATION AND GROUNDWATER ELEVATION (FT)
- FW-1 EXISTING EXTRACTION WELL LOCATION (FW-6 INACTIVE)
- 200 GROUNDWATER ELEVATION CONTOUR (FT)
- INFERRED DIRECTION OF GROUNDWATER FLOW
- EXTRACTION WELL CAPTURE ZONE
- HOT SPOT OR AREA EXCEEDING CANCER RISK OF 1.0E-04 FOR REASONABLE MAXIMUM EXPOSURE SCENARIO

N

SCALE IN FEET
0 150 300

Figure 4
Fabrication Area Capture Zone

CH2MHILL

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Figure 5 Extraction Area Capture Zone

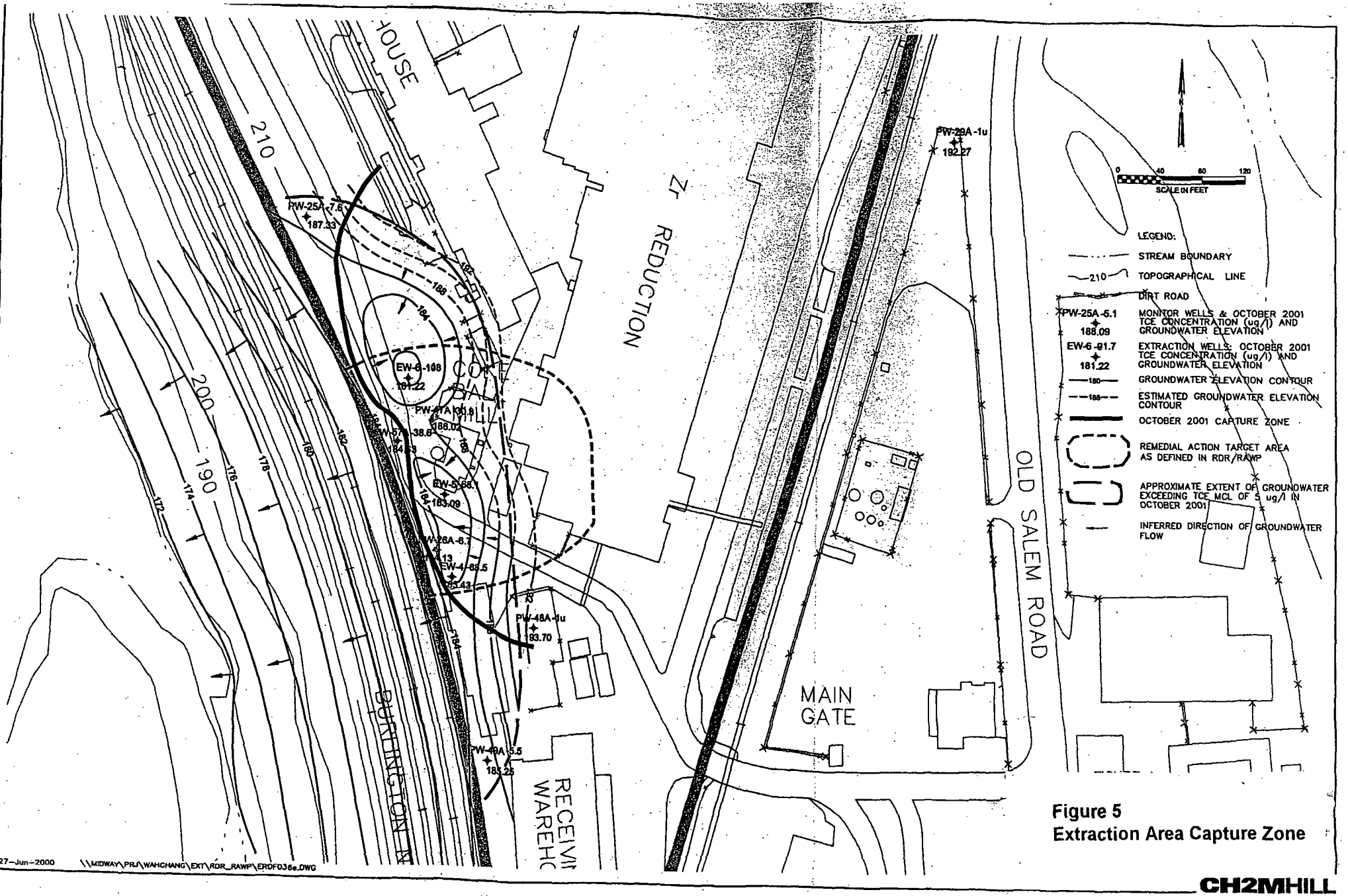

Figure 5
Extraction Area Capture Zone

CH2MHILL

Table 1 Groundwater Treatment System Information

Table 1	Groundwater Treatment System Information			
Site Location	Contaminants of Concern	Date System went on Line	Number of Extraction Wells	Treatment and Discharge
South Extraction Area	VOCs	10/2000	3	GAC[1], Central Works[2]
Fabrication Area - FW 1	VOCs	6/2001	1	GAC, Central Works
Fabrication Area - FW 2	VOCs	6/2001	1	GAC, Central Works
Fabrication Area - FW 3	VOCs	5/2001	1	GAC, Central Works
Fabrication Area - FW 4	VOCs	4/2002	1	GAC, Central Works
Fabrication Area - FW 5	VOCs Ammonia	8/2001	1	GAC, Central Works
Fabrication Area - Located across Old Salem Road FW 7	VOCs	4/2001	1	GAC, Discharge to Truax Creek Tributary
Extraction Area - Feed Makeup PW-28A	radium metals	7/2002	3	treatment in central works by chemical precipitation

[1] Treatment through liquid phase carbon adsorption
[2] Water routed to the central plant water treatment system

Table 2 Fabrication Area Cumulative Treatment System Parameters

Wah Chang - Fabrication Area
Groundwater Remediation Monthly Narrative Summary
September (August 29 to September 30) 2002

		Notes	Prior Month	This Month	Cumulative
Operation Hours					
	(Start Date)				
FW1	6/28/01		610	788	8,085
FW2	6/18/01		597	726	10,000
FW3	5/15/01		650	734	11,590
FW4	4/26/01		623	736	8,977
FW5	8/2/01		670	791	7,366
FW6		(1)	0	0	0
FW7	4/16/01		313	523	5,318
Extraction Gallons					
FW1		Recorded on 8/28	115,323	65,807	2,178,578
FW2		Recorded on 8/28	252,953	311,275	4,280,604
FW3		Recorded on 8/28	72,730	81,465	940,356
FW4		Recorded on 8/28	161,930	101,130	2,506,449
FW5		Recorded on 8/28	60,636	73,879	1,135,908
FW6		(1)	0	0	0
FW7		Recorded on 8/28	51,446	72,141	1,198,497
	Total		**715,018**	**705,697**	**12,240,392**
Influent Concentration					
FW1	(TVOCs) ug/L	Sampled on 7/26	946	1493	
FW2	(TVOCs) ug/L	Sampled on 7/26	676	638	
FW3	(TVOCs) ug/L	Sampled on 7/26	3074	2578	
FW4	(TVOCs) ug/L	Sampled on 7/26	1145	1033	
FW5	(Ammonia+Ammonium) mg/L	Sampled on 7/26	403	983	
FW6	(TVOCs) ug/L	(1)	-	-	
FW7	(TVOCs) ug/L	Sampled on 7/26	24	40	
Midpoint Concentration					
FW1	(TVOCs) ug/L	Sampled on 7/26	181.9	384.0	
FW2	(TVOCs) ug/L	Sampled on 7/26	66.3	2.1	
FW3	(TVOCs) ug/L	Sampled on 7/26	78.6	83.0	
FW4	(TVOCs) ug/L	Sampled on 7/26	414.2	20.1	
FW5	(Ammonia/Ammonium)	-	-	-	
FW6	(TVOCs) ug/L	(1)	-	-	
FW7	(TVOCs) ug/L	Sampled on 7/26	0.0	0.0	
Contaminant Mass Extracted (pounds)					
FW1	(TVOCs)		0.91	0.82	12.3
FW2	(TVOCs)		1.43	1.66	20.3
FW3	(TVOCs)		1.87	1.75	30.9
FW4	(TVOCs)		1.55	0.87	20.9
FW5	(Ammonia/Ammonium)		203.91	606.00	4513.1
FW6	(TVOCs)	(1)	-	-	-
FW7	(TVOCs)		0.01	0.02	0.67
	Total VOCs		**5.76**	**5.13**	**85.1**
	Total Ammonia/Ammonium		**204**	**606**	**4513.1**

Notes:
Due to poor well yield (< 0.1 gpm) no pump or treatment system equipment installed.
Date of last carbon filter changeout:
FW-1 - September 30, 2002
FW-2 - July 24, 2002
FW-3 - No changeout to date
FW-4 - Week of August 5th, 2002
FW-7 - May 29, 2002

Table 2
Fabrication Area Cumulative
Treatment System Parameters

Table 3 Extraction Area Cumulative Treatment System Parameters

Wah Chang - Extraction Area
Groundwater Remediation Monthly Narrative Summary
September (August 29 to September 30) 2002

	Notes	Prior Month	This Month	Annual Average	Cumulative
Operation Days					
South Extraction	(1)	29	33		714
Feed Makeup	(2)	28	33		173
Extraction Gallons					
South Extraction	Recorded 9/30	89,736	92,524		2,041,862
Feed Makeup	Recorded 9/30	28,301	31,847		116,222
Influent Concentration					
South Extraction					
Total VOCs (ug/L)	(4)	79.2	62.0		-
Feed Makeup					
TDS (mg/L)	(5)	13,000	9,900		-
Radium 226 (pCi/L)	(5)	30	22.1	25.1	-
Radium 228 (pCi/L)	(5)	96	71	80.4	
Fluoride (mg/L)	(5)	19	19		-
Midpoint Concentration					
South Extraction					
Total VOCs (ug/L)	(3), (4)	32.6	0.0		-
Feed Makeup					
TDS (mg/L)		-	-		-
Radium (pCi/L)		-	-		-
Fluoride (mg/L)		-	-		-
Contaminant Mass Extracted (pounds)					
Total VOCs		0.06	0.05		2.2
TDS		3070	2631		10,201
Flouride		4.5	5.0		25.4

Notes:
1. South Extraction operations initiated on October 18, 2000.
2. Feed Makeup operations initiated on April 10, 2002.
3. New carbon filter installed on 5/30/02
4. Last sampled on 7/26/02.
5. Data shown is for sample collected on 8/19/02.

Table 3
Extraction Area Cumulative Treatment System Parameters

Concurrence - Five-Year Review for Teledyne Wah Chang

Kevin Rochlin		1-2-03
Bev Gaines	BG	1/7/03
Judi Schwarz		
Joan Shirley		
Dave Croxton	DC	1/6/03