# Reynolds Metals Company
# Superfund Site
Troutdale, Oregon

# Record of Decision
for
# Final Remedial Action

September 29, 2006

US Environmental Protection Agency

Region 10

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# PART 1: THE DECLARATION

## Site Name and Location

The Reynolds Metals Company (RMC) Site is the location of a former primary aluminum production facility on Sundial Road near the City of Troutdale in Multnomah County, Oregon. Reynolds Metals Company, a wholly owned subsidiary of Alcoa, Inc. (Alcoa) is the current owner and former operator of the RMC Site. The Environmental Protection Agency (EPA) identification number is ORD009412677.

## Statement of Basis and Purpose

This decision document presents the selected final remedial action for the RMC Site (Site), which was chosen in accordance with Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended, and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record file for this Site. The State of Oregon Department of Environmental Quality (DEQ) has concurred with the Selected Remedy.

## Assessment of 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. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

## Description of Selected Remedy

This ROD selects the final remedy for the Site. EPA signed an Interim ROD on September 30, 2002. Soils cleanup actions required by the interim ROD have been completed, and the groundwater system required by the interim ROD has been installed and is operational. Additionally, extensive demolition and associated soil sampling and removal activities were taken at the Site that were not required by the interim ROD but were initiated by Alcoa (the owner of RMC) under EPA and DEQ oversight. Removed soil was disposed at permitted disposal facilities. No further soil removal activities are required.

EPA's Selected Final Remedial Alternative includes the following elements:

- Institutional controls to ensure protection of future users of the Site and that future uses of the Site and its associated groundwater are compatible with the cleanup levels achieved, by restricting future uses and groundwater use
- Continued operation of the groundwater focused extraction/production well optimization (FE/PWO) system until groundwater cleanup levels are achieved
- Maintenance and monitoring of capped areas to protect the integrity of the remedy and ensure protection of human health and the environment
- Monitoring groundwater to evaluate the effectiveness of the completed and ongoing cleanup actions.

## Statutory Determinations

The Selected Final Action is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate for this action, and is cost-effective. This action is final and utilizes permanent solutions where possible. The action does not use alternative treatment technologies and none of the alternatives achieve reduction of toxicity, mobility, or volume through treatment. This remedy does not satisfy the statutory preference for treatment as a principal element of the remedy because the source removal remedies that have already been conducted have addressed the principal threats at the site.

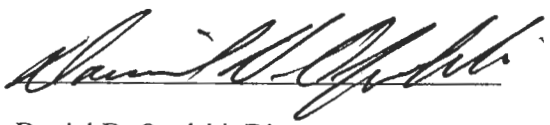
Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, statutory five-year reviews will be conducted every five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

## ROD Data Certification Checklist

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

- Key Contaminants of Concern and concentrations (Section 2 and Tables 7-1 through 7-4)
- Baseline risk represented by the COCs (Section 7)
- Cleanup levels established for chemicals of concern and the basis for these levels (Section 8)
- Current and reasonably expected future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Sections 6 and 7)
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 11)
- Estimated capital, annual operation and maintenance, and total present worth costs; discount rate; and number of years over which the remedy cost estimates are projected (Section 11)
- Key factors that led to the selection of the remedy (Section 11)

## Authorizing Signature



9/29/2006

Daniel D. Opalski, Director
Office of Environmental Cleanup
United States Environmental Protection Agency - Region 10

Date

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# PART 2: THE DECISION SUMMARY

## 1.0 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The Reynolds Metals Company (RMC) Site is located approximately 20 miles east of Portland, Oregon, and just over one mile north of the City of Troutdale. The property is bordered by the Columbia River to the north, the Sandy River to the east, the Troutdale Airport to the south, and Salmon Creek to the west. Alcoa, Inc is the current owner of the 800-acre site. (Figure 1)

The RMC operated a primary aluminum reduction plant where aluminum was produced from the raw material alumina. Approximately 108 acres of the 800-acre site were occupied by the former plant area.

EPA is the lead agency for this Site and the Oregon Department of Environmental Quality (DEQ) is the support agency involved.

***Physical Characteristics***

A US Army Corps of Engineers (COE) dike runs approximately east-west through the northern portion of the property, then turns south at the eastern property boundary. Site areas north and east of the dike are located within the 100 year floodplain. These areas are currently undeveloped and characterized by cottonwood-ash riparian forest and areas vegetated with blackberries and Scot's broom thickets.

The study area is characterized by a mild, temperate marine climate with moderately warm, dry summers and wet winters. The average annual precipitation in the area is approximately 37 inches. The average daily maximum temperature for the study area is 62 degrees F, and the average daily minimum temperature is 44 degrees F.

Seasonal wetlands at the Site contain hydric soils and characteristic hydrophytic plants that are capable of withstanding periods of summer drying. The primary locations of seasonal wetlands are the south wetlands area south of the main plant, low areas in Fairview Farms, low areas northeast of the former scrap yard area, low areas adjacent to Company Lake, and in the forest outside the COE dike.

The Site is mostly level, with less than 20 to 30 feet of variation in elevation. Geologically, the RMC Site is located in the eastern portion of the "Portland Basin," a term describing a 20 mile-wide by 45 mile-long northwest-southeast trending structural depression. The basin is filled with a complex system of unconsolidated and consolidated alluvial sediments containing important water-bearing zones.

***Investigation Areas***:

The RMC site has been divided into four distinct areas for investigation and evaluation of current site conditions. These key site reference areas are shown in Figure 2.

- Outside the Dike
- Fairview Farms
- South Wetlands area
- East (former plant) area (see also Figure 6).

The area Outside the Dike refers to the portion of the RMC site that is to the north and east outside of the US Army Corps of Engineers dike. This area is within the flood plain of the Columbia River, and includes Company Lake, East Lake and the western portion of the north landfill.

The Fairview Farms area is 227 acres located west of Sundial Road. This area was used for cultivated crops and cattle grazing. Although this area was not used for historical plant operations, there were some stormwater overflows from the plant to an adjacent ditch.

The South Wetlands area is 28 acres located south of the former plant. This area was used as a settling pond for wastewater discharges during the early years of plant operations. It is a low-lying area with thick vegetation and some standing water.

The East Area (Figure 3) is 254 acres and includes the area where the former RMC plant was located. The area is generally flat, and currently has no structures or aboveground improvements except for groundwater monitoring and extraction wellheads, and a small building that houses equipment for the groundwater system. The south landfill, scrap yard, and east potliner areas are also located within the East Area.

***Groundwater***

Groundwater generally discharges to the Columbia River in the northern portion of the Site and to the Sandy River in the eastern portion of the site. Two regional aquifer systems exist under the Site. The Sand and Gravel Aquifer (SGA) is the deeper unit.

The Unconsolidated Sedimentary Aquifer (USA) - is the uppermost aquifer and the focus of investigation and cleanup of this site. The unconsolidated sediments in this aquifer have been subdivided into four water-bearing zones for purposes of investigation:

- silt unit (generally 0-30 feet deep, and present mainly in the East Area)
- upper grey sand (up to 50 feet deep)
- intermediate sand (up to 100 feet deep)
- deep sand/gravel (greater than 100 feet deep)

# 2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

## 2.1 Site History

The plant was constructed for the US Government in 1941 to produce aluminum for wartime operations. The Aluminum Company of America (now Alcoa) operated the plant for the federal government from approximately 1941 to 1946. RMC leased the plant from the government in 1946 and purchased it in 1949. RMC operated the plant until 2000. In May 2000, RMC was acquired by a wholly owned subsidiary of Alcoa. That subsidiary (RLM Acquisition Corp.) merged with RMC, with RMC the surviving corporation. Alcoa suspended operations at the Troutdale plant in the fall of 2000, and Alcoa later announced permanent closure of the facility. The plant buildings were subsequently demolished, with demolition taking place from 2003 through January 2006.

## 2.2 Investigation and Cleanup Actions to Date

EPA placed the RMC Site (Site) on the Superfund National Priorities List (NPL) in December 1994. RMC subsequently conducted several early cleanup actions on the Site under a 1995 Administrative Order on Consent (AOC) for the Remedial Investigation/Feasibility Study (RI/FS). These early actions were time-critical removal actions completed under EPA oversight in areas identified as high priority source areas of contamination. Additionally, the 2002 Interim ROD required cleanup of other source areas as remedial actions, and RMC implemented those actions under a Unilateral Administrative Order (UAO) in July 2003. EPA issued a second UAO in July 2005 to address groundwater contamination. Finally, RMC/Alcoa completed substantial additional contaminated soil removal as part of the demolition activities conducted on the Site.

### *Pre-RI/FS Investigations*

The following investigations were conducted at this Site prior to the initiation of the Remedial Investigation and Feasibility Study (RI/FS):

- PRC Environmental Management, an EPA contractor, conducted a Site reconnaissance for EPA in January 1993 and prepared the Final Site Inspection Prioritization Report, dated October 19, 1993.

- RMC investigations were conducted by RMC's contractor, CH2M Hill, in 1994 and 1995.

### *Remedial Investigation and Feasibility Study*

RMC conducted an RI /FS under EPA and DEQ oversight from 1996 through 2000. The findings of the RI/FS, including the results of the baseline risk assessment, were the basis for the Interim ROD that was signed on September 30, 2002.

### *Removal Actions for Contaminated Soil and Waste*

Between 1995 and 2002, several significant early actions were conducted to remove contaminated soil and waste material. These actions targeted various known waste disposal and spill areas and areas that were sources of groundwater contamination. These removal actions are listed in

Table 2-1, followed by additional detail on the scrap yard removal, which was a significant source of groundwater contamination.

## Table 2-1

| Area | Action |
|---|---|
| Bakehouse Sumps Area | Excavation and off-site disposal of 283 tons of contaminated soil from sumps; removal and decommissioning of well points. |
| Casthouse | Excavation and off-site disposal of 515 tons of PCB contaminated dust, siding, soil and concrete, and concrete decontamination. |
| Cryolite Ponds | Excavation and off-site disposal of 13,900 tons of cryolite. |
| Diesel Spill Area | Excavation and off-site disposal of 2,650 tons of soil. |
| East Potliner Area | Excavation and off-site disposal of 11,542 tons of spent potliner and contaminated soil. |
| ESP Containment Area | Excavation and off-site disposal of 1,193 tons of contaminated material. |
| Fairview Farms | Excavation and off-site disposal of 150 tons of debris from four piles. |
| Scrap Yard | Excavation and off-site disposal of 22,918 tons of waste and soil. |
| South Wetlands | Excavation and off-site disposal of 90 tons of PCB-contaminated process residue and soil. |
| West South Ditch | Excavation and off-site disposal of 8,775 tons of process residue, soil and sediment (includes the hot spot portion of east south ditch). |

**Scrap Yard** – This 5.7-acre area, located in the East Area, was used as a storage area for the plant. Soil in the scrap yard was contaminated with fluoride, cyanide, PAHs, PCBs, and metals. Fluoride levels averaged over 30,000 mg/kg in the soils, with the concentrations decreasing with depth. The scrap yard was the source of fluoride and metals contamination in the shallow silt unit, and in underlying intermediate sand and sand/gravel water bearing zones, located between the scrap yard and the production wells. This area was cleaned up through early removal actions. Additional waste removal was completed as part of plant demolition activities. Following cleanup from removal actions, mean total fluoride was 489 mg/kg and PAHs were 1.0 mg/kg.

### *Remedial Actions for Soil Following the 2002 Interim ROD*

Remedial actions for soil and groundwater were completed following the issuance of the 2002 Interim Record of Decision. Three primary remediation activities were selected in the Interim ROD and completed for contaminated soil and waste material. These actions are listed in Table 2-2 and described in greater detail below.

## TABLE 2-2

| Area | Action |
|---|---|
| Company Lake | Excavation and removal of 93,854 tons of process residue and underlying sediment; geotextile and rock cap at west end and soil cap at east end adjacent to north toe of dike to cover small quantities of residue that could not be removed because of slope stability concerns. |
| North Landfill | Excavation and off-site disposal of 10,509 tons of waste and contaminated soil from the eastern portion of the landfill. Installation of rock cap cover on western portion. |
| South Landfill | Excavation and off-site disposal of 66,038 tons of waste and soil. |

These CERCLA interim remedial actions were determined to be necessary to remove sources of fluoride, metals and cyanide contamination in groundwater and reduce risks from direct contact with contaminated waste and soils. The soil cleanup standards set in the 2002 Interim ROD were based on protection of human health through direct contact for industrial uses as defined in Oregon cleanup regulations, and protection of groundwater (from leaching of contaminants) as a potential future drinking water source and discharge to surface water in the Sandy River. Cleanup levels set in the Interim ROD and the levels achieved are included in the waste area descriptions below. For all areas, excavated waste designated as hazardous under the Resource Conservation and Recovery Act (RCRA) was taken to permitted hazardous waste disposal facilities. Excavated waste material that was not designated as hazardous was disposed in off-site permitted solid waste disposal facilities.

**North Landfill** – This 2.4-acre landfill is located north and outside of the dike. The landfill contained carbon waste, refractory brick, demolition waste, solid waste, and miscellaneous debris. Contaminants included high levels of fluoride and PAHs, with low levels of cyanide, metals, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs) and PCBs. The eastern portion of this landfill had significantly higher levels of PAHs and a higher proportion of black carbon material than the western portion of the landfill. Under the Interim ROD, the eastern portion was removed and the western portion was capped (to prevent direct contact and to provide flood protection). Confirmation sampling was conducted to verify that cleanup levels for the eastern portion established in the ROD (4,000 mg/kg for fluoride, 36 mg/kg for carcinogenic PAHs) were met, with mean post-cleanup levels of 437 mg/kg for fluoride and less than 1 mg/kg for carcinogenic PAHs.

**Company Lake** – This 16-acre lake is located north and outside of the dike. During plant operations, storm water and treated wastewater entered the lake from a discharge pipe at the southern end. An outfall ditch drained from the northwestern corner of Company Lake into the Columbia River. Process residue from historical discharges containing fluoride, PAHs, TPH, cyanide, and low levels of PCBs had accumulated in a layer up to four feet thick on the bottom of Company Lake. Wastewater and this process residue were the sources of elevated fluoride concentrations in the shallow and intermediate zone groundwater beneath and adjacent to Company Lake. An estimated 3,780 tons of process residue were removed from a portion of Company Lake in 2001 as part of an early action. An additional 90,850 tons of the process residue and underlying sediment were removed under the Interim ROD. Small quantities of process residue could not be removed because of concerns over slope stability at portions of the west and southeastern ends of the lake, and these areas were capped. Cleanup goals established in the Interim ROD for Company Lake were 1,000 mg/kg for fluoride and 36 mg/kg for PAHs. Following cleanup, mean total fluoride was 481 mg/kg, and PAHs were 1.35 mg/kg.

**South Landfill** – This 5.8-acre landfill was located in the East Area and was used for general plant waste disposal from the early days of operation until about the late 1960s. Contaminants included fluoride (up to 48,000 mg/kg) and PAHs (up to 590 mg/kg). Fluoride migrated from the south landfill into shallow groundwater. A low permeability silt layer beneath the landfill provides a natural barrier that limits migration of contaminants to intermediate and deep groundwater. Waste and soil removal and confirmation sampling were completed for this area under the Interim ROD. Cleanup goals established in the Interim ROD for the south landfill were 4,000 mg/kg for fluoride and 36 mg/kg for carcinogenic PAHs. Following cleanup mean total fluoride was 427 mg/kg and PAHs were 1.9 mg/kg.

### *Evaluation and Remedial Actions for Groundwater*

The 1999 Remedial Investigation/Feasibility Study (RI/FS) identified plumes of fluoride-contaminated groundwater beneath the facility, with much smaller, localized areas of elevated metals, VOCs, and cyanide. The primary contaminant of concern (COC) in the groundwater is fluoride. Groundwater contamination is a result of fluoride leaching from former waste areas including Company Lake, north landfill, south landfill, the scrap yard area, and the east potliner area.

Fluoride concentrations exceed the federal and state Safe Drinking Water Act standard of 4 mg/L MCL (maximum contaminant level) beneath the RMC facility. Metals and cyanide in the shallow silt layer were also detected above MCLs. The east potliner, scrap yard, and south landfill were identified as the sources of these contaminants in groundwater. Figure 4 shows the location of the fluoride plume in the shallow silt zone. Figure 5 shows the location of the fluoride plume in the upper grey sand water-bearing zone; Figure 6 shows the location of the fluoride plumes in the intermediate water-bearing zone.

The Figures show the groundwater plumes based on information that was developed in 1997 as part of a comprehensive groundwater investigation. The investigation included data collection from geoprobes and monitoring wells. In the years since 1997, data from monitoring wells indicates that the plume has been relatively stable in size and concentration levels. Since the sources of contamination were removed in 2002-2005 and the FE/PWO wells started operating in 2005 the concentration levels in some monitoring wells near the source areas have begun to show a downward trend. In other areas, concentrations have not changed significantly or have been variable with no clear trend. Overall, the data indicate that the information in the Figures is generally representative of current site conditions.

Fluoride contamination in groundwater in the northern portion of the Site (the fluoride plume shown in upper portion of Figures 5 and 6) is associated with leaching from the waste that was disposed in Company Lake and the north landfill. Fluoride concentrations in groundwater in this area are generally below 20 mg/l. Evaluation of the northern plume in the Feasibility Study showed that source removal and natural flushing would be effective in substantially reducing fluoride concentrations in groundwater and restore beneficial uses of the aquifer.

Fluoride contamination in the southern portion of the Site (the fluoride plumes shown in the south plant areas of Figures 4, 5 and 6) is associated with leaching from waste and contaminated soils from the south landfill, scrap yard, and east potliner areas. Evaluation of groundwater in these areas showed that there were hot spots of groundwater contamination greater than 45 mg/l, including some smaller areas that were greater than 100 mg/l, and that source removal and active remediation would be needed to reduce concentrations and restore beneficial uses of the aquifer.

Removal of fluoride, PAH, metal and cyanide-contaminated soil has been completed for all source areas through removal or Interim ROD remedial actions. Approximately 347,546 tons of material containing about 7,366 tons of fluoride mass have been excavated and disposed at permitted off-site disposal facilities.

Groundwater remedial actions selected in the Interim ROD and completed at the Site include:

- The previously described soil source removals
- Decommissioning of several production wells and sumps
- Installation of the focused extraction and production well optimization (FE/PWO) system under the Interim ROD

The FE/PWO system, completed in October 2005, is designed to provide hydraulic containment of contaminated groundwater and restore groundwater quality. Two extraction wells, FE02 and FE03, are located in the scrap yard and east potliner areas. Production wells include PW07 and PW08, with backup capacity provided by wells PW03 and PW05; these wells are also an integral part of the FE/PWO system. Startup performance monitoring began in early November 2005, followed by operation and performance evaluation. The current and planned monitoring program will include evaluation of changes in the fluoride plume over time, including mass reduction of fluoride and hydraulic containment. Selected monitoring wells will also be sampled periodically for VOCs and total cyanide analysis. A complete description of the monitoring program, including well locations, depths, monitoring frequency and contaminants is included in the report *Sitewide Groundwater Monitoring Plan (2006 Through 2010) at RMC-Troutdale (CH2M Hill June 2005)*.

### *Site Demolition*

The RMC plant was closed in 2000 after the company was acquired by Alcoa, Inc. Demolition of the plant began in 2003 and was completed in 2005. The decision to demolish the plant was made by Alcoa based on its own business consideration and was not a part of the cleanup activities conducted under CERCLA. Alcoa chose to conduct the cleanup activities and dispose of the contaminated materials that it removed consistent with the soil cleanup levels that were specified in Interim ROD, and with State soil cleanup levels and disposal requirements. EPA and the DEQ performed oversight to ensure protection of human health and the environment, proper disposal of contaminated waste materials from the demolition, and observe confirmation sampling activities. The facility demolition provided the opportunity to complete additional investigation of the area next to and beneath the plant and conduct additional cleanup. The results of the investigation were used to see if additional steps needed to be taken to clean up this newly accessible area.

The demolition provided RMC the opportunity to recycle or reuse some materials and remove and dispose of contaminated materials. During demolition of the Reynolds plant, soil and debris contaminated with asbestos, PCB's, polynuclear aromatic hydrocarbons (PAHs), and spent potliner were taken to permitted off-site disposal facilities. In addition, suitable materials such as wood, brick, asphalt, concrete and steel from the demolition were reused or recycled.

### *Post-Demolition Remedial Investigation*

A post-demolition RI was a conducted to evaluate Site conditions following the plant demolition. RI data gathering was carried out under EPA and DEQ oversight during and after completion of plant demolition and waste and soil removal activities. The post-demolition RI sampling was performed in accordance with *Demolition Plan, Revision 1* (Demolition Plan) (CH2M HILL, April 2004) and *Memorandum WP No. 62: Post-Demolition Remedial Investigation and Risk*

*Assessment Work Plan* (Work Plan) (CH2M HILL, November, 2004). The results of the investigation are summarized in Section 5 and Section 7, Tables 7-1, 7-2, 7-3 and 7-4, and available in the May 2006 Post Demolition RI Report.

### 2.3 Enforcement History

EPA placed the Site on the Superfund National Priorities List (NPL) in 1994. On September 29, 1995, EPA and RMC signed an Administrative Order on Consent (AOC) for RMC to prepare a RI/FS and perform early actions at the Site under EPA's oversight. RMC completed the early cleanup actions as well as the RI/FS, which presents the results of the site investigation and analysis of cleanup alternatives. On September 30, 2002, EPA issued an ROD for an interim remedial action, which required cleanup of several waste areas and fluoride-contaminated groundwater. In 2003, EPA issued a Unilateral Administrative Order (UAO) to RMC to cleanup of the waste areas as required under the Interim ROD. RMC is performing groundwater cleanup as required by the Interim ROD under a second UAO issued by EPA in 2005.

## 3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA prepared a community relations plan for the Site in May 1995. The plan was based on community interviews conducted earlier in that year. A variety of community involvement activities have taken place at the Reynolds Metals site since 1995, including distribution of nine fact sheets, maintenance of information repositories, updates to the project web page and newspaper notices announcing the release of significant documents. A mailing list of approximately 80 addresses has been maintained.

Community relations activities associated with the 2002 Proposed Plan for Source Areas and Groundwater Interim Action included distributing a fact sheet and making site documents available to the public. At that time, EPA made available the Administrative Record, which included the RI/FS Report, Human Health and Ecological Baseline Risk Assessment Reports, and other technical and Site-related documents. A notice of availability of the Proposed Plan and opportunity to comment was published in the Oregonian on August 28, 2002 and public comments were solicited for 30 days. No comments were received during the 30-day public comment period.

The Proposed Plan for Final Remedial Action and the Administrative Record for the Site were made available to the public in August 2006. A fact sheet summarizing the Proposed Plan was mailed on August 1, 2006, to people on EPA's mailing list for the Site. Additional copies of the Proposed Plan were distributed in the community and mailed on request. The notice of availability of the Proposed Plan and opportunity to comment was published in the Oregonian on August 3, 2006. At that time, EPA made available the Administrative Record, which included additional information such as the Post-Demolition Remedial Investigation Report, Post-Demolition Human Health and Ecological Baseline Risk Assessment Report, and other technical and Site-related documents. Two public meetings were held during the 30-day public comment period. The first meeting was held at the Troutdale Community Center on Tuesday, August 22, 2006 from 7 to 9pm. The second public meeting was held at the City of Wood Village City Council Chambers on Friday, August 25, 2006 from 10am to 12:30pm.

EPA did not receive any formal comments on the Proposed Plan for Final Remedial Action during the 30-day comment period.

The content of the Administrative Record for the site served as the basis for this Record of Decision. All records which form the basis for the remedial decisions including Remedial Investigation and Feasibility Study Reports, Risk Assessments and other key documents have been made available for public review during the response actions to date and can be found in the Administrative Record file, which is located at the Gresham Regional Library, 385 NW Miller, Gresham, Oregon and the Superfund Records Center, EPA Region 10, 1200 Sixth Avenue, Seattle, Washington.

## 4.0 SCOPE AND ROLE OF RESPONSE ACTION

This ROD selects the final action to complete the overall Site cleanup. Since 1995, several removal actions have cleaned up immediate threats and high priority areas of contamination above the water table that were sources of groundwater contamination. In September 2002, EPA issued a ROD for interim remedial actions to address additional sources of contamination associated with Company Lake, the South Landfill area, the North Landfill area, and to begin the cleanup of contaminated groundwater. These areas were selected for cleanup in the Interim ROD because they posed a risk to human health and the environment and were sources of contamination in groundwater. The 2002 ROD was an interim action because the investigation and evaluation of other potentially contaminated areas of the Site, including the buildings and other structures in the plant process area, were not addressed.

The remedy selected in the Interim ROD cleans up and protects groundwater and the Sandy River with a phased approach to restoration. The first step was removal of contaminated waste and soil that was the source of groundwater contamination. This was followed by installation of the focused extraction and production well optimization (FE/PWO) system. The system is operational and contaminated groundwater is being extracted to prevent further plume migration and restore groundwater quality. Groundwater monitoring is being conducted to confirm that the system is performing as designed and that intermediate and deep groundwater will be restored in a reasonable time frame and protected from further contribution of contamination from the silt unit.

This final remedial action focuses on residual levels of contamination in site soils that remain onsite following the removal and remedial actions and additional soil removal that has been carried out as part of plant demolition activities, and actions necessary to continue cleanup of contaminated groundwater. It specifically addresses: (1) the former plant process area where the buildings and other structures were demolished and removed over the past three years - these areas were generally not addressed by the Interim ROD; (2) the final groundwater action through continued operation of the groundwater FE/PWO system; and (3) site-wide institutional controls.

## 5.0 SITE CHARACTERISTICS

This section summarizes information obtained as part of RI/FS activities at the Site. It includes characteristics that have been addressed by removal actions and the interim remedy, and presents sources of contamination, subsequent sampling strategies, and documented types of contamination and affected media.

## 5.1 Overview

### *Topography and Climate*

The Site topography is generally flat (20 to 30 feet differential elevation), with some minor variation to the north and northeast. The plant process buildings occupied the central portion of the Site. The eastern part of the plant area within the dike consists of open fields and areas where miscellaneous debris and discarded materials were stored during plant operations. All buildings and structures, with the exception of a small building in the East Area that houses groundwater pumping equipment and controls, have been removed from the Site.

The study area is characterized by a mild, temperate marine climate with moderately warm, dry summers and wet winters. The average annual precipitation in the area is approximately 37 inches. The average daily maximum temperature for the study area is 62 degrees F, and the average daily minimum temperature is 44 degrees F.

### *Floodplains and Wetlands*

The areas north and east of the COE dike are within the 100 year floodplain of the Columbia and Sandy Rivers. These areas are currently undeveloped and characterized by cottonwood-ash riparian forest and areas vegetated with blackberries and Scot's broom thickets.

Seasonal wetlands at the Site contain hydric soils and characteristic hydrophytic plants that are capable of withstanding periods of summer drying. The primary locations of seasonal wetlands are the south wetlands area south of the main plant, low areas in Fairview Farms, low areas northeast of the former scrap yard area, low areas adjacent to Company Lake, and in the forest outside the COE dike.

#### *Historical and Cultural Resources*

There are no places within the Site listed on the National Register of Historic Places. Cultural resource surveys prior to and concurrent with Site excavations did not identify cultural resources.

### *Geologic Conditions*

The RMC Site is located in the eastern portion of the "Portland Basin," a term describing a 20 mile-wide by 45 mile-long northwest-southeast trending structural depression. The basin is filled with a complex system of unconsolidated and consolidated alluvial sediments containing important water-bearing zones.

### *Hydrogeologic Conditions*

Two regional aquifer systems exist under the Site. The Unconsolidated Sedimentary Aquifer (USA) is the uppermost aquifer, and the Sand and Gravel Aquifer (SGA) is the deeper unit. The unconsolidated sediments within the uppermost regional groundwater system beneath the facility have been subdivided into four water-bearing zones for purposes of investigation. The four zones are the silt unit (generally 0-30 feet deep), the upper grey sand (up to 50 feet deep), the intermediate sand (up to 100 feet deep), and the deep sand/gravel. The silt unit exists in the southern portion of the Site but does not generally occur in the northern portion of the Site. Groundwater generally discharges to the Columbia River in the northern portion of the Site and to the Sandy River in the eastern portion of the site.

## 5.2 Sources of Contamination

Facility operations, including past waste disposal, spills, leaks, and other releases, were primarily responsible for soil and groundwater contamination. The waste material on the RMC Site included process and nonprocess residues from the aluminum reduction plant. Process wastes were primarily associated with the reduction areas, the carbon plant, and the casthouse. Nonprocess wastes included demolition debris, scrap equipment, construction materials and general refuse. Sources of contamination to groundwater were generally associated with areas onsite where process-related waste and other discarded materials were stored or disposed. These sources of contamination were described in the original RI report, the Interim ROD and Section 2 of this document.

The RMC site has been divided into four distinct areas for investigation and evaluation of current site conditions: outside the dike, Fairview Farms, the South Wetlands area, and the East (former plant) area (Figure 2).

The northern portion of the RMC site is located outside of the US Army Corps of Engineers dike within the flood plain of the Columbia River. This area includes Company Lake and East Lake. The western portion of the north landfill, which was capped as part of the work performed under the Interim ROD, is also located in this area.

The Fairview Farms area is located to the west of Sundial Road, across from the former plant location. This area was not used as part of the historical plant operations, although there were some stormwater overflows to an adjacent ditch. Some portions have been used for cultivated crops and cattle grazing in the past. It is approximately 227 acres.

The South Wetlands area is located south of the former plant. This area was used as a settling pond for wastewater discharges during the early years of plant operations. It is a low-lying area of approximately 28 acres with areas of thick vegetation and some standing water.

The East Area (Figure 3) is approximately 254 acres and includes the area where the former RMC plant was located. The area is generally flat, and currently has no structures or aboveground improvements except for groundwater monitoring and extraction wellheads and a small building that houses equipment needed for the operation of the groundwater system. All other facility structures, paved areas, and most foundations to approximately 8 feet below the ground have been demolished and removed from the site. This area is also the former location of the south landfill, scrap yard, and east potliner areas that were cleaned up through previous removal and remedial actions.

***Conceptual Site and Exposure Models***

The Conceptual Site Model (CSM) identifies the means by which humans or ecological receptors on or near the RMC site may be exposed to site contaminants. The CSM that was developed for the RI and Baseline Risk Assessment (BLRA) was revised for the post-demolition risk assessment (post-demolition RA) to consider the changes to the site that have taken place since the BLRA. The demolition of the plant buildings and structures and the removal of large volumes of contaminated waste and soil have changed the physical setting and some of the potential exposure pathways at the Site. The revisions and the exposure assumptions are related to site soils. The CSM for groundwater has not changed significantly since the RI and BLRA.

The updated conceptual exposure model for human exposure to residual levels of contaminants in soil is shown on Figure 7. Three pathways of exposure to residual soils are potentially complete: 1) direct contact with contamination with surface soils (before and during development, 2) direct contact with contamination in subsurface soil, and 3) dust generated from wind or other disturbances. Potentially complete human exposure pathways and routes of exposure include:

- Incidental ingestion of and dermal contact with surface soil by trespassers, recreational users, occupational workers and construction workers
- Incidental ingestion of and dermal contact with subsurface soil by excavation and construction workers
- Inhalation of dust in ambient air by trespassers, recreational users, occupational workers, and construction workers

The scenarios for human exposure for the individual assessment areas and assumptions for each of the exposed are presented in the Site risk section.

The ecological conceptual exposure model has not changed from the BLRA.

## 5.3 Sampling Strategy

The pre-Interim ROD RI/FS began in 1996 and focused on establishing the nature and extent of soil and groundwater contamination. The RI included sampling of waste, soils, groundwater, surface water, and sediments. Waste and soils were characterized through surface and subsurface individual and composite samples. Test pits were excavated in the old landfill areas, including the north landfill, south landfill, and scrap yard areas, to allow direct observation of buried materials and to provide access for subsurface sample collection.

The post-demolition RI was a comprehensive data gathering and analysis program that evaluated Site conditions following the plant demolition. Soil investigations, including surface and subsurface sampling, were conducted at 56 assessment areas. In addition, geophysical techniques, such as electromagnetic and resistivity surveys, were completed to identify buried material. Soil samples were analyzed for fluoride, PAHs, cyanide, PCBs, pesticides, metals, VOCs, and semivolatile organic compounds (SVOCs). The assessment areas were combined into four general areas for investigation and evaluation: outside the dike, Fairview Farms, the south wetlands and the East (former plant) area.

Groundwater was sampled using a system of 50 groundwater monitoring wells that were installed on or adjacent to RMC property. The monitoring wells were installed at different depths in the aquifer, and were generally classified as shallow, intermediate and deep wells, depending on installation depth. Direct push sampling also measured fluoride in groundwater at depths up to 50 feet below ground surface (bgs). Semi-annual monitoring has been conducted at selected groundwater monitoring wells for the past several years.

## 5.4 Nature and Extent of Contamination

Section 2.2 provided a summary of the findings in key areas of the site as well as a summary of the removal, interim, and demolition-related actions that were conducted in those areas. The Interim ROD and associated documents, including the RI/FS, summarize the site conditions that prompted the cleanup actions that have since been completed at the site. Those actions have generally reduced residual concentrations of contaminants of concern to below target levels that were established in the interim ROD.

Section 5.3 discussed the post-demolition remedial investigation that was conducted. As noted, the post-demolition RI was a comprehensive data gathering and analysis program that evaluated Site conditions following the plant demolition. Details of the post-demolition remedial investigations and its findings are presented in the Post-demolition RI Report, and summary data regarding the residual soil concentrations in the 4 areas is provided in Tables 7-1 through 7-4 below in Section 7. Areas where the report provided updated information from the original RI/FS are summarized below:

**Fairview Farms** – A drainage area in the northeastern portion of the Fairview Farms area was not adequately investigated during the original RI. Additional sampling was conducted in 2005 to assess current conditions in this area. The results showed the area has not been significantly impacted by the contamination from the Site.

**Outside the Dike** – Company Lake, the adjacent discharge ditch, and the north landfill were cleaned up through removal and remedial actions pursuant to administrative orders or the Interim ROD. The post-demolition RI evaluated these areas following the completion of this work to confirm that the performance criteria established in the Interim ROD were achieved.

**South Wetlands Area** – This area was assessed in the draft RI/FS, and a removal of PCB-contaminated process residue was conducted in 1999. Additional sampling of a portion of the railroad embankment was conducted in 2004. Although this area has elevated levels of fluoride, it has not impacted the upper grey sand water-bearing-zone beneath the silt zone. Residual levels of contamination were evaluated as part of the post-demolition investigation.

**East Area** – Even though a number of historical investigations and cleanup actions were conducted in the East (plant) Area, a comprehensive evaluation of the area was conducted following demolition to ensure that areas of the Site that were newly accessible were properly assessed. RMC's Demolition Plan included collection of samples and removal of structures, foundations and contaminated soils. EPA monitored demolition and sampling activities. Areas of the Site that were not addressed as part of the Demolition Plan were sampled by RMC, with EPA oversight. The results of the post-demolition investigation, which are presented in the Post-Demolition RI report, showed low residual levels of contamination in soils.

The FE/PWO system is currently operating and is hydraulically containing contaminated groundwater in the intermediate and deep zones, and restoring groundwater quality in the upper grey sand by reducing the fluoride concentration in the grey sand and the fluoride mass migrating from the silt unit to the grey sand. Startup performance monitoring began in early November 2005. Routine monitoring is being performed. During the first 5 months of operation, the system operated as designed with fluoride concentrations of 2 to 3 mg/l discharged to the Columbia River.

# 6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

## 6.1 Land Use

The majority of the Site, including the area where the former plant was located, is currently zoned for general industrial use. Property to the west and south of the Site is currently used for a variety of commercial and industrial purposes. RMC property north and outside of the dike is zoned open space, and a small portion of Fairview Farms is agricultural.

It is anticipated that Site will be developed as mixed-use general industrial consistent with the general industrial zoning currently designated for the property. Most of the property is within the urban growth boundary for the City of Troutdale, and could be annexed to the City in the future. The area outside the dike is expected to remain open space, as further development of the RMC property north and east of the dike is not likely because the area is subject to flooding.

### 6.2 Groundwater Use

A survey of groundwater uses within a 1-mile radius of the Site identified local groundwater uses as part of the original RI/FS. The survey identified 17 domestic wells, 5 municipal wells, and irrigation and industrial wells. Only two active wells are potentially downgradient from RMC, an industrial well at Sundial Marine Tug & Barge Works, Inc (223 ft deep) and a domestic well (not currently used for drinking water) at Gresham Sand & Gravel (127 ft deep). The closest municipal supply well is the City of Troutdale's well #4, which is located offsite and to the south of the Site, in the sand and gravel aquifer. This well is deeper and upgradient of the areas where fluoride contamination has been observed at the RMC Site. The RI/FS concluded that the wells have not been impacted by contamination from the RMC Site.

The City of Fairview added a municipal supply well following the completion of the groundwater survey included in the RI/FS. The well is located on NE Bluelake Road and is approximately 6,090 feet west of the projected western edge of the groundwater plume.

On-site deep production wells supplied process water and drinking water for the aluminum reduction facility during its operation, although RMC suspended drinking water uses in the past few years and supplied bottled water for workers. Tap water was a composite from multiple production wells. Future groundwater use will depend on the needs of future users of the Site; however, use for drinking water is unlikely and currently unacceptable because fluoride levels are above drinking water standards. Use of water for industrial purposes would need to be compatible with proper operation of the FE/PWO groundwater system selected in the interim ROD. If the property is annexed to the City of Troutdale, then the City could extend their public water supply to serve the area in the future.

Groundwater use restrictions are expected to be permanent for shallow contaminated groundwater (the silt unit) in the south plant area. The shallow silt zone is not considered a usable source of drinking water because of low yields in this portion of the aquifer. An evaluation of the restoration potential of the silt zone estimated that yields were generally below 0.1 gpm, which limits its potential use as a drinking water source. However, groundwater contaminated with fluoride at concentrations that exceed the drinking water standard have migrated from the silt unit into the underlying upper grey sand. Protection of the beneficial use of the underlying drinking water is

anticipated through the combination of removal of the scrap yard soil source of contamination to groundwater, and operation of the FE wells in the upper grey sand beneath the silt unit.

### 6.3 Surface Water Use

The RMC Site is located adjacent to the Columbia and Sandy rivers. Beneficial uses designated by the State of Oregon for the Sandy River Basin, which includes the Columbia River from River Miles 86 to 120, are shown in attached Table 6-1.

When the facility was in operation, it discharged treated wastewater and stormwater to the Columbia River via Company Lake under a National Pollution Discharge Elimination System (NPDES) permit. Wastewater from facility operations has not been produced or discharged since the plant ceased operations in the fall of 2000. Stormwater runoff and extracted groundwater is currently discharged to the Columbia River under a new NPDES permit issued by DEQ in 2003. Groundwater with elevated levels of fluoride discharges to the Columbia River north of the plant site.

### 6.4 Endangered Species

The Columbia River and Sandy River provide habitat for documented threatened or endangered species. Several species of special-status fish, including Snake River fall Chinook salmon, spring Chinook salmon, and sockeye salmon, occur in the both rivers (see Table 6-2, attached, for listing and status). Two terrestrial species that potentially could occur in the area are federally listed: the bald eagle (threatened) and the American peregrine falcon (endangered).

## 7.0 SUMMARY OF SITE RISKS

### 7.1 Overview

RMC conducted a baseline risk assessment (BLRA) as part of the RI/FS to determine the potential current and future effects of contaminants on human health and the environment. The baseline risk assessment estimated the likelihood of health or environmental problems if no cleanup action were taken at the Site.

Since the preparation of the BLRA, removal and remedial actions required by the Interim ROD, as well as subsequent plant demolition and associated source removal actions, have been performed. These actions reduced contaminated materials on the Site and potential sources of exposure, and eliminated certain exposure pathways. Removal of source material significantly reduced sources of contamination to groundwater.

Projected future land use changes also required consideration of exposure scenarios different from those assumed in the BLRA. The Site is planned to be developed as a mixed-use general industrial complex consistent with the general industrial zoning currently designated for the property. The Site is expected to be built out over an extended period of time.

The post-demolition risk assessment (RA) documented the final condition at the Site after plant demolition and remediation of the property were completed, and considered the reasonably anticipated future land uses at the Site. The post-demolition RA considered exposure scenarios for direct contact pathways associated with soil for the most plausible future site users: site trespassers, recreational users, construction workers, excavation/ trench workers, and standard occupational

workers. An updated ecological risk assessment was also developed for the south wetlands area using current data representative of final conditions.

The post-demolition RA evaluated the Site, which includes Fairview Farms to the west and areas outside the dike to the north. This RA was performed on four discrete exposure areas.

- Fairview Farms
- Outside the dike
- South wetlands
- East Area (former plant area east of Sundial Road)

## 7.2 Human Health Risks

***Exposure Assessment***

The exposure assessment component of the risk assessment identifies the means by which individuals on or near the Site may contact chemicals in environmental media. The post-demolition RA included a human health exposure assessment, which identified potential exposure scenarios according to which contaminants of concern (COCs) in Site media could contact humans and quantified the intensity and extent of the exposures. The main objective of the human health RA was to determine whether residual concentrations of chemicals in soil result in cancer or noncancer risks that exceed regulatory risk threshold levels. A consideration of reasonably anticipated future land uses provided identification of the most feasible human exposure pathways for future use of the Site.

The COCs and exposure point concentrations (EPCs) for the four assessment areas are shown on Table 7-1 (Fairview Farms) Table 7-2 (Outside the Dike) Table 7-3 (South Wetlands) and Table 7-4 (East Area)

The estimation of potential exposure required specific assumptions to describe potential exposure situations. Upper-bound exposure assumptions were used to define reasonable maximum exposure (RME) conditions to provide a bounding estimate on exposure. In accordance with *Guidance for Conduct of Deterministic Human Health Risk Assessments (DEQ, 2000a)*, deterministic risk assessments should also define central tendency estimates (CTEs) of exposure and risk. The exposure assumptions for the scenarios evaluated are described below. Standard EPA default assumptions were used except for some exposure duration assumptions for specific scenarios that were developed (based on best professional judgment in consultation with EPA) as noted in this section.

Trespasser – assumes that a person (35 kg adolescent) could be exposed to chemicals in surface soils through dermal contact, incidental ingestion, and inhalation. It is assumed that exposure would occur for 5 days per year for 5 years under the CTE scenario, and for 26 days per year for 5 years under the RME scenario.

Recreational user – assumes that a person (35 kg adolescent) could be exposed to chemicals in surface soils through dermal contact, incidental ingestion, and inhalation. It is assumed that exposure would occur for 5 days per year for 5 years under the CTE scenario, and for 26 days for 5 years under the RME scenario.

Construction Worker – assumes that a worker (70 kg adult) could be exposed to chemicals in soil through dermal contact, incidental ingestion, and inhalation. It is assumed that exposure would occur for 250 days per year for 0.5 year under the CTE scenario and for 250 days per year for 1 year for the RME scenario. The CTE and RME assumptions were modified for the south wetlands area to 90 days per year to account for the shorter construction season for this area.

Excavation/trench Worker – assumes that a worker (70 kg adult) could be exposed to chemicals in subsurface soil through direct contact, incidental ingestion, and inhalation. It is assumed that exposure would occur for 9 days per year for 0.5 year under the CTE scenario and 9 days per year for 1 year under the RME scenario.

Occupational Worker – assumes that a worker (70 kg adult) could be exposed to chemicals through direct contact, incidental ingestion, and inhalation. It is assumed that exposure would occur for 250 days per year for 6 years under the CTE scenario and 250 days per year for 25 years under the RME scenario.

The exposure scenarios for each of the identified areas, based on reasonably likely future users for the individual areas, are presented in Table 7-5.

**Table 7.5: Summary of Scope of Exposure Scenarios Evaluated**

| Exposure Area | Human Health | | | | | Ecological |
|---|---|---|---|---|---|---|
| | Short-Term Trespasser | Recreational User | Construction Worker | Excavation/ Trench Worker | Occupational Worker | |
| Fairview Farms | X | | X | X | X | |
| Outside the Dike | X | X | | | | |
| South Wetlands | X | | X | X | | X |
| East Area | X | | X | X | X | |

***Toxicity Assessment***

The human health toxicity assessment quantified the relationship between estimated exposure (dose) to COCs in Tables 7-1 through 7-4 and the increased likelihood of adverse effects. Risks of contracting cancer due to site exposure were evaluated based on toxicity factors (cancer slope factors or CSFs) from IRIS. Quantification of non-cancer hazards relied on published reference doses (RfDs) in IRIS, if available, or EPA's Health Effects Assessment Summary Tables (HEAST) or EPA Region 9 PRG toxicity factor tables.

CSFs are used to estimate the probability that a person would develop cancer given exposure to site-specific contaminants. This site-specific risk is in addition to the risk of developing cancer due to other causes over a lifetime. Consequently, the risk estimates generated in risk assessments are frequently referred to as "incremental" or "excess lifetime" cancer risks (ELCRs).

RfDs represent a daily contaminant intake below which no adverse human health effects are expected to occur. To evaluate noncarcinogenic health effects, the human health impact of contaminants is approximated using a hazard index (HI). Hazard index values are calculated by comparing the estimates of site-specific human exposure doses with RfDs. Values greater than 1.0 represent a potential risk.

## 7.3 Human Health Risk Characterization

### *Risk Quantification Results*

The results of the human health risk assessment are presented in Table 7-6 below.

**Table 7-6: Human Health Risk Assessment Results Summary**

| Exposure Area | Exposure Scenario | Excess Lifetime Cancer Risk * | | Noncancer Hazard Index (RME and CTE) | Primary Excess Lifetime Cancer Risk Contributors (approximate percent contribution) |
|---|---|---|---|---|---|
| | | CTE | RME | | |
| Fairview Farms | Short-Term Trespasser | $1 \times 10^{-8}$ | $2 \times 10^{-7}$ | <1 | None |
| | Construction Worker | $3 \times 10^{-8}$ | $2 \times 10^{-7}$ | <1 | None |
| | Excavation/Trench Worker | $1 \times 10^{-9}$ | $6 \times 10^{-9}$ | <1 | None |
| | Occupational Worker | $2 \times 10^{-7}$ | $2 \times 10^{-6}$ | <1 | None |
| Outside the Dike | Short-Term Trespasser | $1 \times 10^{-7}$ | $2 \times 10^{-6}$ | <1 | None |
| | Recreational User | $1 \times 10^{-7}$ | $2 \times 10^{-6}$ | <1 | None |
| South Wetlands | Short-Term Trespasser | $8 \times 10^{-7}$ | $1 \times 10^{-5}$ | <1 | Benzo(a)pyrene ELCR = $3 \times 10^{-6}$ (32%)<br>Dibenzo(a,h)anthracene ECLR = $2 \times 10^{-6}$ (21%) |
| | Construction Worker | $4 \times 10^{-7}$ | $3 \times 10^{-6}$ | <1 | None |
| | Excavation/Trench Worker | $4 \times 10^{-8}$ | $3 \times 10^{-7}$ | <1 | None |
| East Area | Short-Term Trespasser | $9 \times 10^{-8}$ | $1 \times 10^{-6}$ | <1 | None |
| | Construction Worker | $4 \times 10^{-7}$ | $2 \times 10^{-6}$ | $\underline{<}1$ | None |
| | Excavation/Trench Worker | $1 \times 10^{-8}$ | $9 \times 10^{-8}$ | <1 | None |
| | Occupational Worker | $1 \times 10^{-6}$ | $1 \times 10^{-5}$ | <1 | Benzo(a)pyrene ELCR = $5 \times 10^{-6}$ (38%)<br>Arsenic ELCR = $2 \times 10^{-6}$ (17%) |

* Aggregate risk from all carcinogens combined.

This table provides the excess lifetime cancer risk and noncancer hazard index results for each exposure area and exposure scenario that was evaluated. It also provides a summary of the primary risk contributors and their respective contributions to the total area-specific risk estimate, when appropriate.

### *Soil Comparison with Target Risk*

Risks were compared to EPA's target risk range of 1x10-4 to 1x10-6 for carcinogens and to a Hazard Index of 1.0 for systemic toxicants. The interim remedial actions and demolition removal actions were undertaken to remove sources of contamination to groundwater and reduce site risks to acceptable levels. The Interim ROD cleanup levels and target soil levels used by RMC for owner-initiated removal of contaminated soil during demolition considered DEQ target risk levels, described in the Section 8.0. The Interim ROD also required Institutional Controls to ensure that future site use is compatible with the cleanup levels achieved. In the post-demolition RA, as shown in the tables,

risks for industrial exposure had been reduced by the soil and debris removals and do not exceed EPA's risk range. However, if the caps are disturbed or land use changes (to residential), the risks would be higher Based on the results of the post-demolition RI and RA, reduction of human exposure through direct contact with contaminated soil and debris has largely been achieved by the actions that have been undertaken . Site soils do not currently pose an unacceptable risk based on the exposure scenarios evaluated. However, future Site use will need to be restricted to non-residential uses and the north landfill cap and the two small capped areas in Company Lake will need to be maintained.

### *Groundwater Human Health Risk*

Human health risk associated with exposure to groundwater was estimated in the BLRA and was not part of the post-demolition RA. The risk with current exposure (at the time of the preparation of the BLRA) to groundwater did not exceed the HI of 1.0. Risk estimates for potential future exposure to fluoride in groundwater showed that the future off-site residential exposure scenario resulted in an HI of 3.3. The future off-site residential exposure was based on a hypothetical well located in the northeast portion of the Fairview Farms area, which has since been incorporated by purchase into the Reynolds Site. Future exposure from on-site consumption of groundwater would be greater if shallow or intermediate groundwater within the fluoride plume were used for drinking water.

Groundwater risk was not re-evaluated in the Post-demolition risk assessment. The FE/PWO system that was selected in the Interim ROD has been constructed and operating for less than a year. The system has begun to reduce groundwater risks by reducing the mass of fluoride migrating from the silt unit and within the upper grey sand, and providing hydraulic containment of the plume in the intermediate and deep zones in the south plant area. Removal of the scrap yard soil source of contamination to the silt unit and underlying drinking water is expected to be effective in reducing the mass of fluoride migrating downward through the silt unit and into the underlying drinking water zones.

The Interim ROD did not require extraction of groundwater in the northern part of the Site. Excavation and off-site disposal of the process residue layer in Company Lake, the source of groundwater contamination in the north area, is expected to be effective in achieving long-term restoration of groundwater quality in this portion of the Site.

## 7. 4 Ecological Risks

The main objective of the post-demolition ecological RA was to update the south wetlands ecological risk assessment that was presented in the BLRA, using characterization data representative of final Site conditions and the most current regulatory guidance. The purpose was to evaluate the effectiveness of a polychlorinated biphenyl (PCB) removal action in this area in September 1999, and to consider additional sampling data (since the BLRA) from the railroad embankment, south landfill, north landfill, and Company Lake. Ecological evaluations for other areas at the Site were documented in the BLRA.

The ecological risk assessment was an evaluation of the actual or potential effects of contamination at the Site on plants and animals. It included an identification of assessment endpoints and representative measures of exposure and measures of effect. Ecological exposure estimates were quantified for selected representative ecological receptors and expressed as a hazard quotient.

## 7.5 Ecological Risk Characterization

### *Risk Quantification Results*

A post-demolition residual ecological RA was performed for south wetlands to evaluate the effectiveness of a PCB removal action in this area in September 1999, and the addition of sampling data (since the BLRA) from the railroad embankment. The ecological RA provided an assessment of the potential impacts on wildlife of residual concentrations at south wetlands, assuming that site development does not occur. If the area is developed in the future, then the habitat would no longer exist and the ecological risk results will become invalid at that time. Additional areas at the Site where ecological exposures could occur were previously addressed during the BLRA.

The ecological RA for south wetlands was conducted using a tiered approach, structured to focus the ecological RA on the contaminants of potential ecological concern and receptors with the greatest potential for ecological exposure. Tier 1 consisted of a screening-level ecological assessment that served to narrow the field of chemicals detected in site media to those that are of most concern to ecological receptors. Tier 2 used site-specific information to provide more realistic exposure estimates and to better characterize risk for south wetlands, but only for those chemicals and receptors that were not screened out during Tier 1.

The previous BLRA indicated that the contaminants of potential ecological concern with the highest potential for ecological exposure were PCBs, primarily in south wetlands, and fluoride and polynuclear aromatic hydrocarbons (PAHs), primarily within Company Lake. Since the BLRA, these constituents have been addressed by the remedial actions at Company Lake (as outlined in the Interim ROD and the PCB removal action in September 1999 at south wetlands.

The results of the Tier 2 ecological RA presented indicated that response actions have been effective in further reducing ecological risk in south wetlands within acceptable levels. The removal at south wetlands was effective at reducing the PCB exposure point concentration in surface soil by 65 percent. The Post-demolition RA concluded, based on calculated HQs for heron (0.9) hawk (0.2) and mink (1.0), that the area does not pose significant risk to those species.

### *Groundwater Ecological Risk*

The BLRA included ecological risk estimates for groundwater discharging to the Columbia and Sandy rivers. There are no ambient water quality criteria for fluoride available, so water aquatic toxicity data from literature sources were used to estimate toxicity potential. Data from wells adjacent to the Columbia and Sandy Rivers indicates that present discharges to the rivers have a relatively low potential for toxicity to aquatic species but modeling predicted that without plume containment future discharges would increase in concentration and therefore increase the potential for fluoride toxicity to aquatic receptors in the Sandy River. RMC completed a technical memorandum on the predicted effect on future groundwater discharges to the Columbia and Sandy Rivers if groundwater pumping ceased. The analysis showed that if pumping is discontinued in the intermediate and deep zones, the fluoride plumes would migrate toward the Sandy River and fluoride concentrations in groundwater discharging to the Sandy River would be expected to increase over the next few years and to continue for several decades during which time there would be an increased potential for toxicity.

## 7.6 Uncertainties

Risks to human health may be over- or underestimated based on the appropriateness of the assumptions regarding exposure, bioavailability of chemicals, and assumptions associated with the derivation of toxicity factors. However, the uncertainties in any risk assessment affect the estimations of risk such that EPA believes that the estimates are only accurate to within an order of magnitude. Risks to ecological receptors may be over- or underestimated based on the appropriateness of the representative receptor species and home range estimates.

## 7.7 Basis for Response Action

The BLRA established that unacceptable human health risks were present at the Site that required the implementation of remedial actions. The required actions for soils were described in the Interim ROD and were undertaken at the Site, except for Institutional Controls, which have not yet been implemented. Additionally, demolition actions at the Site, and associated soil removal further reduced site risks. Human health and ecological risks from exposure to soil and sediments at the Site have been reduced to acceptable levels for industrial use under current conditions by the actions that have been taken. However, actions are still needed to ensure the remedy is maintained and future site uses are restricted to industrial uses to remain protective.

The BLRA also identified risks from exposure to groundwater, including unacceptable human health risks from consumption of groundwater that is above drinking water MCLs, the potential for groundwater with unacceptably high concentrations of fluoride to be present off-site, and the potential for groundwater migration off-property and into the Columbia and Sandy Rivers. Groundwater response actions were required to prevent migration and inappropriate use of groundwater at the Site, and to restore the beneficial use of groundwater. Operation of the existing production wells and installation of additional focused extraction pumping wells was required and have been implemented to control these risks. However, because concentrations of constituents of concern are still unacceptable, groundwater management actions will need to be continued until risks have been acceptably reduced.

# 8.0 REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for the final Remedial Action at this Site are:

*1) Reduce human exposure through direct contact (ingestion, inhalation, and dermal contact) with contaminated soil and debris that would result in unacceptable excess lifetime cancer risk or above a Hazard Index of 1.0 for the reasonably anticipated (non-residential) future land uses.*

*2) Restore and maintain use of the groundwater (except the shallow silt zone) as a drinking water source. The restoration goal is the federal and state safe drinking water standard (MCL).*

*3) Minimize the migration of contaminants from waste and soils to groundwater at concentrations that are protective for underlying drinking water, reduce the fluoride mass in shallow and intermediate groundwater, and control migration of fluoride and other constituents of concern in groundwater.*

*4) Reduce and control the migration of fluoride in groundwater to the Sandy River.*

The above RAOs are consistent with the RAOs that were developed for the Interim ROD.

Soil and debris removals were conducted to meet the first and third objectives. Based on the results of the post-demolition RI and RA, reduction of human exposure through direct contact with contaminated soil and debris has been achieved. The Site no longer poses an unacceptable risk based on the exposure scenarios evaluated. However, future Site use will need to be restricted to non-residential uses to meet the first objective, and the north landfill cap and the two small capped areas in Company Lake will need to be maintained.

***Key ARARs***

Key Appropriate and Relevant Administrative Requirements (ARARs) for soils at this site include Oregon Environmental Cleanup Rules. Risks for each exposure area were evaluated relative to goals established by DEQ that defined acceptable risk for individual carcinogenic compounds to be set at one in one million (1 x 10E-6) excess risk for cancer and one in one hundred thousand (1 x 10E-5) for cumulative risks from carcinogenic compounds. Acceptable risk for noncarcinogenic constituents was set at a hazard index equal to 1. If calculated risks within an exposure area are below these target risk levels, risks are assumed to be acceptable and no further evaluation or action will be taken. This comparison is provided in Table 8-1 below.

**Table 8-1: Comparison of Human Health Risk Results with DEQ Criteria**

| Exposure Area | Exposure Scenario | DEQ Target Risk Exceedance—Is Total ELCR > 1 x $10^{-5}$? | | Is Total HI for RME and CTE > 1.0? | Are Individual Chemical ELCRs > 1 x $10^{-6}$? |
|---|---|---|---|---|---|
| | | CTE | RME | | |
| Fairview Farms | Short-Term Trespasser | No | No | No | No |
| | Construction Worker | No | No | No | No |
| | Excavation/Trench Worker | No | No | No | No |
| | Occupational Worker | No | No | No | No |
| Outside the Dike | Short-Term Trespasser | No | No | No | No |
| | Recreational User | No | No | No | No |
| South Wetlands | Short-Term Trespasser | No | No | No | Yes.[a] Two PAHs |
| | Construction Worker | No | No | No | No |
| | Excavation/Trench Worker | No | No | No | No |
| East Area | Short-Term Trespasser | No | No | No | No |
| | Construction Worker | No | No | No | No |
| | Excavation/Trench Worker | No | No | No | No |
| | Occupational Worker | No | No | No | Yes. One PAH and arsenic. Arsenic concentrations are at background levels. |

[a] Individual chemical ELCRs do not exceed 1 x $10^{-6}$ when assuming a more realistic trespass frequency of less than 11 days per year at south wetlands, as described in Section 4.6.2 of the main report.

The Site meets DEQ's 1 x 10E-5 cumulative target risk and total hazard index (less than 1.0) for the CTE case for all human health exposure scenarios. The Site also meets the 1 x 10E-6 individual target risk criterion for the CTE case for all human health exposure scenarios.

For the RME case, the Site meets DEQ's 1 x 10E-5 cumulative target risk and total hazard index (less than 1.0) for all human health exposure scenarios. The Site also meets the 1 x 10E-6 individual target risk criterion, except for the RME site trespasser scenario at south wetlands and the RME occupational worker scenario at the East Area. However, the individual target risk criterion is not exceeded for these two areas under the CTE scenario. The slight exceedance of the 1 x 10E-6 individual target risk for the RME site trespasser scenario at south wetlands is not considered significant in light of the results for the CTE case for this Site. An additional calculation indicated that even if the trespass frequency were assumed to be 11 days per year, there would be no exceedances of the 1 x 10E-6 individual target risk for this area. For trespass exposure at south wetlands, an exposure frequency of about 5 days per year (assumed under the CTE case) is more reasonable than the 26 days per year assumed under the RME case, and results in acceptable risk. In addition, the thick vegetation and standing water would serve to minimize direct contact with soil at south wetlands.

In addition to the above risk estimates, all soil samples in the Fairview Farms area, outside the dike area, south wetlands, and East Area (except one sample in south wetlands) met the risk-based screening levels identified in DEQ's Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites (DEQ, 2003.

***Cleanup levels***

Cleanup levels for soils are not being established because the results of the risk assessment and evaluation of Oregon Cleanup rules shows that risk associated with residual levels of contamination in soils are acceptable for the reasonably likely future uses at the Site.

Cleanup levels for groundwater are being established for this ROD. CERCLA specifies that federal MCLs are relevant and appropriate cleanup goals for groundwater. The groundwater cleanup level applies to all groundwater except for groundwater in the shallow silt zone in the south plant area. The shallow silt zone is not considered to be a usable source of drinking water because of low yields in this portion of the aquifer. An evaluation of the restoration potential of the silt zone estimated that yields were generally below 0.1 gpm, which limits its potential use as a drinking water source. Groundwater use restrictions are expected to be permanent for shallow contaminated groundwater in the silt unit in the south plant area. EPA also established a 5 mg/l discharge standard for fluoride from the FE/PWO system in the Interim ROD.

The Interim ROD required the installation and operation of the FE/PWO system to meet the second, third, and fourth RAOs. The FE/PWO system is expected to reduce concentrations of fluoride migrating from the silt unit to levels that are protective of the underlying drinking water zones, and to restore groundwater in the upper grey sand and intermediate zones. The FE/PWO system has been operating successfully for the past 6 months and will need to continue to operate until the cleanup goals have been achieved.

## 9.0. DESCRIPTION OF ALTERNATIVES

The Post-Demolition RA demonstrated that as long as land use is maintained and caps are in place, exposure to site soils no longer poses an unacceptable risk to human or ecological receptors. As a result, only two alternatives for soils are being evaluated: no action and institutional controls. Although institutional controls were required by the Interim ROD, they have not been finalized for the Site.

In the Interim ROD, EPA selected construction and operation of the FE/PWO system, in conjunction with monitoring, and institutional controls as the groundwater cleanup alternative. The FE/PWO system was recently placed into operation and an evaluation of the system is currently on-going. Continued operation of that system is a remedial alternative. The no action alternative and institutional controls for groundwater are also considered.

### *Alternative 1 - No Action (Soils and Groundwater)*

Analysis of the no action alternative is generally required to establish a baseline for comparison. Under this alternative, EPA would take no action to prevent current or future exposure to soil or groundwater, either through institutional controls or additional groundwater cleanup at the Site. Discontinued operation of the FE/PWO system would be a component of the no action alternative.

### *Alternative 2 - Institutional Controls (Soils and Groundwater)*

Institutional controls are actions such as restrictive easements, fencing and warning signs, or use restrictions. Institutional controls for soils include restrictive covenants, easements or equitable servitude to prevent future residential use of the Site and restrict occupational use of the south wetlands area. Institutional controls would also include provisions to protect areas capped through previous cleanup actions against disturbance, other than appropriate maintenance activities. These capped areas include the western portion of north landfill and the two small areas in Company Lake.

This alternative would not include groundwater pumping. An evaluation of a “no pumping” scenario as an alternative for groundwater was presented in the 1999 feasibility study. This scenario included groundwater monitoring but would discontinue operation of the production wells.

Institutional controls for groundwater would be developed and implemented to prevent use of contaminated groundwater for drinking water until cleanup levels are achieved. The groundwater use restrictions are expected to be permanent for shallow contaminated groundwater (the silt unit) in the south plant area. There are no current or projected uses of the shallow groundwater in the south plant area because of low yield.

### *Alternative 3 - Continued Operation of the Interim ROD Groundwater Remedy*

Contaminated groundwater will be hydraulically contained through operation of production wells and concentrations of fluoride reduced through focused extraction of groundwater in the south plant area, as required by the Interim ROD. The well locations are shown in Figure 9. The groundwater system operates the production wells to hydraulically control contaminated groundwater plumes by maintaining a “capture zone.” Production wells PW07 and PW08, or designated backup wells, will be pumped at an estimated 600 gallons per minute (gpm) each to control migration of fluoride and other chemicals of concern in the intermediate and deep zones under the facility. The focused extraction wells operate to reduce the concentration of fluoride in the upper grey sand and

reduce the concentration of fluoride migrating from the overlying silt unit. The focused extractions wells will be pumped at an estimated 20 to 40 gpm.

Results of the first months of operation indicate that the fluoride levels in water from wells FE02 and FE03 have been about 40 mg/l and 20 mg/l, respectively. Groundwater from the production wells are already below the MCLs, and the fluoride concentration of the blended flow from the FE/PWO system during the first months of operation has been 2 to 3 mg/l. This concentration is below the 5mg/l standard for fluoride discharge that was established in the Interim ROD for protection of aquatic species. The combined flow from the production wells and focused extraction wells is being discharged to the Columbia River in accordance with limits established by the Interim ROD and NDPES permit number 100757. Fluoride concentrations are expected to decrease over time as concentrations in groundwater in the south plant area decrease. This alternative also includes groundwater monitoring.

### *Alternative 4 – Continued Operation of the Interim ROD Groundwater Remedy and Institutional Controls.*

This alternative combines all of the elements of Alternatives 2 and 3 and is the preferred alternative.

## 10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes and compares the cleanup alternatives based on the nine criteria established by CERCLA for the evaluation and comparison of cleanup alternatives. This analysis focuses on the primary distinguishing factors EPA considered in selecting its Preferred Alternative. The no action alternative is not described in detail because it does not provide overall protection of human health and the environment and EPA cannot select an alternative that does not satisfy this threshold criterion.

**10.1 Overall Protection of Human Health and the Environment** *evaluates whether an alternative achieves and maintains adequate protection of human health and the environment.*

Direct contact exposure risks have been addressed by the soil cleanup actions that have been completed throughout the Site. Excavation and off-site disposal of the waste and contaminated soil under the Interim ROD and additional waste removal associated with plant demolition have reduced exposure for workers, recreational users and trespassers by eliminating direct contact with unacceptable levels of chemicals of concern in waste, surface and subsurface soils. It has also reduced the migration of chemicals of concern to groundwater by removing sources of groundwater contamination.

Alternative 1, no action, would not be adequately protective of all potential future uses at the Site and would not prevent the use of contaminated groundwater as a source of drinking water. It also would not provide restoration of beneficial uses for most portions of the aquifer, and would not provide hydraulic containment of or reduce fluoride mass in groundwater in the south plant area to control anticipated future discharges of fluoride-contaminated groundwater to the Sandy River.

Institutional controls under Alternatives 2 and 4 provide additional protection of human health and the environment by eliminating, reducing, or controlling residual risks associated with soils and groundwater exposure. However, institutional controls alone (Alternative 2) would not restore the beneficial uses of groundwater and would not provide adequate protection of the Sandy River from

anticipated future discharges of contaminated groundwater. An evaluation of a "no pumping" scenario as an alternative for groundwater was presented in the 1999 feasibility study. The analysis showed that a significant mass of fluoride would be discharged to the Sandy River in a few years and would continue for several decades if the plume in the south plant area was not contained by pumping of the production wells at the Site.

Alternative 3 would provide protection of the Sandy River and restoration of beneficial uses of groundwater, but would not provide adequate protection if there are no restrictions on future use of the property or drinking water.

Alternative 4 provides the best overall protection of human health and the environment by controlling risks associated with exposure to residual levels of contamination, controlling further migration of fluoride-contaminated groundwater to other portions of the aquifer and the Sandy River, and protecting and restoring beneficial uses of the groundwater. The Groundwater FE/PWO will need to operate for an estimated 5 to 10 years to maintain hydraulic control and achieve protective levels in the intermediate and deep zones. Restrictions on the use of groundwater may need to continue for 20 years for some (generally shallower) portions of the aquifer, and are expected to be permanent for the shallow silt zone in the south plant area.

**10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** *evaluates how each alternative complies with federal and state statutes and regulations that pertain to the site.*

Alternatives 1 and 2 would not achieve compliance with ARARs of Federal and State laws because groundwater would not meet MCLs for fluoride and this beneficial use would not be protected and restored. Alternatives 3 and 4 (Preferred Alternative) are expected to achieve compliance with ARARs for groundwater. It is estimated that the groundwater FE/PWO system will need to operate for at least an additional 5 to 10 years after the source control actions were completed in 2005 to achieve compliance with the MCLs for intermediate and deep groundwater. Restoration of some portions of the aquifer (shallower areas beneath the silt unit or near Company Lake) could take up to 20 years.

Soil cleanup levels achieved during the Interim Action, combined with institutional controls (Alternatives 2 and 4) would comply with ARARs for soils. Alternatives 1 and 3 would not comply with State ARARs because the residual levels in soils are above the levels allowed by Oregon State cleanup rules for residential use.

**10.3 Long-term Effectiveness and Permanence** *evaluates the ability of an alternative to maintain protection of human health and the environment over time.*

Excavation and off-site disposal of contaminated waste and soil, including sources of groundwater contamination, has been an effective and permanent solution to human and ecological exposure to contamination at the Site. Removal of the process residue layer in Company Lake is expected to be effective in achieving long-term restoration of groundwater quality in the northern part of the Site.

Alternatives 3 and 4 (Preferred Alternative) includes removal of fluoride mass from the groundwater through operation of the FE/PWO system, which is expected to provide long-term protection of groundwater in the southern part of the Site and minimize any future impacts to the Sandy River. Institutional controls in Alternatives 2 and 4, including restrictive covenants for future

site and groundwater use, are an effective means of ensuring that the site use is compatible with the protective levels achieved and the continued operation of the FE/PWO system. Institutional controls will also protect the areas that have been capped.

**10.4 Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment** *evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.*

None of the alternatives achieve reduction of toxicity, mobility, or volume through treatment. Highly contaminated waste and soil have already been excavated and disposed off-site as part of early removal actions, the Interim ROD, and additional cleanup associated with plant demolition activities. These actions did not include treatment. Removal of contaminated soil and debris that was a source of groundwater contamination has reduced leaching of contaminants to groundwater.

Continued operation of the groundwater system under the Preferred Alternative does not include treatment of fluoride. The Interim ROD concluded that the treatment processes evaluated in the feasibility study have not been shown to be effective in treating the expected fluoride concentration of 75 mg/l that would be pumped from the focused extraction wells. The Interim ROD indicated that treatment would be re-evaluated if fluoride concentrations in the focused extraction wells exceeded 75 mg/l. Results of the first months of operation indicate that the fluoride levels in water from wells FE02 and FE03 have been about 40 mg/l and 20 mg/l, respectively. Groundwater from the production wells are already below the MCLs, and the fluoride concentration of the blended flow from the FE/PWO system during the first month of operation has been 2 to 3 mg/l. This concentration is below the 5mg/l standard for fluoride discharge that was established in the Interim ROD for protection of aquatic species.

**10.5 Short-term Effectiveness** *evaluates the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.*

All of the alternatives with institutional controls provide some measure of short-term effectiveness by preventing exposures to residual levels of contamination. Alternative 3 would provide hydraulic control and fluoride mass reduction in groundwater, but would not restrict use of groundwater while the cleanup is underway. The combination of hydraulic control, reduction of fluoride mass in groundwater, and institutional controls in Alternative 4 will provide the best short-term protection during the groundwater cleanup and initial site re-development activities.

The combined flow from the production wells and focused extraction wells for Alternatives 3 and 4 will be discharged directly to the Columbia River. There are no ambient water quality criteria for fluoride available, so water aquatic toxicity data from literature sources were used to estimate toxicity potential. EPA determined in the Interim ROD that 5 mg/l will be the standard for fluoride discharge for the FE/PWO system action, and believes that treatment will not be needed to meet this standard based on predicted and initial fluoride concentrations. EPA believes that the 5 mg/l standard for fluoride at the predicted flowrates will be protective of aquatic species in the Columbia River. For other constituents that may be present, EPA will use ambient water quality criteria for protection of aquatic organisms as the standard. The point of compliance will be prior to the discharge to the Columbia River.

**10.6 Implementability** *evaluates the technical and administrative feasibility of implementing the alternative.*

The groundwater FE/PWO system that would be operated under Alternatives 3 and 4 has been constructed and is functioning as designed during the first months of operation. The components of the system are proven and reliable and are capable of removing fluoride mass from the plume beneath the southern part of the Site. The FE/PWO system was designed and constructed with the flexibility to allow operational adjustments and minor modifications. The effectiveness of groundwater extraction and containment will be monitored and evaluated, and adjustments or modifications to the FE/PWO system made, as necessary. Institutional controls in Alternative 2 and 4 can be implemented and are expected to be put in place after completion of the final ROD. Institutional controls will be put in place through enforceable mechanisms such as an easement and equitable servitude that have been used successfully at other sites in the State of Oregon.

**10.7 Cost** *includes estimated capital and operation and maintenance costs as well as present worth costs.*

The Preferred Alternative and Alternative 3 have estimated annual operation and maintenance costs of $231,000. These costs are for operation of the FE/PWO system and groundwater monitoring. Annual costs for groundwater monitoring only under Alternative 2 are estimated at $88,000. Costs for groundwater monitoring are based on sampling and analysis of the monitoring wells as described in the Site-wide Groundwater Monitoring Plan (2006-2010). For cost estimating purposes, it was assumed that operations and monitoring of the FE/PWO system would be required for 10 years, and monitoring only for additional 5 years. The present worth cost for Alternative 4 is $1,850,000, assuming a 7% discount rate.

**10.8 State/Support Agency Acceptance** *evaluates whether the State of Oregon agrees with the U.S. EPA's analyses and recommendations of the RI/FS and the Proposed Plan*

The State of Oregon Department of Environmental Quality has concurred with EPA's selected remedy.

**10.9 Community Acceptance** *evaluates whether the local community agrees with U.S. EPA's analyses and preferred alternative.*

The public comment period for the Proposed Plan was held from August 3, 2006 to September 4, 2006. Two public meetings were held during the comment period. Information regarding the Preferred Alternative and the other alternatives was presented at each of the public meetings, followed by general discussions and an opportunity for formal comment. Informal input was generally supportive of completing the cleanup and returning the site to productive use. EPA did not receive any verbal or written comments on the Proposed Plan during the public comment period.

# 11.0 THE SELECTED REMEDY

## 11.1 Description of the Selected Remedy

Based upon consideration of CERCLA requirements and the detailed analysis of the alternatives using the nine criteria, EPA has determined that Alternative 4 is the most appropriate remedy for completing the cleanup at the RMC Site. The Selected Remedy consists of the following elements:

- Use institutional controls (IC) to ensure protection of future users of the Site and that future uses of the Site, including groundwater use, are compatible with the cleanup levels achieved. ICs are necessary to restrict residential use of the Site, restrict the use of groundwater that exceeds MCLs as a drinking water source, and protect the integrity of the cap. The ICs will include:
    - A legal description of the property with a corresponding map will be prepared to clearly identify the property where the ICs will be implemented.
    - A restrictive easement or covenant that runs with the land to prohibit residential use of the property, and identify conditions (i.e., additional protective measures, such as capping or special soil handling requirements) under which non-industrial site uses would be considered. For groundwater, the restrictions will include a prohibition on use of Site groundwater that exceeds MCLs for drinking water, prohibition of other groundwater uses that would interfere with the successful operation of the groundwater FE/PWO system, and access for inspection and continued operation of the system.
    - Use restrictions on the capped areas to protect the integrity of the existing cap or require suitable capping to allow for intended use of the area.
- Continued operation of the groundwater focused extraction/production well optimization (FE/PWO) system until groundwater cleanup levels are achieved or EPA approves modification, reduction or suspension of the operation of the system. Groundwater from the FE/PWO system will continue to be discharged pursuant to the fluoride standard established in the Interim ROD and the existing Oregon DEQ NPDES permit # 100757 or as modified by DEQ.
- Maintenance and monitoring of capped areas to ensure protection of human health and the environment, including inspections of the capped areas to verify cap integrity and making repairs when problems are observed. A cap inspection and maintenance plan will be required to be submitted to EPA for approval and implementation, and will be implemented in accordance with the approved plan.
- Monitoring groundwater to evaluate the effectiveness of the completed and ongoing cleanup actions. Monitoring and reporting for the first five years is expected to be carried out in accordance with the Site-wide Groundwater Monitoring Plan (2006-2010). An addendum to the Site-wide Groundwater Monitoring Plan will be developed and

submitted for approval by EPA and DEQ, following completion of the February 2007 groundwater monitoring event, that provides criteria for evaluating performance of the focused extraction system and scrap yard soil source removal on long-term decline in fluoride concentrations in the silt unit and protectiveness for the underlying drinking water. A second addendum to the Site-wide Groundwater Monitoring Plan will be developed and submitted for approval by the EPA and DEQ at the completion of the five-year monitoring period defining long-term monitoring and reporting for the site.

### 11.2 Rationale and Expected Outcomes for the Selected Remedy

The Selected Remedy for the RMC Site will achieve the RAOs through a combination of institutional controls, continued operation of the groundwater FE/PWO system, and long-term maintenance and monitoring. The remedy was selected because the Post-Demolition RA shows that current site conditions are within acceptable risk levels for the reasonably expected future uses at the Site. Previous cleanup actions have achieved substantial and long-term risk reduction. Based on current information, EPA believes that known contaminated soil and debris have been removed from the Site so that residual concentrations of contaminants have been reduced to acceptable levels for future industrial use and that residual risks can be controlled by use of institutional controls.

The groundwater remedy will complete the phased approach to groundwater restoration. The first phase of the groundwater remedy was source removal, which was completed through early removal actions and the remedial actions required by the Interim ROD to eliminate the sources of contamination to groundwater. The second phase was construction of the FE/PWO system, followed by successful start-up testing to demonstrate that the system is functioning as designed. The final phase is the operational phase, which requires operation of the FE/PWO system for approximately 5 to 10 years to contain the plume in the south plant area and restore groundwater quality. Control of migration of fluoride from the silt unit to the underlying drinking water is anticipated to be achieved through the combination of scrap yard soil source removal and continued operation of the focused extraction wells. Progress of remediation, measured by containment of the fluoride plume and restoration of groundwater quality and protection of beneficial use will be confirmed by sampling of monitoring wells.

Cleanup levels for groundwater are the federal drinking water standards. Fluoride is the key contaminant addressed by the groundwater remedy and its MCL is 4 mg/l. Performance criteria and monitoring that will be required to meet the remedial action objectives for groundwater, including capture zone monitoring and water quality, were developed as part of the Site-wide Groundwater Monitoring Plan (2006 through 2010) and as amended by the focused extraction addendum to be submitted by the end of 2006.

The beneficial use of the aquifer (except for the shallow silt zone) is as a source of water for industrial uses and for drinking water. Groundwater extracted from the deep portions of the aquifer has been used for this purpose both on and off site. In addition, discharge to surface water is a beneficial use of the aquifer. The Selected Remedy will significantly reduce the mass of fluoride, protect the Sandy River, and restore beneficial uses within a reasonable time frame.

The shallow silt zone is not considered to be a usable source of drinking water because of low yields in this portion of the aquifer. An evaluation of the restoration potential of the silt zone estimated that yields were generally below 0.1 gpm, which limits its potential use as a drinking water source and the technical practicability of active remediation options to reduce fluoride levels within the silt in a reasonable timeframe. The scrap yard soil source removal above the silt zone and the

focused extraction of fluoride contaminated water from beneath the silt zone are expected to reduce and control migration of fluoride from the silt zone to the underlying portions of the aquifer. The area of the site where the shallow silt zone occurs and is not considered a usable source of drinking water is shown on Figure 3. Federal MCLs are not ARARs for the silt zone in this area and attainment of groundwater cleanup levels is not required for this area. However, remedial action is required to reduce and control migration of contamination from the silt zone to protect the beneficial use of the underlying drinking water.

There are no established federal water quality criteria for fluoride. EPA established a fluoride level of 5 mg/l in the Interim ROD for discharge of groundwater from the FE/PWO system. This concentration is based on protection of beneficial uses, including aquatic receptors. The State of Oregon Water Quality Standards and federal water quality criteria are also ARARs for this discharge. These concentrations are listed in Table 12.2. The point of compliance for the discharge of water from the extraction system is on-site prior to the discharge of the blended flow (focused extraction and production well water) to the Columbia River, and the current monitoring location is in the FE/PWO pump house. These concentrations of fluoride and these ARARs are also the goal for non-point discharges from the site into the Columbia and Sandy River.

### 11.3 Summary of Estimated Remedy Costs

Construction of the groundwater FE/PWO remedy was completed under the Interim ROD, and no additional construction is required by the Selected Remedy. The Selected Remedy has an estimated annual operation and maintenance cost of $231,000 for 10 years, and $88,000 for monitoring only costs for an additional 5 years. Costs for groundwater monitoring are based on sampling and analysis of the monitoring wells as described in the Site-wide Groundwater Monitoring Plan (2006-2010). An additional $50,000 in the first year costs was included as a contingency for modifications to the monitoring well network and institutional controls. Assuming a 7% discount rate, the combined present worth cost for the Selected Remedy is $1,850,000.

## 12.0 STATUTORY DETERMINATIONS

Based on information currently available, EPA believes the Selected Remedy provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria. The remedy satisfies the statutory requirement in CERCLA section 121(b) to: 1) be protective of human health and the environment; 2) comply with ARARs; and 3) be cost-effective. It also uses permanent solutions to the extent practicable. However, because major sources of contamination have been cleaned up through previous removal and remedial actions, and treatment was not found to be practicable for groundwater, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

The following sections discuss how the Selected Remedy meets these statutory requirements.

### 12.1 Protection of Human Health and the Environment:

The Selected Remedy will be protective of human health and the environment. Human health risk and ecological risk for the sources addressed by this action will be reduced below EPA and DEQ target risk criteria. Since the construction aspects of the remedy have been completed, implementation of this remedy would create virtually no short-term risk to the environment.

## 12.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The Selected Remedy is expected to comply with all action-specific, location-specific and chemical-specific applicable or relevant and appropriate requirements as follows:

**Safe Drinking Water Act - maximum contaminant levels**

The Safe Drinking Water Act regulations establish maximum levels of contaminants in public drinking water sources (40 CFR Part 141). The NCP states that MCLs are potentially relevant and appropriate during remediation of groundwater or surface waters that are current or potential sources of drinking water. Federal MCLs are relevant and appropriate for the RMC Site. Constituents of concern for groundwater at RMC and corresponding MCLs are listed in Table 12-1.

**Clean Water Act - water quality criteria**

EPA has established federal water quality criteria under Section 304 of the Clean Water Act. Water quality criteria are set for human health and protection of aquatic life. CERCLA Section 121(d) requires that water quality criteria be attained if relevant and appropriate to the circumstances of the site. Water quality criteria are relevant and appropriate at RMC for determining acceptable contaminant levels in the Columbia and Sandy rivers. Water quality criteria for the discharge of focused extraction and production well water from RMC are listed in Table 12-2. The point of compliance is on-site prior to the discharge of the blended flow (focused extraction and production well water) to the Columbia River, and the current monitoring location is in the FE/PWO pump house. The water quality criteria are also relevant and appropriate for non-point discharges from the site into the Columbia and Sandy River.

**Oregon Water Quality Standards**

Oregon Water Quality Standards under OAR 340-041 for the Willamette Basin (Columbia River) and Sandy River Basin are relevant and appropriate for the discharges of focused extraction and production well water from RMC. The water quality criteria are also relevant and appropriate for non-point discharges from the site into the Columbia and Sandy River.

**Oregon Environmental Cleanup Law (ORS 465.200) and Oregon Environmental Cleanup Rules (OAR 340-122)**

The Oregon Environmental Cleanup Law is patterned after CERCLA, and is applicable to the extent that its standards are more stringent than federal standards. Under Oregon Environmental Cleanup Rules, the level of contaminants assumed to be protective of human health and the environment are an excess lifetime cancer risk of 1x10E-6 for individual carcinogens, a cumulative excess lifetime cancer risk of 1x10E-5, and a hazard index of less than or equal to 1 for systemic toxicants with similar endpoints. For protection of ecological receptors, the acceptable level of risk is at the point before significant adverse impacts are expected to occur.

The post-demolition risk assessment concluded that previous cleanups at the Site have achieved acceptable risk levels for the reasonably likely future uses at the site. The selected remedy will meet this ARAR for residual levels of contamination by achieving acceptable risk levels through institutional controls.

**Well Installation Requirements**

The Oregon Water Resources Department regulates the construction, abandonment, maintenance and use of water wells and monitoring wells. The requirements in OAR 690 200 through 240 would apply to wells constructed, operated or abandoned as part of the remedial action.

## 12.3 Cost-Effectiveness

In EPA's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness". (NCP 300.430(f)(ii)(D)). The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs; hence, this alternative represents a reasonable value for the money to be spent.

## 12.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The Selected Remedy is a permanent solution for the groundwater below the Site. Alternative treatment technologies have not been found applicable.

## 12.5 Preference for Treatment as a Principal Element

The principle threat waste at the RMC site was addressed by removal actions and the remedial actions required by the Interim ROD.

The groundwater action uses plume extraction and containment to reduce the mass and mobility of fluoride in groundwater. Treatment processes evaluated in the FS were not shown to be effective in reducing predicted contaminant concentrations in extracted groundwater, and the actual concentrations of fluoride in extracted groundwater are lower than predicted in the FS. Therefore, treatment of extracted groundwater is not necessary. The statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will not be satisfied by this action.

## 12.6 Five-Year Review Requirements

Because this remedy, although reducing contaminant loads and concentrations in groundwater below the Site, will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

# 13.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM THE PREFERRED ALTERNATIVE IN THE PROPOSED PLAN

The Proposed Plan was released for public comment on August 1, 2006. It identified Alternative 4 as the Preferred Alternative for remediation. No comments were received during the 30-day public comment period. EPA did not make any significant changes to the Preferred Alternative in the Selected Remedy

# PART 3: RESPONSIVENESS SUMMARY

The public comment period for the Proposed Plan was held from August 3, 2006 to September 4, 2006. Two public meetings were held during the comment period. Information regarding the Preferred Alternative and the other alternatives was presented at each of the public meetings, followed by general discussions and an opportunity for formal comment.

EPA did not receive any verbal or written comments on the Proposed Plan during the public comment period.

# Figure 1 - Vicinity Map

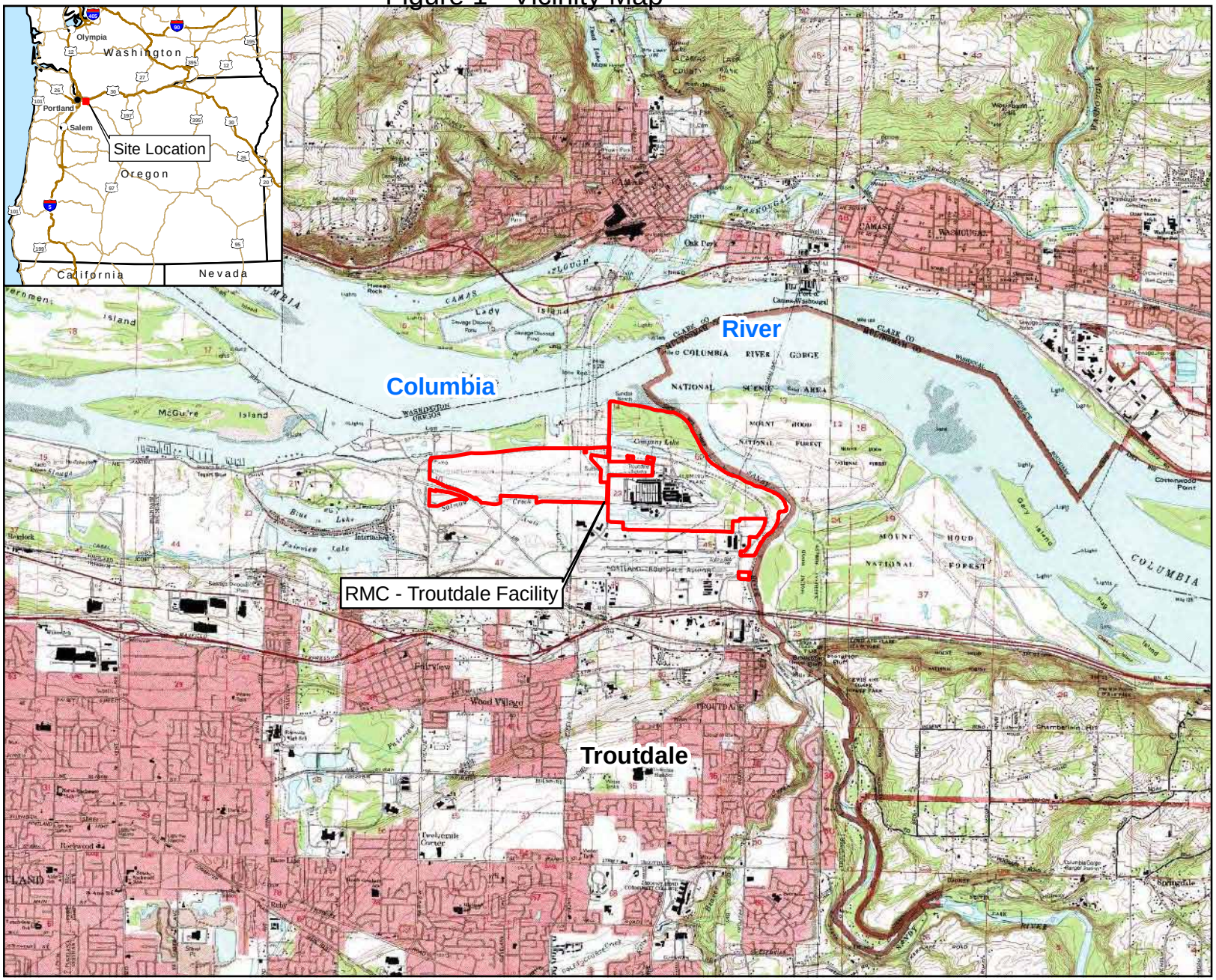


Figure 2 - Site Features and Evaluation Area

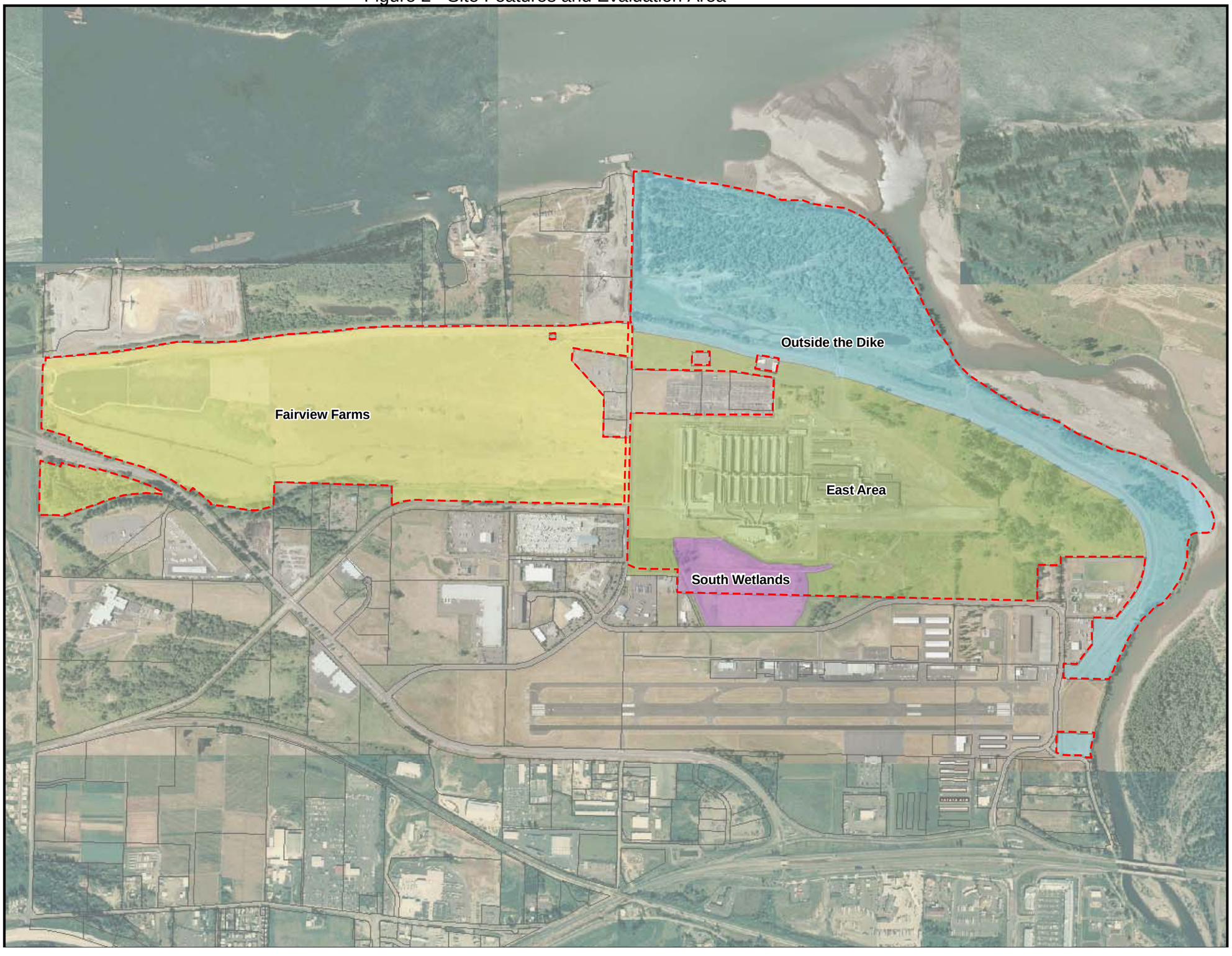


Figure 3 - RMC Site East Area - Detail View

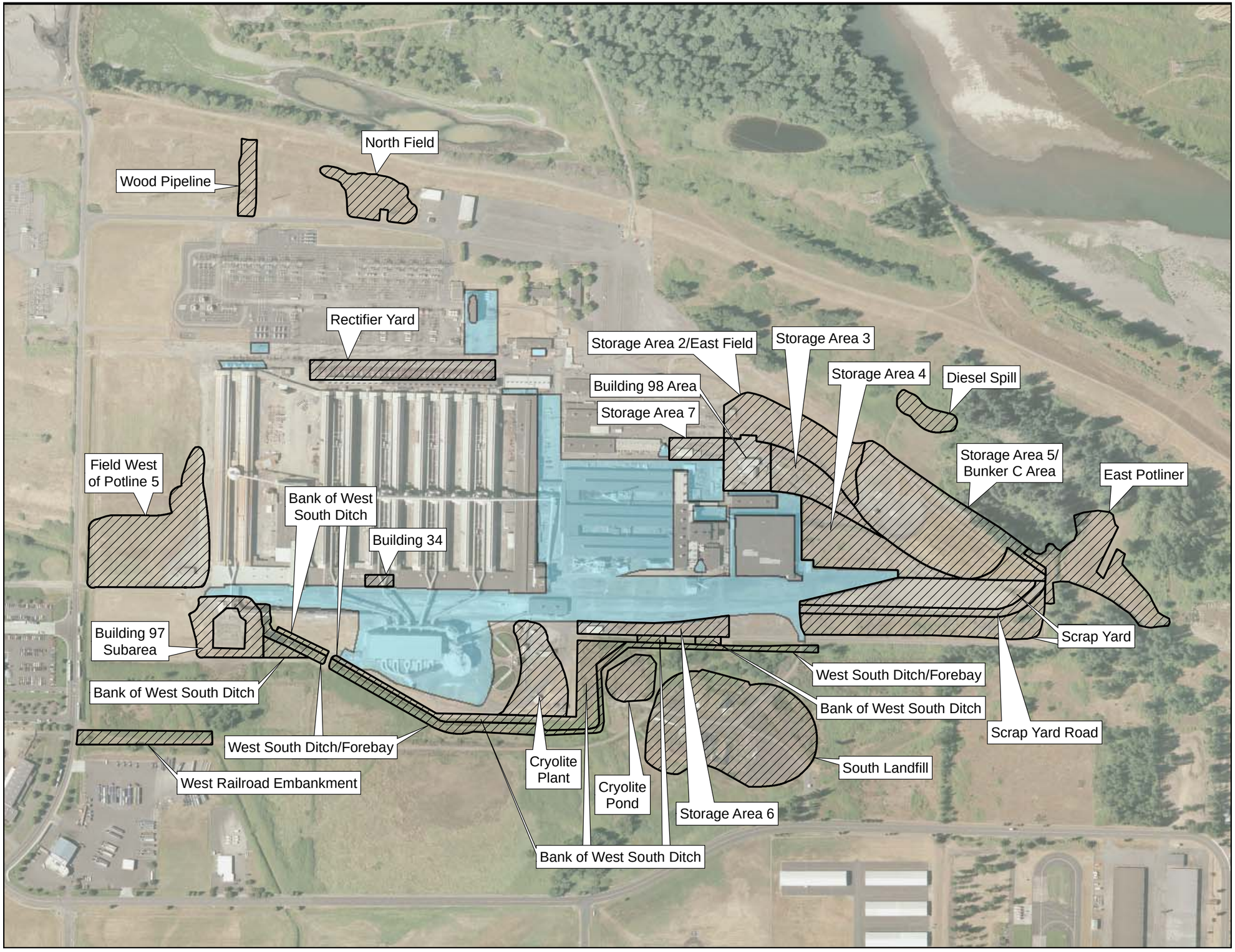


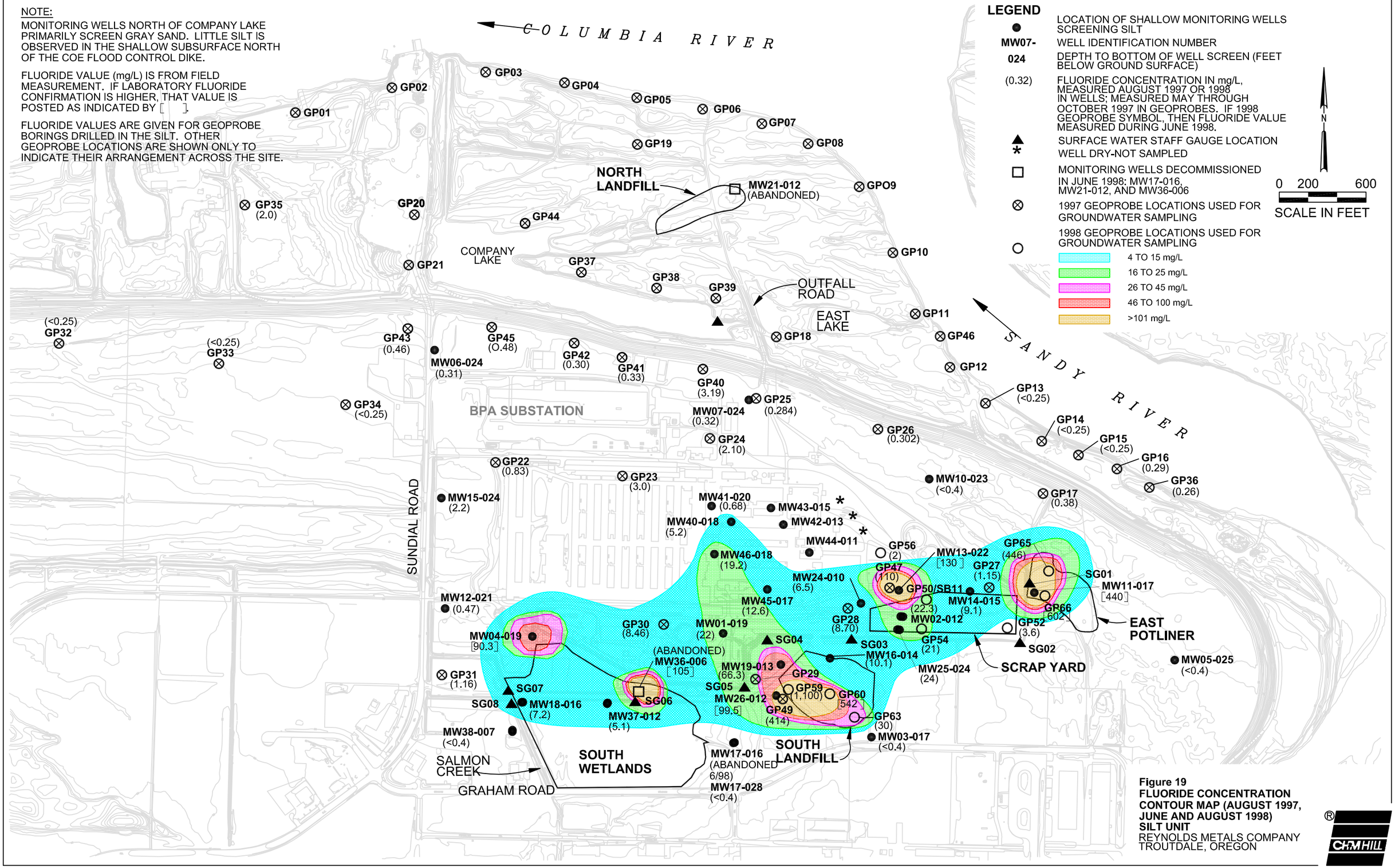
Figure 4 Shallow Silt Zone Fluoride Plume

NOTE:

MONITORING WELLS NORTH OF COMPANY LAKE PRIMARILY SCREEN GRAY SAND. LITTLE SILT IS OBSERVED IN THE SHALLOW SUBSURFACE NORTH OF THE COE FLOOD CONTROL DIKE.

FLUORIDE VALUE (mg/L) IS FROM FIELD MEASUREMENT. IF LABORATORY FLUORIDE CONFIRMATION IS HIGHER, THAT VALUE IS POSTED AS INDICATED BY [ ].

FLUORIDE VALUES ARE GIVEN FOR GEOPROBE BORINGS DRILLED IN THE SILT. OTHER GEOPROBE LOCATIONS ARE SHOWN ONLY TO INDICATE THEIR ARRANGEMENT ACROSS THE SITE.




**LEGEND**

- ● LOCATION OF SHALLOW MONITORING WELLS SCREENING SILT
- MW07-024 WELL IDENTIFICATION NUMBER
- (0.32) FLUORIDE CONCENTRATION IN mg/L, MEASURED AUGUST 1997 OR 1998 IN WELLS; MEASURED MAY THROUGH OCTOBER 1997 IN GEOPROBES. IF 1998 GEOPROBE SYMBOL, THEN FLUORIDE VALUE MEASURED DURING JUNE 1998.
- ▲ SURFACE WATER STAFF GAUGE LOCATION
- * WELL DRY-NOT SAMPLED
- □ MONITORING WELLS DECOMMISSIONED IN JUNE 1998: MW17-016, MW21-012, AND MW36-006
- ⊗ 1997 GEOPROBE LOCATIONS USED FOR GROUNDWATER SAMPLING
- ○ 1998 GEOPROBE LOCATIONS USED FOR GROUNDWATER SAMPLING
- 4 TO 15 mg/L
- 16 TO 25 mg/L
- 26 TO 45 mg/L
- 46 TO 100 mg/L
- >101 mg/L

N

0 200 600

SCALE IN FEET

**Figure 19**
**FLUORIDE CONCENTRATION CONTOUR MAP (AUGUST 1997, JUNE AND AUGUST 1998) SILT UNIT**
REYNOLDS METALS COMPANY
TROUTDALE, OREGON

CH2MHILL

PLOT DATE: 23-May-2006 FILENAME: \\Rosa\proj\REYNOLDS\39293\CD\COLOR6D-Fig 19.dwg

Fig. 5 - Upper Grey Sands Fluoride Plume -UGS

NOTE:
FLUORIDE VALUE (mg/L) IS FROM FIELD MEASUREMENT. IF LABORATORY FLUORIDE CONFIRMATION IS HIGHER, THAT VALUE IS POSTED AS INDICATED BY [ ].

FLUORIDE VALUES ARE GIVEN FOR GEOPROBE BORINGS DRILLED IN THE UPPER GRAY SAND. OTHER GEOPROBE LOCATIONS ARE SHOWN ONLY TO INDICATE THEIR ARRANGEMENT ACROSS THE SITE.

**LEGEND**

- LOCATION OF SHALLOW MONITORING WELLS SCREENING UPPER GRAY SAND
- MW08- WELL IDENTIFICATION NUMBER
- 027 DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
- (2.8) FLUORIDE CONCENTRATION IN mg/L, MEASURED AUGUST 1997 OR 1998 IN WELLS; MEASURED MAY - OCTOBER 1997 IN GEOPROBES; FOR 1998 GEOPROBE LOCATIONS FLUORIDE MEASURED DURING JUNE 1998.
- 1997 GEOPROBE LOCATIONS USED FOR GROUNDWATER SAMPLING
- 1998 GEOPROBE LOCATIONS USED FOR GROUNDWATER SAMPLING
- 4 TO 15 mg/L
- 16 TO 25 mg/L
- 26 TO 45 mg/L
- 46 TO 100 mg/L
- >101 mg/L

N

0 200 600

SCALE IN FEET

COLUMBIA RIVER

SANDY RIVER

GP02 (3.09)
GP01 (1.24)
GP03 (12.0)
MW52-045 (10.3)
MW08-027 (2.8)
GP04 (13.0)
GP05 (0.77)
GP06 (0.48)
GP07 (0.64)
GP08 (0.29)
GP19 (4.60)
MW30-030 (0.85)
MW27-045 (20.2)
NORTH LANDFILL
MW09-030 (31.50)
MW23-025 (9.1)
MW21-025 (12.1)
GP09 (0.35)
(18.60) GP20
GP35 (2.8)
(15.90) GP44
MW22-027 (13.6)
GP10 (0.27)
GP21 (12.40)
COMPANY LAKE
(21.40) GP37
MW20-026 (5.0)
(16.80) GP38
(24.50) GP39
OUTFALL ROAD
GP11 (4.36)
EAST LAKE
(<0.25) GP32
MW31-034 (<0.4)
GP43 (0.70)
(<0.25) GP33
MW06-022
GP45
GP42 (0.30)
GP41 (3.2)
GP18 (2.50)
MW53-034 (3.04)
GP46 (2.49)
GP12 (<0.25)
MW29-033 (0.54)
GP40 (9.45)
DIKE
MW07-024
GP25 (0.625)
GP34 (<0.25)
BPA SUBSTATION
GP13 (<0.25)
GP14 (<0.25)
GP15 (<0.25)
GP16 (0.39)
GP36 (0.3)
GP26 (0.207)
GP24 (O.66)
GP22 (0.35)
GP23 (0.30)
MW32-040 (0.84)
MW10-023
GP17 (0.39)
MW33-033 (0.25)
MW15-024
MW41-033 [0.59]
MW43-027 [9.2]
MW40-030 [1.4]
MW42-027 [22.0]
SUNDIAL ROAD
MW34-038 (35.4)
MW46-043 [0.84]
MW44-027 [3.1]
GP56 [131]
MW35-038 (<0.4)
GP65 [343]
MW24-010
GP50/SB11 (50.6)
GP27 (1.05)
GP66 [570]
MW45-042 [0.7]
GP28 (1.8)
MW12-021
MW02-012
MW02-034 (6.0)
GP47 (66)
EAST POTLINER
GP30 (1.06)
MW01-019
MW04-019
MW25-024
GP52 (<0.4)
MW25-035 (0.25)
GP54 (0.54)
MW16-014
MW05-025
SCRAPYARD
GP31 (0.256)
MW19-013
MW36-036
GP29
GP59 (61)
GP60 (2)
SOUTH LANDFILL
GP49 (0.51)
GP63 (1.6)
MW18-031
MW18-016 (0.34)
MW37-030
MW37-012 (0.33)
MW38-035
MW38-007 (<0.40)
SOUTH WETLANDS
MW17-016
MW17-028
MW03-017
GRAHAM ROAD

**Figure 20**
**FLUORIDE CONCENTRATION CONTOUR MAP (AUGUST 1997, JUNE AND AUGUST 1998) UPPER GRAY SAND**
REYNOLDS METALS COMPANY
TROUTDALE, OREGON

CH2MHILL

Fig. 6 - Intermediate Depth Fluoride Plume

NOTE:
INTERMEDIATE-DEPTH MONITORING WELLS ARE GENERALLY SCREENED IN GRAY UNCONSOLIDATED SAND 80 TO 100 FEET BELOW GROUND SURFACE.

FLUORIDE VALUE (mg/L) IS FROM FIELD MEASUREMENT. IF LABORATORY FLUORIDE CONFIRMATION IS HIGHER, THAT VALUE IS POSTED AS INDICATED BY [ ].

FLUORIDE VALUES ARE GIVEN FOR GEOPROBE BORINGS DRILLED IN INTERMEDIATE-DEPTH SAND. OTHER GEOPROBE LOCATIONS ARE SHOWN ONLY TO INDICATE THEIR ARRANGEMENT ACROSS THE SITE

* TO TARGET AN INTERVAL SUSPECTED OF BEING CONTAMINATED, MW08-127 WAS SCREENED APPROXIMATELY 50 FEET DEEPER THAN NEARBY INTERMEDIATE-DEPTH WELLS. THEREFORE, WATER LEVEL ELEVATIONS AND CONCENTRATIONS AT THIS LOCATION MAY NOT BE COMPARABLE WITH THOSE AT NEARBY LOCATIONS.

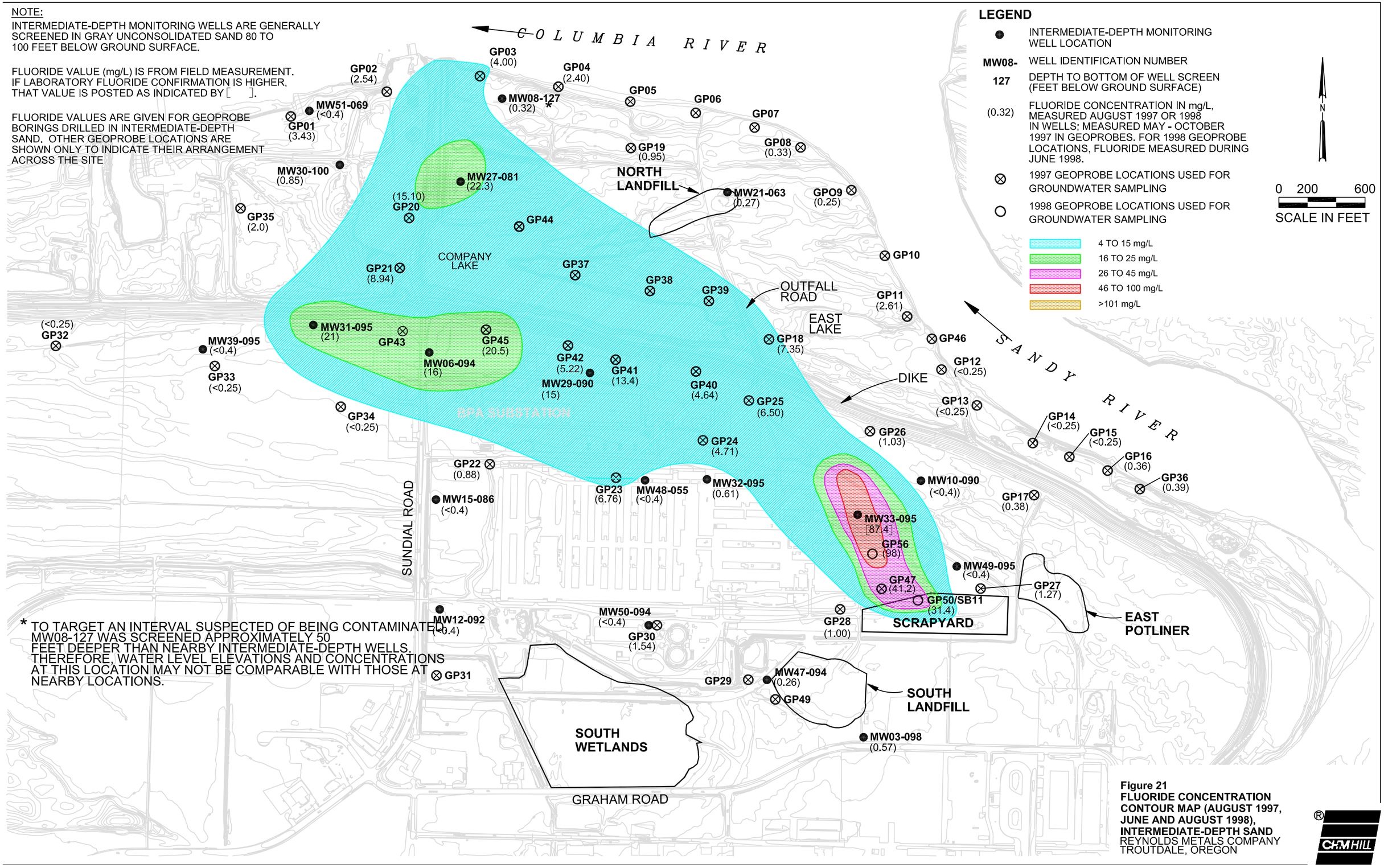



**Figure 21**
**FLUORIDE CONCENTRATION CONTOUR MAP (AUGUST 1997, JUNE AND AUGUST 1998), INTERMEDIATE-DEPTH SAND**
REYNOLDS METALS COMPANY
TROUTDALE, OREGON

CH2MHILL

Fig. 7 - FE/PWS Well Locations

COLUMBIA RIVER

SANDY RIVER

**LEGEND**

- ▲ PRODUCTION WELL LOCATION
- ● FOCUSED EXTRACTION WELL LOCATION
- PROPOSED NEW PIPING ALIGNMENT
- EXISTING 16" UNDERGROUND TRANSITE PIPING
- EXISTING 16" ABOVEGROUND HDPE PIPING
- (1) AC/TRANSITE PIPE CONNECT, SEE DWG C-6 FOR DETAILS
- (2) FOCUSED EXTRACTION WELL PUMP DISCHARGE PIPING, SEE DETAIL 3/C-5

GENERAL NOTE

1. EXISTING UNDERGROUND PIPING, NOT USED, SHALL BE DISPOSED OF OFF-SITE BY ALCOA DEMOLITION CONTRACTOR. EXISTING ABOVE GROUND PIPING AND APPURTENANCES, NOT USED, SHALL BE DISPOSED OF OFF-SITE, BY THIS CONTRACT.

FOR RESTRAINED JOINT REQUIREMENTS IN THIS AREA, SEE DWG C-4

RESTRAINED JOINTS
39° DEFLECTION
20'
4"
50'
8"
50'
NTS

8" PVC- ± 566'
TYPE 2 TRENCH
MULTIPLE
PIPE TRENCH
SECTION
DETAIL 4/C-5

12" PVC- ± 2765'
TYPE 2 TRENCH

FIELD ROUTE BETWEEN ROAD AND BPA FENCE LINE, MIN 10' FROM EITHER

PW05
PW03
PW08
PW07

SEE DWG C-3

8" PVC- ± 335'
TYPE 2 TRENCH
DETAIL 4/C-5

4" PVC- ± 1025'
TYPE 1 TRENCH
DETAIL 4/C-5

8" PVC- ± 118'
TYPE 2 TRENCH
DETAIL 4/C-5

4" PVC- ± 683'
TYPE 1 TRENCH
DETAIL 4/C-5

4" PVC- ± 290'
TYPE 1 TRENCH
DETAIL 4/C-5

FE02
FE03

RESTRAINED JOINTS
20'
20'
20'
NTS

RESTRAINED JOINTS
20'
20'
20'
±34.5° DEFLECTION
NTS

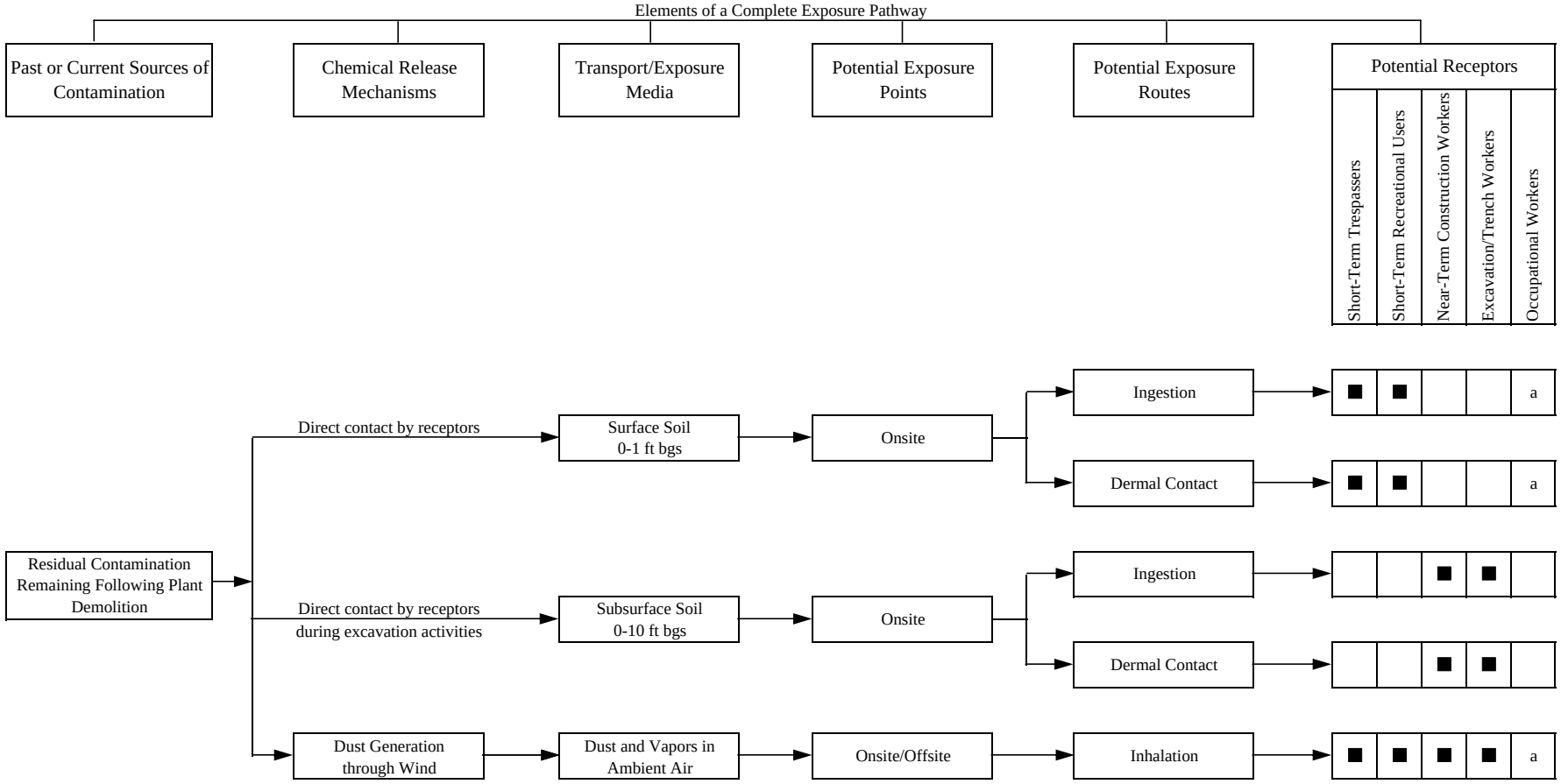
FE03
20'
±34.5° DEFLECTION
RESTRAINED JOINTS
NTS

N

0 500 1000

REGISTERED PROFESSIONAL ENGINEER
62607PE
OREGON
NOVEMBER 9, 1999
TIMOTHY G. YAMADA
EXPIRES: 6/30/2006

**Figure 8 Human Health**
**Conceptual Exposure Model**




■ = Potentially complete pathway
Blank = Incomplete pathway

a. Conceptual development of areas for planned industrial use include covering the areas with structural fill, railways, rail bed ballast (crushed rock), roadways, parking areas, structures, and/or landscaping as part of development. However, the occupational worker exposure scenario is included to demonstrate whether controls may be necessary to ensure acceptable risk.

## Table 6-1

## Designated Beneficial Uses
## Sandy Basin
## (340-41-0286)

| Beneficial Uses | Streams Forming Waterfalls Near Columbia River Highway | Sandy River | Bull Run River and all Tributaries | All Other Tributaries to Sandy River |
|---|---|---|---|---|
| Public Domestic Water Supply[1] | | X | X | X |
| Private Domestic Water Supply[1] | | X | | X |
| Industrial Water Supply | | X | | X |
| Irrigation | | X | | X |
| Livestock Watering | | X | | X |
| Fish & Aquatic Life[2] | X | X | X | X |
| Wildlife & Hunting | X | X | | X |
| Fishing | X | X | | X |
| Boating | | X | | X |
| Water Contact Recreation | X | X | | X |
| Aesthetic Quality | X | X | X | X |
| Hydro Power | | X | X | X |
| Commercial Navigation & Transportation | | | | |

[1] With adequate pretreatment (filtration & disinfection) and natural quality to meet drinking water standards.

[2] See also Figures 286A and 286B for fish use designations for this basin.

Table produced November, 2003

**Table 6-2**
**Special Status Species**

| Species | | Status | | |
|---|---|---|---|---|
| Common Name | Scientific Name | Federal[a] | State[b] | Occurrence[c] |
| **Plants** | | | | |
| Columbia Cress | *Rorippa columbiae* | s-o-c | S-c | Adjacent |
| **Amphibians** | | | | |
| Clouded salamander | *Aneides ferreus* | - | S-u | No habitat |
| Western Toad | *Bufo boreas* | - | S-v | ? |
| Northern red-legged frog | *Rana aurora aurora* | s-o-c | S-u | ? |
| **Reptiles** | | | | |
| Western painted turtle | *Chrysemys picta belli* | - | S-c | Adjacent |
| Northwestern pond turtle | *Clemmys marmorata marmorata* | s-o-c | S-c | Adjacent |
| **Birds** | | | | |
| Bald Eagle | *Haliaeetus leucocephalus* | FT | ST | Adjacent |
| American peregrine falcon | *Falco peregrinus anatum* | FE | SE | ? |
| **Mammals** | | | | |
| Yuma myotis | *Myotis yumaensis* | - | S-u | ? |
| Silver-haired bat | *Lasionycteris noctivagans* | - | S-u | ? |
| Western gray squirrel | *Sciurus griseus* | - | S-u | ? |

***Sources:*** *Oregon Natural Heritage Program (February 1995*
*Andrew Robinson, USFWS, (December 9, 1996)*

[a]*Federal Status Codes:* *FE = Endangered; FT = Threatened*
*s-o-c = Species of concern (informal category, not legally designated)*

[b]*State Status Codes:* *SE = Endangered; ST = Threatened; S-c = Sensitive (critical);*
*S-v = Sensitive (vulnerable); S-u = Sensitive (undetermined status)*

[c]*Occurrence codes:* *Adjacent = Observed within 2 miles of site, ? = Unknown status onsite*

## Table 7-1 Fairview Farms Area
## Chemicals of Potential Concern and Exposure Point Concentrations (EPC)
## Post-demolition residual surface soil levels

| Analyte | Number of Detects | Number of Samples | Minimum Detected Value | Maximum Detected Value | Arithmetic Mean | EPC |
|---|---|---|---|---|---|---|
| Aluminum | 36 | 36 | 1.17E+04 | 2.83E+04 | 1.89E+04 | 1.98E+04 |
| Anthracene | 7 | 44 | 1.00E-02 | 2.60E-01 | 1.36E-01 | 1.68E-01 |
| Aroclor-1260 | 2 | 6 | 1.20E-01 | 1.70E-01 | 8.17E-02 | 1.25E-01 |
| Barium | 39 | 39 | 5.97E+01 | 2.15E+02 | 1.42E+02 | 1.49E+02 |
| Benzo (a) anthracene | 20 | 42 | 3.00E-02 | 6.00E-01 | 2.17E-01 | 3.07E-01 |
| Benzo (a) pyrene | 13 | 42 | 4.00E-02 | 7.00E-01 | 2.00E-01 | 2.99E-01 |
| Benzo (b) fluoranthene | 19 | 42 | 5.00E-02 | 1.10E+00 | 2.76E-01 | 4.43E-01 |
| Benzo (k) fluoranthene | 16 | 44 | 2.00E-02 | 1.20E+00 | 2.04E-01 | 3.31E-01 |
| Beryllium | 36 | 42 | 5.40E-01 | 1.20E+00 | 6.76E-01 | 7.24E-01 |
| Bromomethane | 1 | 1 | 5.00E-03 | 5.00E-03 | 5.00E-03 | 5.00E-03 |
| Cadmium | 3 | 39 | 5.40E-01 | 1.12E+00 | 3.33E-01 | 4.04E-01 |
| Chromium | 39 | 39 | 1.35E+01 | 3.14E+01 | 2.30E+01 | 2.41E+01 |
| Chrysene | 22 | 43 | 4.00E-02 | 2.20E+00 | 3.00E-01 | 5.32E-01 |
| Cobalt | 38 | 38 | 6.10E+00 | 1.55E+01 | 9.72E+00 | 1.03E+01 |
| Copper | 38 | 38 | 2.46E+01 | 4.02E+01 | 3.25E+01 | 3.36E+01 |
| Cyanide, Total | 2 | 28 | 5.20E-01 | 2.10E+00 | 5.03E-01 | 7.84E-01 |
| Fluoranthene | 12 | 42 | 5.00E-02 | 7.00E-01 | 2.01E-01 | 2.41E-01 |
| Fluoride | 42 | 42 | 1.10E+01 | 6.20E+02 | 3.07E+02 | 3.83E+02 |
| Indeno (1,2,3-cd) pyrene | 10 | 44 | 8.00E-02 | 1.50E+00 | 2.18E-01 | 3.87E-01 |
| Lead | 42 | 42 | 8.50E+00 | 3.43E+01 | 1.94E+01 | 2.11E+01 |
| Manganese | 38 | 38 | 1.10E+02 | 7.58E+02 | 3.46E+02 | 3.88E+02 |
| Nickel | 38 | 38 | 1.18E+01 | 2.80E+01 | 1.97E+01 | 2.07E+01 |
| Pyrene | 16 | 42 | 5.00E-02 | 8.00E-01 | 2.30E-01 | 3.50E-01 |
| Selenium | 2 | 39 | 1.00E+00 | 1.10E+00 | 5.27E-01 | 5.63E-01 |
| Zinc | 38 | 38 | 3.79E+01 | 1.89E+02 | 7.81E+01 | 8.43E+01 |

Unit are mg/kg

## Table 7-2 Outside the Dike Area
## Chemicals of Potential Concern and Exposure Point Concentrations
## Post-Demolition residual surface soil levels

| Analyte | Number of Detects | Number of Samples | Minimum Detected Value | Maximum Detected Value | Arithmetic Mean | EPC |
|---|---|---|---|---|---|---|
| Acenaphthene | 20 | 83 | 1.90E-03 | 6.30E-01 | 6.06E-02 | 1.32E-01 |
| Aluminum | 17 | 17 | 9.26E+03 | 1.05E+05 | 2.04E+04 | 4.44E+04 |
| Anthracene | 39 | 85 | 8.50E-04 | 9.20E-01 | 7.54E-02 | 1.70E-01 |
| Aroclor-1260 | 1 | 10 | 8.90E-01 | 8.90E-01 | 4.43E-01 | 8.90E-01 |
| Aroclor-1268 | 2 | 8 | 1.20E+00 | 1.95E+00 | 7.62E-01 | 1.29E+00 |
| Arsenic | 20 | 22 | 9.00E-01 | 2.12E+01 | 3.47E+00 | 7.51E+00 |
| Barium | 19 | 19 | 3.68E+01 | 1.56E+02 | 7.37E+01 | 8.56E+01 |
| Benzo (a) anthracene | 58 | 84 | 1.60E-03 | 7.30E+00 | 4.25E-01 | 1.44E+00 |
| Benzo (a) pyrene | 49 | 84 | 3.89E-03 | 9.80E+00 | 5.47E-01 | 2.02E+00 |
| Benzo (b) fluoranthene | 53 | 84 | 1.40E-03 | 1.00E+01 | 7.35E-01 | 2.53E+00 |
| Benzo (k) fluoranthene | 48 | 84 | 1.30E-03 | 5.10E+00 | 3.80E-01 | 1.01E+00 |
| Benzoic Acid | 2 | 2 | 4.80E+00 | 5.30E+00 | 5.05E+00 | 5.30E+00 |
| Beryllium | 3 | 22 | 1.40E+00 | 9.20E+00 | 8.23E-01 | 2.60E+00 |
| Cadmium | 8 | 22 | 7.20E-01 | 2.10E+00 | 6.96E-01 | 1.27E+00 |
| Chromium | 22 | 22 | 8.44E+00 | 5.19E+01 | 2.02E+01 | 2.39E+01 |
| Chrysene | 61 | 84 | 5.94E-04 | 7.40E+00 | 6.08E-01 | 2.38E+00 |
| Cobalt | 14 | 14 | 6.43E+00 | 1.68E+01 | 1.01E+01 | 1.15E+01 |
| Copper | 22 | 22 | 1.65E+01 | 1.18E+03 | 1.11E+02 | 6.44E+02 |
| Cyanide, Total | 7 | 28 | 1.90E-01 | 1.37E+01 | 1.05E+00 | 5.83E+00 |
| Dibenzo (a,h) anthracene | 41 | 85 | 1.10E-03 | 1.50E+00 | 1.34E-01 | 3.05E-01 |
| Fluoranthene | 63 | 84 | 1.90E-03 | 8.30E+00 | 5.16E-01 | 1.53E+00 |
| Fluorene | 19 | 85 | 1.30E-03 | 3.60E-01 | 6.48E-02 | 1.43E-01 |
| Fluoride | 80 | 87 | 5.90E+00 | 9.50E+03 | 5.37E+02 | 1.21E+03 |
| Indeno (1,2,3-cd) pyrene | 47 | 84 | 1.40E-03 | 8.00E+00 | 3.94E-01 | 1.09E+00 |
| Lead | 21 | 22 | 5.40E+00 | 1.23E+02 | 2.00E+01 | 3.04E+01 |
| Manganese | 13 | 13 | 1.40E+02 | 4.47E+02 | 2.52E+02 | 2.94E+02 |
| Mercury | 4 | 22 | 1.00E-01 | 3.00E-01 | 1.26E-01 | 1.99E-01 |
| Naphthalene | 39 | 85 | 3.50E-04 | 1.20E-01 | 6.08E-02 | 1.20E-01 |
| Nickel | 22 | 22 | 1.12E+01 | 3.64E+02 | 3.96E+01 | 1.09E+02 |
| Polychlorinated Biphenyls (PCBs) | 2 | 16 | 1.30E+00 | 5.10E+00 | 5.25E-01 | 3.64E+00 |
| Pyrene | 66 | 82 | 1.51E-03 | 7.90E+00 | 4.70E-01 | 1.77E+00 |
| Vanadium | 19 | 19 | 4.16E+01 | 2.47E+02 | 6.56E+01 | 8.41E+01 |
| Zinc | 21 | 21 | 2.94E+01 | 2.02E+02 | 6.59E+01 | 1.08E+02 |

Units are mg/kg

## Table 7-3 South Wetlands Area
## Chemicals of Potential Concern and Exposure Point Concentrations
## Post-demolition residual surface soil levels

| Analyte | Number of Detects | Number of Samples | Minimum Detected Value | Maximum Detected Value | Arithmetic Mean | EPC |
|---|---|---|---|---|---|---|
| Acenaphthene | 6 | 27 | 1.00E-02 | 8.00E-01 | 2.24E-01 | 4.69E-01 |
| Aluminum | 30 | 30 | 9.34E+03 | 1.79E+05 | 4.87E+04 | 6.28E+04 |
| Anthracene | 6 | 27 | 2.00E-02 | 1.40E+00 | 2.66E-01 | 5.66E-01 |
| Antimony | 2 | 11 | 4.00E+00 | 4.00E+00 | 1.70E+00 | 3.21E+00 |
| Aroclor-1248 | 1 | 3 | 3.00E-02 | 3.00E-02 | 2.50E-02 | 3.00E-02 |
| Aroclor-1254 | 1 | 3 | 4.40E-01 | 4.40E-01 | 1.60E-01 | 4.40E-01 |
| Arsenic | 23 | 23 | 4.70E-01 | 3.18E+01 | 1.06E+01 | 1.53E+01 |
| Barium | 21 | 21 | 3.14E+01 | 1.67E+02 | 9.20E+01 | 1.03E+02 |
| Benzo(a)anthracene | 18 | 26 | 1.20E-01 | 6.10E+01 | 3.46E+00 | 2.67E+01 |
| Benzo(a)pyrene[a] | 12 | 26 | 1.50E-01 | 5.80E+01 | 3.36E+00 | 1.02E+01 |
| Benzo(b)fluoranthene | 20 | 26 | 1.90E-01 | 1.40E+02 | 7.99E+00 | 6.16E+01 |
| Benzo(k)fluoranthene | 15 | 26 | 7.00E-02 | 2.60E+01 | 1.62E+00 | 1.16E+01 |
| Beryllium | 12 | 23 | 5.20E-01 | 5.77E+00 | 1.32E+00 | 3.51E+00 |
| Cadmium | 5 | 21 | 5.30E-01 | 1.06E+01 | 8.31E-01 | 2.97E+00 |
| Chromium | 21 | 21 | 1.29E+01 | 1.73E+02 | 5.79E+01 | 8.03E+01 |
| Chrysene | 20 | 26 | 1.40E-01 | 1.80E+02 | 9.95E+00 | 7.80E+01 |
| Cobalt | 21 | 21 | 3.40E+00 | 6.97E+01 | 2.46E+01 | 3.59E+01 |
| Copper | 41 | 41 | 2.46E+01 | 1.01E+03 | 3.43E+02 | 4.43E+02 |
| Cyanide, Total | 17 | 22 | 1.00E-01 | 5.50E+01 | 8.50E+00 | 2.65E+01 |
| Dibenzo(a,h)anthracene | 8 | 27 | 4.00E-02 | 1.50E+01 | 9.61E-01 | 6.62E+00 |
| Fluoranthene | 20 | 26 | 1.90E-01 | 4.40E+02 | 1.99E+01 | 1.87E+02 |
| Fluorene | 6 | 27 | 7.30E-03 | 5.00E-01 | 1.98E-01 | 4.28E-01 |
| Fluoride | 43 | 47 | 3.20E+02 | 3.50E+04 | 7.65E+03 | 2.04E+04 |
| Indeno(1,2,3-cd)pyrene | 10 | 26 | 1.60E-01 | 4.20E+01 | 2.66E+00 | 1.96E+01 |
| Lead | 23 | 23 | 2.10E+00 | 2.59E+02 | 4.65E+01 | 6.88E+01 |
| Mercury | 19 | 34 | 2.10E-01 | 3.16E+00 | 6.37E-01 | 1.92E+00 |
| Naphthalene | 4 | 27 | 6.10E-03 | 4.00E-01 | 1.86E-01 | 4.00E-01 |
| Nickel | 21 | 21 | 1.52E+01 | 3.24E+03 | 9.47E+02 | 1.65E+03 |
| Polychlorinated Biphenyls (PCBs) | 33 | 41 | 3.00E-01 | 1.10E+01 | 3.07E+00 | 4.19E+00 |
| Pyrene | 19 | 26 | 1.30E-01 | 4.00E+02 | 1.76E+01 | 1.70E+02 |
| Selenium | 8 | 21 | 1.20E+00 | 1.22E+01 | 2.44E+00 | 9.85E+00 |
| Silver | 8 | 21 | 1.00E+00 | 3.79E+00 | 9.80E-01 | 1.75E+00 |
| Thallium | 1 | 21 | 1.30E+00 | 1.30E+00 | 5.38E-01 | 6.10E-01 |
| Vanadium | 42 | 42 | 4.32E+01 | 2.26E+03 | 5.49E+02 | 7.39E+02 |
| Zinc | 21 | 21 | 3.64E+01 | 2.74E+02 | 7.63E+01 | 9.38E+01 |

Units are mg/kg

## Table 7-4 East Area
## Chemicals of Potential Concern and Exposure point concentrations
## Post-demolition residual surface soil levels

| Analyte | Number of Detects | Number of Samples | Minimum Detected Value | Maximum Detected Value | Arithmetic Mean | EPC |
|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 1 | 14 | 8.40E-04 | 8.40E-04 | 3.44E-03 | 8.40E-04 |
| 1,4-Dichlorobenzene | 1 | 15 | 5.00E+00 | 5.00E+00 | 3.69E-01 | 3.68E+00 |
| 2-Methylnaphthalene | 2 | 26 | 5.80E-03 | 8.00E-02 | 2.01E-01 | 8.00E-02 |
| Acenaphthene | 74 | 209 | 4.80E-04 | 1.00E+00 | 7.27E-02 | 1.33E-01 |
| Acetone | 2 | 8 | 1.19E-03 | 4.00E-02 | 6.72E-03 | 4.00E-02 |
| Aluminum | 69 | 69 | 2.95E+03 | 5.63E+04 | 1.15E+04 | 1.30E+04 |
| Anthracene | 89 | 209 | 6.40E-04 | 2.30E+00 | 1.11E-01 | 2.91E-01 |
| Aroclor-1248 | 14 | 106 | 4.00E-02 | 2.06E+00 | 5.92E-02 | 7.92E-01 |
| Aroclor-1268 | 44 | 97 | 4.30E-03 | 3.10E+00 | 2.09E-01 | 5.29E-01 |
| Arsenic[a] | 83 | 142 | 3.20E-01 | 1.98E+01 | 2.84E+00 | 3.75E+00 |
| Barium | 84 | 84 | 9.92E+00 | 8.42E+02 | 6.03E+01 | 6.46E+01 |
| Benzo(a)anthracene | 165 | 234 | 6.10E-04 | 1.00E+01 | 6.80E-01 | #N/A |
| Benzo(a)pyrene[a] | 168 | 234 | 7.00E-04 | 1.40E+01 | 7.95E-01 | 1.32E+00 |
| Benzo(b)fluoranthene | 169 | 234 | 9.90E-04 | 1.70E+01 | 1.15E+00 | #N/A |
| Benzo(k)fluoranthene[a] | 158 | 236 | 4.80E-04 | 7.97E+00 | 4.85E-01 | 7.53E-01 |
| Beryllium | 49 | 127 | 1.10E-01 | 1.12E+01 | 5.44E-01 | 9.46E-01 |
| Bromomethane | 5 | 21 | 1.60E-03 | 2.30E-03 | 1.96E-03 | 2.30E-03 |
| Cadmium | 13 | 84 | 1.20E-01 | 5.21E+00 | 6.73E-01 | 1.12E+00 |
| Chromium | 84 | 84 | 2.90E+00 | 1.30E+02 | 1.38E+01 | 2.14E+01 |
| Chrysene | 163 | 234 | 1.10E-03 | 1.30E+01 | 9.24E-01 | 2.40E+00 |
| Cobalt | 9 | 13 | 3.40E+00 | 2.30E+01 | 7.66E+00 | 1.21E+01 |
| Copper | 59 | 59 | 5.71E+00 | 4.90E+02 | 3.82E+01 | 8.25E+01 |
| Cyanide, Total | 86 | 159 | 3.50E-02 | 4.10E+02 | 5.29E+00 | 2.21E+01 |
| Dibenzo(a,h)anthracene[a] | 149 | 236 | 1.00E-03 | 2.60E+00 | 1.87E-01 | 2.80E-01 |
| Dibenzofuran | 3 | 23 | 7.50E-03 | 4.10E-01 | 1.99E-01 | 4.10E-01 |
| Fluoranthene | 144 | 207 | 8.20E-04 | 1.50E+01 | 7.41E-01 | 2.25E+00 |
| Fluorene | 57 | 209 | 5.70E-04 | 7.60E-01 | 5.97E-02 | 1.07E-01 |
| Fluoride | 189 | 240 | 6.80E+00 | 2.10E+04 | 6.61E+02 | 1.32E+03 |
| Indeno(1,2,3-cd)pyrene | 164 | 235 | 1.50E-03 | 1.20E+01 | 6.30E-01 | #N/A |
| Lead | 81 | 130 | 6.20E-01 | 3.38E+02 | 2.27E+01 | 4.96E+01 |
| Manganese | 43 | 43 | 5.40E+01 | 1.58E+03 | 1.86E+02 | 3.44E+02 |
| Mercury | 24 | 129 | 2.00E-02 | 3.79E+00 | 1.36E-01 | 3.34E-01 |
| Methylene Chloride | 3 | 21 | 1.04E-03 | 3.70E-03 | 2.81E-03 | 3.70E-03 |
| Naphthalene | 46 | 209 | 2.40E-04 | 5.50E-01 | 4.44E-02 | 7.94E-02 |
| Nickel | 73 | 74 | 2.50E+00 | 1.90E+02 | 1.40E+01 | 1.52E+01 |
| Pyrene | 138 | 207 | 1.10E-03 | 1.30E+01 | 7.11E-01 | 2.12E+00 |
| Vanadium | 13 | 13 | 1.77E+01 | 1.40E+02 | 5.19E+01 | 6.87E+01 |
| Zinc | 59 | 59 | 1.11E+01 | 2.74E+02 | 5.22E+01 | 9.88E+01 |

Units are mg/kg

**Table 12-1**
**Groundwater COC's and MCL's (ug/l)**

| **Inorganics** | | **Volatile Organics** | |
|---|---|---|---|
| Arsenic | 50 | 1,1-DCE | 7 |
| Beryllium | 4 | PCE | 5 |
| Chromium | 100 | | |
| Cyanide | 200 | | |
| Fluoride | 4,000 | | |
| Lead | 15[a] | | |

[a]Action level

**Table 12-2**
**Relevant and Appropriate Water Quality Criteia (µ/L)**

| | **Freshwater Aquatic Life** | | **Human Health Consumption** | |
|---|---|---|---|---|
| **Constituent** | **Acute CMC** | **Chronic CCC** | **Water and Organism** | **Organism** |
| Arsenic | 340 | 150 | $0.0022_s$ | $0.0175_s$ |
| Beryllium | - | - | $6{,}800_c$ | $117{,}000_c$ |
| Chromium | $570_t/16_h$ | $74_t/11_h$ | $50_{hs}$ | - |
| Cyanide | 22 | 5.2 | $200_s$ | 220,000 |
| Fluoride | - | - | - | - |
| Lead | 65 | 2.5 | - | - |
| Nickel | 470 | 52 | $13.4_s$ | $100_s$ |
| 11-DCE | - | - | $0.057_c$ | $3.2_c$ |
| PCE | - | - | $0.8_c$ | $8.85_c$ |

- = Not established
c = Based on carcinogenity of $10^{-6}$ risk
h = hexavalent
p = pentavalent
s = state water quality criteria that is more stringent than federal
t = trivalent

Notes:

- For complete qualifying information for values, see national Recommended Water Quality Criteria Correction, EPA document 822-Z-99-001, April 1999.
- Nickel values are hardness dependent, 100 mg/L hardness used