Frontier Hard Chrome
Institutional Control Plan
Work Assignment Number: 153-RARA-1027

EPA Region V

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Response Action Contract

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INSTITUTIONAL CONTROLS PLAN
FRONTIER HARD CHROME
Vancouver, Washington

Prepared for
U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101

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FRONTIER HARD CHROME
INSTITUTIONAL CONTROL PLAN
VANCOUVER, WASHINGTON

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REVISION 2—19 DECEMBER 2003

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LIST OF ACRONYMS

Acronym	Definition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CCHD	Clark County Health Department
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FFS	Focused Feasibility Study
FHC	Frontier Hard Chrome Superfund Site
ISRM	In-Situ Redox Manipulation
MSL	Mean Sea Level
MTCA	Model Toxics Control Act
PCB	Polychlorinated Biphenyls
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
VOC	Volatile Organic Carbon
VMC	Vancouver Municipal Code
WAC	Washington Administrative Code

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SECTION 1

INTRODUCTION

1.1 PURPOSE

The purpose of this plan is to provide a comprehensive approach to limiting human exposure to contaminants from the Frontier Hard Chrome Superfund site (FHC) through implementation of institutional controls until the principal threat has been eliminated.

This institutional controls plan provides a summary of site conditions and potential risks as they pertain to human health. This plan also provides a summary of the potential receptors and lists institutional controls that are suggested for implementation.

1.2 NEED

The initial Record of Decision (ROD) for FHC (EPA 1987, 1988) called for institutional controls as part of the preferred remedy for this site. Recently, a final focused feasibility study (FFS; URS Greiner 2000) was completed to re-evaluate the selected remedy given current conditions at this site. Based on the final FFS, EPA completed a ROD Amendment on August 31, 2001 (EPA 2001) addressing both the groundwater and soil at the site. The preferred remedy called for the reduction of hexavalent chromium in soil and groundwater to trivalent chromium. The ROD also recommended institutional controls be implemented as part of the preferred remedy.

The onsite soil and groundwater underwent a remedial action that was completed in September 2003. Soil and groundwater in the source area was treated to reduce the hexavalent chromium concentration to non-detectable levels. However, onsite groundwater that was outside the hot spot source area boundary, and offsite groundwater likely contain chromium at concentrations above drinking water standards (50 ug/L).

Onsite soil contains elevated levels (i.e., above background) of trivalent chromium. Concentrations of trivalent chromium may be as high as 2,000 mg/kg based on concentrations of total chromium found during the remedial action.

This institutional controls plan covers potential exposure to contaminants that appear to have originated from FHC. These contaminants predominantly consist of metals originating from plating processes.

1.3 SITE LOCATION

The FHC site is located in the southeastern portion of Vancouver, Washington **(Figure 1-1**). The facility address is 113 “Y” Street, Vancouver, Washington. The site is located in the

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Section 25, Township 2 north, Range 1 east, Willamette Meridian in Clark County, Washington. The location in latitude and longitude coordinates is 45 degrees, 37 minutes, 19 seconds north by 122 degrees, 38 minutes 45 seconds east (Degrees, Minutes, Seconds [DMS]). The site was previously occupied by several metals fabricating businesses and was used for storage and as a staging area for a neighboring business. Currently, no buildings exist on the site and the site is vacant.

The FHC site is located on a former floodplain of the Columbia River at an elevation of approximately 30 feet above mean sea level (MSL), about 0.5 mile north of the north bank of the river. A short distance north of the site (north of 5th Street), a bluff rises to an elevation of approximately 160 feet. The FHC site covers approximately 0.5 acre and is bordered to the east by Grand Avenue, to the south by Cassidy Manufacturing, and to the west by "Y" Street.

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SECTION 2

BACKGROUND

2.1 SITE HISTORY

The FHC site derives its name from a company that operated a chrome plating operation at the site from 1970 until 1983. The FHC site was the location of chrome plate operations for approximately 25 years between 1958 and 1983. Activities began at the site in 1955, when the site was filled with hydraulic dredge material and construction rubble. The site was occupied by two businesses engaged in chrome plating. Pioneer Plating operated at the site from 1958 to 1970. The business was taken over by FHC and operated until 1983.

FHC's activities consisted of hard chrome plating during most of its years of operation. For a period of about 1 year, from about 1981-82, FHC also performed electrode-less nickel plating. FHC operated twelve tanks in its hard chrome plating operation. Of these, eleven were chromium plating baths and one was a stripping bath. Typical composition of the chromium baths is presented below:

Chromium (hexavalent):	28-32 oz/gal (210,000-240,000 mg/L)
SO_4:	2.8-3.2 oz/gal (21,000-24,000 mg/L)
pH:	0.5-1.0

In addition to these constituents, the plating baths contained variable amounts of dissolved metals and other contaminants from the metal pieces being plated, including iron, nickel, and chromium (trivalent). Total volume of the eleven chromium baths was estimated at 10,000 gallons. The stripping bath, which contained hydrochloric acid and contaminants picked up from the metal pieces, contained approximately 150 gallons.

Until about 1977-78, a major component of wastewater from the chromium plating operation consisted of water used to wash down the wet fume scrubbers located over the plating tanks. Dragout from the plating tanks (i.e., solutions carried from the baths when the metal was removed) and water associated with cleanup and other operations resulted in a wastewater flow of about 4,000 gallons per day. After about 1978, the wet fume scrubbers were replaced with dry scrubbers; wastewater flow then decreased to an average of about 1,000 gallons per day.

During the operation of Pioneer Plating, chromium plating wastes were discharged to the sanitary sewer system.

FHC discharged untreated process wastewater containing hexavalent chromium and other heavy metals from its plating process directly to the City of Vancouver sewage collection system until 1976. In November 1975, the city developed stricter discharge requirements because metals in the wastewater were destroying desirable bacteria in the City's secondary sewage treatment plant. FHC was asked by the city and the Washington State Department of Ecology (Ecology) to

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cease discharge to the sewer system until a treatment system was installed to remove chromium from their waste.

In June 1976, FHC modified its disposal system by redirecting untreated chromium-contaminated wastewater to an on-site "dry well" and routing cooling water to the unfilled area east of the FHC building. It is thought that process wastewater from the facility was routed to a sump immediately adjacent to the building and then (via a PVC line 2 feet below ground) to the dry well for disposal. On occasion, the dry well is reported to have been overflowing wastewater into the surrounding area. Discharge into the dry well continued for the next 7 years, until FHC terminated its operations in January 1983.

Ecology apparently gave FHC a wastewater disposal permit for discharge to the dry well in 1976. The permit also contained a schedule for the installation of a treatment system for its wastes. Between 1976 and 1981, several extensions of the permit and schedule were granted, as the deadlines passed without compliance.

In 1982, Ecology found FHC in violation of Washington State Dangerous Waste Act for illegal disposal of hazardous wastes. About this time it was discovered that an industrial supply well about one-quarter mile southwest of FHC was contaminated with chromium at more than twice the drinking water standard of 0.05 mg/L (CH2M Hill 1983). FHC again did not comply with the permit requirements for economic reasons. Shortly afterwards FHC went out of business. In December 1982, the FHC site was proposed for inclusion on the National Priorities List under Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA or Superfund). The listing was finalized in September 1983.

In March 1983, EPA and Ecology signed a Cooperative Agreement that gave Ecology the lead in investigating the FHC site under Superfund. Ecology retained Dames & Moore to conduct a remedial investigation (RI) at the site (Dames & Moore 1987). The RI eventually led to a feasibility study (FS) to determine the most cost-effective remedial action for the site (Dames & Moore and Bovay Northwest 1987). The FS was completed in October 1987.

EPA and Ecology divided the work at the site into two operable units, a source control/soils unit and a contaminated groundwater unit. A remedial investigation/feasibility study (RI/FS) was completed for both soil and groundwater. The EPA issued separate RODs for each of these media. The soil and groundwater RODs were issued in December 1987 and July 1988, respectively.

The soil ROD recommended stabilization as the preferred remedy. Groundwater was to be remedied by a pump-and-treat system. Both RODs had institutional controls as part of the remedy.

Several studies were completed after the RODs were issued to define design parameters for the selected remedies. Data from these studies indicated that the selected remedies for soil and groundwater should be re-evaluated since groundwater concentrations were decreasing naturally and stabilization of soil contaminants did not provide the effectiveness desired.

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EPA initiated preparation of a focused feasibility study (FFS) for soil and groundwater to update the remedy selection for FHC. The FFS was completed in July 2000. Based on the final FFS, EPA completed a ROD Amendment in August 2001 addressing both the groundwater and soil at the site. The preferred remedy called for the reduction of hexavalent chromium in soil and groundwater to trivalent chromium. The ROD also recommended institutional controls be implemented as part of the preferred remedy.

Work began on the remedial design in October 2001. The remedial design was completed in February 2003. The remedial action, consisting of building demolition, treatment of source area soil and groundwater, and installation of an in-situ treatment wall (to treat hexavalent chromium), was completed in September 2003. Monitoring of site groundwater began in October 2003. Monitoring of offsite groundwater downgradient of the treated areas is anticipated to begin the first quarter of 2004.

2.2 GEOLOGY

The FHC site is located in the northern part of the Portland Basin a sediment-filled structural basin located in northwestern Oregon and southwestern Washington. Older Eocene to Miocene volcanic and sedimentary rocks underlie the basin. The basin is filled with consolidated and unconsolidated non-marine sedimentary rocks containing important water-bearing units.

Five geologic units underlie the FHC site. The youngest unit is the fill unit, which consists of hydraulic fill and construction debris emplaced prior to development of the site. The fill unit was placed on fine-grained Holocene alluvium, which is underlain by glacial flood deposits of Pleistocene age.

Fill materials consist of both hydraulic fill (silt and sand) and construction fill. The hydraulic fill materials consist of generally fine-grained sand, with silty sand near the surface and sand at depth. Construction fill has also been placed at portions of the site beginning in the 1960s. The construction fill consists of concrete debris, asphaltic debris, red bricks, metal (iron chips), silt, sand, gravel, and minor clay. A contact between the hydraulic dredge fill and the construction fill is probably located beneath the former FHC building. Approximately 12 to 20 feet of fill is present in the area of the FHC site.

Underlying the fill unit is the clayey silt unit, also known as the upper aquitard. The unit is typically 3 to 7 feet thick, but thins to the north and is absent along the northern margin of the floodplain.

Underlying the clayey silt unit is the alluvial unit that generally consists of poorly sorted sandy gravels, silty sandy gravels, and sandy silts. The deposits of coarse sandy gravel to gravely sand are interpreted to result from channel deposition that resulted in a higher degree of particle sorting than the associated overbank deposits. These deposits are characterized by a lower silt content and increased permeability.

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In the general site area, a 1- to 5-foot-thick semicontinuous layer of very dense sandy silt to silty sand with lesser clay and gravel is present at approximately -3 to -7.5 feet MSL. This fine-grained unit is important because this deposit may act as the "lower aquitard" to locally separate the upper portion of the alluvial unit into "A" and "B" zones.

2.3 HYDROGEOLOGY

Shallow groundwater in the FHC area occurs within a complex, heterogeneous alluvial aquifer system that is hydraulically connected to the Columbia River. In general, the alluvial aquifer system exhibits both quasi-confined and confined characteristics. This semiconfined condition is due, in part, to a low-permeability clayey silt unit that directly overlies the alluvial aquifer and to permeability contrasts within the alluvial aquifer.

The site hydrogeology consists of 15 to 20 feet of random fill and silty sand, which is largely unsaturated, a 5-foot-thick upper confining bed of clayey silt, and a heterogeneous anisotropic alluvial aquifer system that may be as thick as 70 feet beneath the site. Localized zones of perched groundwater are present above the top of the clayey silt within the fill materials. **Figure 2-1** is a conceptual diagram of the general hydrostratigraphy inferred to be locally present in the FHC site area.

The uppermost hydrogeologic unit consists of perched groundwater in the fill unit. The fill unit is generally unsaturated, but locally perched water is present. The dry well used to discharge chrome-contaminated wastewater was open at the base of the fill unit. Groundwater in the perched aquifer is generally recharged from precipitation by direct infiltration and stormwater dry wells and roof drains. Separating the fill unit from the alluvial unit is the 1- to 5-foot-thick confining unit.

Underlying the clayey silt unit is the alluvial aquifer. The alluvial aquifer is a sand and gravel layer beginning 15 to 20 feet below ground surface (bgs). The upper portion of the alluvial unit has been subdivided into two water-bearing zones based on the apparent presence of a discontinuous silty sand or sandy silt zone present at depth of 25 to 35 feet bgs. The upper zone has been referred to as the "A" zone or "A" aquifer, and the lower zone was designated as the "B" zone or "B" aquifer. The hydraulic significance of this lower aquitard unit has been overstated. The silt zone, when present, is generally from 1 to 3 feet thick and appears to be discontinuous. The silt zone, recognized by a increase in drilling resistance and little or no groundwater entering the drill casing as the boring encountered this unit, was rarely sampled either because it is relatively thin or because of the wide sampling interval used. Although this layer may be a local confining unit, the preponderance of evidence suggests that this unit does not act as a hydraulic barrier within the alluvial aquifer. "A" level wells were completed in the upper 10 to 15 feet of the alluvial aquifer; "B" level wells were completed in a zone in the alluvial aquifer 35 to 50 feet bgs.

The potentiometric surface is generally almost flat across the inactive floodplain on which the FHC site is located. In general, recharge to the aquifer system occurs along the northern margin

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of the floodplain from another hydraulically connected alluvial aquifer. Recharge also occurs from incident precipitation of the floodplain, which is flat and poorly drained. Groundwater discharges to the Columbia River; however, fluctuations in river stage exert a strong influence on water levels and the hydraulic gradients within the alluvial aquifer system.

Representative water levels in "A" and "B" zone wells during 1997 are presented in **Figures 2-2 and 2-3**, respectively. Groundwater flow at that time was approximately 0.5 to 5 feet per day towards the river. The hydraulic gradient averaged 0.00015 ft/ft. A more recent groundwater study completed in 2003 (EPA 2003a) determined that the hydraulic gradient averaged 0.000022 ft/ft with a groundwater flow of approximately 0.1 to 1 foot per day towards the river.

The alluvial aquifer is hydraulically connected to the Columbia River and groundwater levels in the alluvial aquifer appear to be primarily controlled by the stage of the Columbia River. During high river stages, groundwater flow away from the river has been recorded. There is no distinct vertical gradient between the "A" and "B" level wells.

The hydraulic conductivity of the alluvial aquifer ranges from 1×10^{-3} to 1×10^{-1} cm/sec averaging 5×10^{-1} cm/sec as measured by slug tests, grain size analysis, and pumping tests.

2.4 PRE-REMEDIAL ACTION: NATURE AND EXTENT OF CONTAMINATION

A series of soil borings and monitoring wells were installed on the site to characterize contamination. **Figure 2-4** shows the locations of these borings and wells. Additional soil and groundwater samples were collected in 1999. Locations of these samples are shown on **Figure 2-5.**

Samples of surface and subsurface soil, surface water, and groundwater from the FHC site have been analyzed for organic and inorganic contamination. The results of these studies indicate that elevated concentrations of chromium exists in soil and groundwater.

2.4.1 Surface Soil

Surface soil samples (0 to 0.5 foot bgs) were collected from 86 locations as part of the RI (Dames and Moore 1987). Surface soil locations are shown in **Figure 2-6**.

In surface soil, total chromium was found in concentrations from less than 2 mg/kg to 5,200 mg/kg. Three samples were analyzed for soil hexavalent chromium and the results ranged from less than 0.5 mg/kg to 10 mg/kg. The highest surface soil concentrations of chromium occur near the dry well. In addition, an area directly north of the FHC building and another area at the east edge of the site had elevated levels of total chromium.

Seven surface soil samples were analyzed using the EP Toxicity procedure. The seven samples had a range of 25 mg/kg to 5,200 mg/kg of total chromium, but only the sample with 5,200 mg/kg chromium yielded an EP Toxicity extract concentration above the detection limit with a concentration of 0.2 mg/L.

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2.4.2 Subsurface Soil

In total, 240 subsurface soil samples (0.5 to 46 feet bgs) were collected from 49 boreholes both inside and outside the FHC building at the site as part of the RI (Dames and Moore 1987) and remedial design (RD) studies (Radian 1991; ICF Technology 1993).

Chromium was found throughout the site in subsurface soil. Total chromium concentrations up to 17,000 mg/kg were found in the subsurface area around the dry well. Hexavalent chromium concentrations as high as 7,500 mg/kg were found under the FHC building. Generally, the maximum chromium concentrations in soil borings across the site occurred near the fill/clay interface that is present at depths of 15 to 20 feet below grade.

Chrome concentrations in subsurface soil are shown in **Figures 2-7, 2-8, 2-9 and 2-10**.

2.4.3 Surface Water

Three surface water samples were collected during the RI (Dames and Moore 1987) from surface water puddles. Chromium was detected in all surface samples at concentrations ranging from 0.01 to 0.9 mg/L.

2.4.4 Groundwater

2.4.4.1 "On-Site" Wells

Groundwater samples were collected from 40 on-site monitoring wells installed within the study area. Groundwater samples were analyzed for metals, volatile organic compounds (VOCs), pesticides, polychlorinated biphenyls (PCBs) and conventional water quality parameters.

Four groundwater sampling events were conducted during the RI. Since the RI, several additional groundwater sampling events have occurred over the years. The most recent site-wide well sampling occurred in February 1999 (Weston 1999). Geoprobe groundwater sampling was also performed in August 1999 (URS Greiner 1999). Finally, another round of Geoprobe sampling was completed in 2002 during pilot scale testing of the In-Situ Redox Manipulation (ISRM) technology (Weston 2003). The spatial distribution of chromium from these groundwater sampling events (prior to the remedial action) is shown in **Figures 2-11, 2-12, 2-13 and 2-14**.

The initial results of the RI showed that groundwater beneath the site contained elevated concentrations of total and hexavalent chromium and that the chromium had spread beyond the boundaries of the site to the southwest. The highest concentration of total chromium detected was 300 mg/L (300,000 µg/L). Total chromium concentrations have generally declined since 1985. The highest concentration of total chromium detected in the 1999 Geoprobe sampling event was 48.7 mg/L (48,700 µg/L) in a Geoprobe located east of the Frontier Hardchrome Building. This is similar to the maximum hexavalent chromium concentration of 55.0 mg/L (55,000 µg/L) detected south of the Richardson Metals Building. The steady reduction of

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chromium concentrations suggests that significant attenuation of chromium concentrations by adsorption, dispersion, and dilution has occurred at the site.

The 1997 sample results indicate that the hexavalent chromium concentrations average 97 percent of the total chromium concentrations. These results indicate little difference between the hexavalent and total chromium values and that essentially all of the chromium present in groundwater is in the hexavalent form. This is consistent with expected results since the only other form of chromium, trivalent Cr(III), is only very slightly soluble in water at ambient pH levels.

2.4.4.2 "Off-Site" Wells

Two City of Vancouver well stations are located in the vicinity of the FHC site. Well Station No. 4, the source of water for more than 10,000 people in the area, is located 1 mile east of the site. Well Station No. 1 is approximately 1 mile north of the site (CH2M Hill 1983). Off-site well locations are shown on **Figures 2-15 and 2-16**.

Water samples were collected from several off-site wells, including monitoring wells, irrigation wells, and public water supply wells. Water samples were collected from the monitoring wells located at the Cascade Tempering property (AGI-1 and AGI-3). Water samples were collected from the irrigation well at the track of the Washington School for the Deaf. In total, seven samples were collected from potable water sources in the vicinity of FHC from off-site wells including a drinking fountain at Cox Cable; a water faucet, drinking fountain and bathroom faucet at Richardson Metal, and water faucet at shed on the FHC site. Temperature, pH, and specific conductivity were also measured at each location.

Groundwater samples were obtained from seven wells including Fort Vancouver National Historical Site well, City of Vancouver Well Field No. 4 (three wells), Washington School for the Deaf (one well), and Cascade Tempering (two wells).

Total and hexavalent chromium concentrations were not detected in the potable water samples except for dissolved total chromium in one sample (drinking fountain at Richardson Metal). Chromium was not detected when this source was resampled.

2.5 POST-REMEDIAL ACTION: NATURE AND EXTENT OF CONTAMINATION

2.5.1 Soil

Soil within the site boundary was treated to depths of 20 to 25 feet. The depth of treatment was based on the extent of hexavalent chromium in both soil and groundwater. Approximately 21,000 cubic yards of soil was treated with a sulfur based reducing agent. Soil confirmatory samples were collected and analyzed for hexavalent chromium to ensure the effectiveness of treatment. Samples were collected typically at approximately 1/3 and 2/3 of the treatment depth. Results of the soil sampling indicated that the hexavalent chromium had been treated to non-detectable levels (i.e., less than 5 mg/kg; the detection limit). Soil sampling locations and results

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are shown in **Figure 2-17.** Average total chromium concentrations in surface soil are anticipated to be less than 1,200 mg/kg (95th confidence interval about the mean). The concentration of chromium in soil is less than MTCA Method B concentrations (240 mg/kg hexavalent chromium; 120,000 mg/kg trivalent chromium) for unrestricted land use.

2.5.2 Groundwater

Groundwater within the source area was also treated during the remedial action when reagents were added to soil in the saturated zone. Groundwater samples were collected and analyzed for hexavalent chromium. The sample results indicated that hexavalent chromium in groundwater had been treated to non-detectable levels (i.e., less than 800 ug/L; the detection limit was elevated due to interferences with the remedial action reagent used for treatment). Groundwater sampling locations and results are shown in **Figure 2-18**.

2.5.3 Groundwater Wells

Figure 2-19 shows the current (October 2003) configuration of onsite wells.

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SECTION 3

INSTITUTIONAL CONTROLS PROGRAM

This section describes institutional control options available for the FHC site and provides an analysis of the anticipated effectiveness of applying specific institutional controls to the site.

3.1 INSTITUTIONAL CONTROLS PROGRAM PLAN OBJECTIVES

There are three primary objectives of this plan:

1. Track chromium plume over time
2. Keep agencies and private parties informed
3. Prevent human exposure to contaminants

3.1.1 Plume Tracking

The first objective of this plan is to track the extent of the contaminant plume such that the plume boundaries are identified. Plume boundaries are defined as "the horizontal area where groundwater has been impacted by releases from the Frontier Hard Chrome facility." Plume tracking is necessary to identify potential receptors that have the possibility of coming in contact with impacted groundwater. Knowing the boundaries of the plume will allow receptors to be forewarned of possible risks associated with activities that bring groundwater to the surface.

The boundaries of the plume are anticipated to vary with time, and concentrations within the plume boundaries are also anticipated to change. Plume tracking will be based primarily on total chromium concentrations since this is the principal contaminant of concern at the FHC site. Defining the boundaries of the plume will be primarily based on groundwater monitoring.

3.1.2 Inform Agencies and Private Parties

The second objective of this plan is to provide information regarding plume location, contaminant concentrations, methods of contacting groundwater, exposure pathways, and possible health effects to private parties and governing agencies. Making these entities aware of this information will minimize the risks from exposure to groundwater contaminants.

Keeping these parties informed will consist of methods such as mailing fact sheets, holding public meetings as needed, providing copies of monitoring reports to public facilities where they can be accessed, and other methods.

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3.1.3 Prevent Human Exposure to Contaminants

This objective consists of implementing new controls or enforcing existing controls to prevent human exposure to contaminants from the FHC site. This objective consists of identifying local and state regulations that limit exposure to groundwater contaminants. These regulations will be evaluated to determine their efficacy—deficiencies will be identified. Additional controls will be recommended as necessary to minimize potential human exposure to contaminants.

Agreements or understandings with local agencies to implement new controls or assure enforcement of existing regulations will help prevent human exposure.

3.2 GENERAL INFORMATION

3.2.1 Summary of Land Use

Land use in the project area is primarily industrial, with some manufacturing and commercial uses. Land ownership in the area is predominantly private, with the exception of Pearson Air Park, which is publicly owned. The site and all immediate surrounding properties are zoned "ML" by the City of Vancouver, allowing light industrial use.

3.2.2 Property Ownership Information

A review of public records was performed to identify the property owners in the area that could be potentially exposed to contaminants in groundwater. The list of property owners is based on taxpayer records from the Clark County Assessor's Office. The property ownership and the owner's address for each parcel was also obtained from the Assessor's taxpayer files. Forty-eight property parcels were identified within or adjacent to the area of interest. These parcels were identified by lot number and are designated on **Figure 3-1**. A list of property users—businesses and residents—within the area of interest is provided in **Appendix A**.

3.2.3 Location of Existing Nearby Wells

The locations of existing residential/commercial wells and resource protection wells that could be potentially impacted by releases from FHC were determined. Well drillers are required by Washington State law to file a record of new water wells, borings, and resource protection wells with the Washington State Department of Ecology (Ecology). Approximately 70 notices recorded with Ecology for Section 35 of Township 2 North, Range 1 East were reviewed to determine the location of existing residential/commercial wells and resource protection wells that could potentially impacted by releases from FHC. Several wells were also identified from site assessment reports by Dames and Moore (1994) and Maul Foster & Alongi (1997).

A list of wells identified during this search is summarized in **Table 3-1**; the well locations are shown in **Figure 2-16**.

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Four industrial wells (associated with Buffalo Electro-Chemical Co., and Food Machinery/ Chemical Corp.[FMC]) were located in the chromium groundwater plume at the site of the former businesses. These wells were screened between 84 to 140 feet bgs and are as large as 36 inches in diameter. The wells apparently were used for industrial process water, but may not have been in use since 1981. Elevated concentration of chromium (0.12 mg/L) were previously detected in samples from one of the wells (CH2M Hill 1983). Records show three of these wells were abandoned in 1999. No record could be found for the fourth well, however, a condominium complex sits where the fourth well previously existed.

Twenty five resource protection wells were identified in the area of interest (excluding wells on the FHC site). Three of the resource protection wells (B-100, B-100A, B-102) were located north of the FMC production wells and are described in a report by Maul Foster & Alongi (1997). These wells were likely installed for site characterization during development of the Columbia Shores Facility. Records show these wells were abandoned in 1999. Twenty two other abandoned wells were identified at various locations. Seven of the abandoned resource protection wells (AGI-1 through AGI-4, CT-1 through CT-3) were formerly located at the former Cascade Tempering site. Six of these seven wells were reportedly abandoned in January 1994 and one well (AGI-4) cannot be located (Shump 1998).

Recorded water rights in the area of interest on file with Ecology were reviewed. The only recorded water rights for the area were associated with the FMC property.

There do not appear to be any active or inactive wells located downgradient of the chromium plume, excluding resource protection wells installed to monitor chromium concentrations downgradient of the FHC site.

Based on the review of available records, no residential wells were identified in the area of interest.

3.2.4 City of Vancouver Water Supply Well Network

The City of Vancouver currently obtains all of its drinking water from 40 groundwater supply wells. The closest water supply wells are designated water stations 1 and 4. Water Station No. 1 is located approximately 1 mile northwest of the FHC site. Water Station No. 1 does not appear to be impacted by the FHC site because it is located upgradient of the FHC; the FHC site is not with the zone of capture of this water station. Water Station No. 1 utilizes a water treatment system for organic solvents prior to adding the water to the distribution system. Water Station No. 4 is located approximately 1 mile east of the FHC site. Water Station No. 4 produces water from the shallow unconsolidated sedimentary aquifer, also referred to as the Lower Orchard aquifer, which is essentially equivalent to the shallow aquifer present beneath the FHC site. The pumping rate for Water Station No. 4 is now limited because a water treatment system for organic solvents is being used to treat the water prior to adding the water to the distribution system.

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Well head protection areas have been delineated for all City of Vancouver Water Stations. The City of Vancouver has enacted a Water Resources Protection Ordinance that requires protection for a 1,800 foot radius around all City of Vancouver well heads The well head protection area defined for Water Station 4 (Clark County 1995) is cross-gradient of the FHC chromium plume (see **Figure 2-16**).

3.3 GENERAL TYPES OF INSTITUTIONAL CONTROLS

There are several types of institutional controls that have been used on Superfund sites to control exposure to residual contaminants. The institutional controls consist of local ordinances, state water resource regulations, permits, regional health district regulations, deed notices and government or private party enforced restrictions.

3.3.1 Local Ordinances

This type of institutional control is enacted at the local (city or county) level. These governmental agencies may pass ordinances preventing certain activities from taking place. These ordinances can range from building restrictions to requirements for utility (water, sewer, etc.) usage.

3.3.2 State Regulations

The State of Washington has regulations governing the use of the states water resources and requirements for constructing water wells. A well cannot be drilled without the well owner first obtaining a water permit from the department authorizing the use of water from the well.

3.3.3 Permits

Local governing agencies have permit requirements that control new development construction, installation of wells and use of public water supplies. These controls require permits to be filed and permission granted before new construction can begin. Local agencies also have requirements to show details regarding the source of water to be used in any new development.

3.3.4 Health District Regulations

The Clark County Health Department has health regulations regarding new developments, requirements for drinking water sampling and permits required for new construction within the county limits. The health district can also issue health advisories regarding potential health risks due to toxic substances found in the water supply or due to other exposure mechanisms. Generally, the health district has responsibility for ensuring the health of its residents but does not enforce, clean up, or regulate exposure to hazardous materials associated with Superfund sites.

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3.3.5 Deed Notices

These institutional controls can consist of the property owner placing a notice with the property deed at the County Auditor's Office. These notices would be used to inform potential buyers of the presence of impacted groundwater at the property in question and the potential health concern associated with groundwater. The notice could forewarn against certain activities that may result in exposure to impacted groundwater such as well installation and intrusive construction activities. However, recording a deed notice has no legal effect on a property owner's rights regarding use of the property. Deed notices can serve as a long-term mechanism to ensure potential health risk warnings associated with the property are not lost.

3.3.6 Government/Private Party Enforced Restrictions

These include restrictive covenants, easements, and other real property conveyances and limitations on use that are legally binding by private parties and/or government agencies by order or agreement.

3.4 SUMMARY OF EXISTING CONTROLS AND RESTRICTIONS

This section summarizes the controls, restrictions, regulations and mechanisms that could be used to prevent human exposure to soil or groundwater contaminants at FHC.

3.4.1 Local Ordinances

The City of Vancouver has several municipal codes that regulate water hookups within the city limits. Pursuant to Vancouver Municipal Code (VMC) 14.04, new developments must submit a request for utility services to the City of Vancouver during the building permit application process. If no City of Vancouver water supply is available, then the developer must request a water assessment evaluation from the CCHD to supply a new source of potable water.

VMC 19.25.020 "*Public Improvements Required*" requires that water lines with valves and fire hydrants serving subdivisions or short subdivision and connecting the subdivision or short subdivision to the city mains shall be installed according to specifications of the City of Vancouver as administered by the Department of Public Works.

Policy 90 of the City of Vancouver's Growth Management Plan states "new private wells are not permitted within the Vancouver urban area."

Policy 91 of the City of Vancouver's Growth Management Plan states "existing private wells should be properly abandoned in accordance with state regulations and converted to public water service when it becomes available. Programs to ease the transition to public water service should be developed."

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3.4.2 State Regulations (Water Resource and Well Construction)

The following information was excerpted from the State of Washington well drilling regulations.

WAC 173-160-121: A well cannot be drilled without the well owner first obtaining a water permit from Ecology authorizing the use of water from the well (this requirement is exempted for lawn watering, stock watering, and domestic or industrial wells producing less than 5,000 gallons per day). The licensed operator must have a copy of the permit or certificate on site at all times. Every well that requires a permit shall be constructed to meet the provisions of the permit.

WAC 173-160-141: Anyone who constructs a well is required to submit a complete report on the construction, alteration, or decommissioning of the well to Ecology within thirty days after completion of a well, or after the drilling equipment has left the site. This applies to all water wells. The water well report must be made on a form provided by Ecology, or a reasonable facsimile of the form, as approved by Ecology. The water well report must include the following information:

- Owner name; operator/trainee name; operator/trainee license number; contractor registration number, drilling company name
- Tax parcel number
- Well location address
- Location of the well to at least ¼, ¼ section or smallest legal subdivision
- Unique well identification tag number
- Construction date
- Start notification number
- Intended use of well
- The well depth, diameter, and general specifications of each well

WAC 173-160-151: The property owner, owner's agent, or water well operator shall notify Ecology of the intent to begin well construction, reconstruction-alteration, or decommissioning procedures at least seventy-two hours before starting work. The notice of intent, submitted on forms provided by Ecology, contains the following:

- Well owner name
- Well location; street address; county name; ¼, ¼ section, township, and range, and tax parcel number
- Proposed use (if the intended withdrawal requires a water right, the permit or certificate shall be attached to the notice of intent)

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WAC 173-160-171: Wells shall not be located within certain minimum distances of known or potential sources of contamination. Some examples of sources or potential sources of contamination include:

- Landfills
- Hazardous waste sites
- Chemical and petroleum storage areas

Minimum set-back distances for water wells other than for public water supply are:

- One hundred feet from all other sources or potential sources of contamination except for solid waste landfills

All public water supply wells shall be located by the department of health or the local health authority. Before construction begins, site approval must be obtained from the department of health, or the local health authority. The requirements of the state board of health regulations regarding public water supplies shall apply. This regulation includes requirements for zones of protection, location of wells, accessibility features, and certain construction requirements. In sitting a well, the driller shall consider:

- All local and state water well construction regulations, policies, and ordinances
- Adjacent land uses
- End use of well

When a well is located in an area of known or potential contamination, the water well casing and seal shall be impervious to the contaminants. Before construction, the water well operator should strongly emphasize to the well owner, the importance of retaining good accessibility to the well to permit future inspection, maintenance, supplementary construction, and decommissioning.

Ecology has delegated authority to inspect wells in Clark County to the Clark County Health Department (CCHD).

3.4.3 Permits

City of Vancouver—Permits are required within the city limits for construction, utility installation, and building improvement work. To obtain these permits, plans and applications are reviewed by the City of Vancouver's Community Development Division. Plans for new developments are reviewed to determine the source of potable water. Potable water supplies are required to be provided from the cities water supply system with the water service area. Water sources other than city water would be disapproved and the permit would not be granted unless the water supply was changed. A "lock holder notice" can be placed in the city's permitting database. This database is reviewed for pertinent information regarding the issuance of permits. All permitting specialists review this database before approving permit applications.

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Clark County—Permits are required outside the city limits (rural areas) for new building construction. Before a new building permit can be obtained, the builder must designate the source of potable water if required. This process applies to new developments only. If a well is installed as the source, the CCHD must sample it before the building permit will be issued. The driller is also required to provide Ecology a copy of the start card 72-hours prior to beginning drilling. Ecology's database containing the start card is accessible by CCHD.

3.4.4 Health District Regulations

CCHD regulations require new developments to have their water source sampled before permits are issued. In addition, a Water Assessment Evaluation must be completed for all new buildings needing a new potable water supply. This assessment evaluates the source proposed for potable water. This process has been implemented to comply with RCW 36.70A (i.e., Washington State Growth Management Act).

Ecology has delegated their authority to inspect water wells (WAC 173-160) to CCHD, which is responsible for inspecting well seals, tagging and decommissioning wells as necessary. Inspections are not required for 100 percent of all wells. Approximately 40 percent are required to be inspected under the state's delegated authority.

3.4.5 Deed Notices

Deed notices are usually placed in a file in the County Assessor's Office by the property owner. These notices can identify pertinent information regarding a specific parcel of property. Property owners can also remove the deed notices that they have filed, at their own discretion. Only under certain circumstances can government agencies place a deed notice. For instance, the local regional health district in Clark County has the authority to place deed or title information in public files for property associated with illegal drug manufacture. These notices are useful when consideration is being given to property purchase: title searches will turn up information in these types of files that may influence purchase or future use.

3.5 APPROACH TO IMPLEMENTING INSTITUTIONAL CONTROLS

Implementation of the institutional controls plan must address the three primary objectives as discussed above: plume tracking, keeping agencies and private parties informed, and protecting human health. Tasks to be performed for these objectives are discussed below.

3.5.1 Chromium Groundwater Plume Monitoring

3.5.1.1 New Wells

New resource protection wells will be installed and sampled to further delineate the extent to which the chromium groundwater plume travels off-site. These wells will be placed in areas where data gaps exist with regard to groundwater contaminant concentrations. These new wells will be sampled initially to provide data to further define the location of impacted groundwater.

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It is anticipated that the wells will be sampled for total chromium except in cases where turbidity is an issue; in those cases both dissolved and total chromium will be analyzed.

The location of the new wells will be determined based on historical groundwater information, the anticipated groundwater movement, and data from a current round of groundwater sampling to be conducted during the first quarter off 2004. The proposed approach for locating the new wells will be determined during development of the Long Term Monitoring Plan to be prepared in November/December 2003 (EPA 2003b).

3.5.1.2 Existing Wells

Existing data from past sampling rounds will be compiled. This data will be used to evaluate plume behavior, further delineate the plume extent, and predict trends in contaminant concentrations. Selected existing "on-site" and "off-site" resource protection wells will be sampled initially for metals including chromium. The resource protection wells to be sampled will likely consist of those near or in the anticipated pathway of the plume.

Prior to sampling any wells on private property, a notice and request for consent will be sent to the property owners informing them of the desire to access their wells and the purpose for sampling. Consent for this sampling will be requested as part of the notice. Return of the signed consent will be requested by a specific date. If consent has not been received, telephone contact will be made and arrangements made when an EPA representative can stop by to obtain the signed consent.

Sampling of the resource protection wells will occur annually at a minimum until it is determined that there is no longer a threat from groundwater contamination.

3.5.1.3 Identify Plume Location

Groundwater data from sampling new and existing wells will form the basis for predicting the plume location.

The plume boundaries will be reviewed and modified based on the results of groundwater sampling. Figures will be prepared showing the estimated plume location; these figures will be updated a minimum of every 5 years after the remedial action has been completed. The anticipated location and concentrations of the plume will be estimated for 1, 5, and 10 years into the future to forewarn of possible future impacts and to identify any actions that should be taken now. Future plume location estimates will be based on groundwater sample results and changes in plume dimensions (trends) from year to year.

3.5.1.4 Long-Term Monitoring Plan

A Long Term Monitoring Plan will be developed in the fourth quarter of 2003. The Long Term Monitoring Plan will discuss monitoring requirements for offsite plume identification (see Section 3.5.1.3 above) as well as monitoring requirements to show the remedial action remains operational and functional.

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Long-term monitoring will consist of sampling selected wells on a periodic basis. This sampling will occur quarterly to annually for the first 5 years. At that time, a 5-year review will be completed and the frequency of monitoring will be reevaluated. For details regarding sampling methods, frequencies, analytes and QA/QC procedures, please refer to the Long Term Monitoring Plan.

3.5.2 Inform Agencies and Private Parties

3.5.2.1 List of Pertinent Agencies and Contacts

During the development of this Institutional Controls Plan, several agencies were contacted to obtain information regarding current ordinances and regulations. A list of the agencies, contact person, phone number, location and responsibility is provided in **Table 3-2**.

3.5.2.2 Potentially Affected Property Owners, Operators, and Residents

A listing of the names and addresses of property owners in the area potentially affected by chromium contamination from FHC is provided as **Table A-1 (Appendix A)**.

3.5.2.3 Disseminating Public Information

3.5.2.3.1 Types of Informational Documents

Several documents will be produced during implementation of the institutional controls plan at FHC to disseminate information regarding the site to the public and government agencies. These documents include technical reports documenting plume tracking activities, and public notices and fact sheets informing potentially impacted residents and businesses about threats to human health and the environment. This section describes the required content of these informational documents and the schedule for their development.

Periodic Groundwater Sampling Reports—Technical reports documenting the long-term groundwater monitoring activities will be developed by EPA. EPA is currently responsible for long-term groundwater monitoring; however, future groundwater monitoring may be delegated to other agencies, e.g., Ecology. Delegation of the groundwater monitoring would be done on a mutually agreeable schedule to both parties.

After sampling is completed, the monitoring reports will be prepared within three months. The reports will document the sampling activities and sample analysis results and will include the following:

- Monitoring well inspection results.
- Map of wells sampled.
- Sampling procedures and sample analytical methods used.
- Tabular results of sample analyses.

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- Isoconcentration contour map(s) of chromium in groundwater.
- Copies of analytical laboratory sample results and QA/QC results.
- Groundwater sampling field logs (including sampling techniques and water quality parameter field measurements.

A summary of the analytical results should be made available in electronic format to the interested agencies. Posting of the results at an Internet site may also be appropriate.

Plume Projection Analysis Reports—A report summarizing the analysis of the chromium plume's behavior will be prepared by EPA every 5 years and be made available to the interested agencies at the time of the 5-year review. These reports may consist of parcel maps with overlays of the chromium isopleths. Preparation of the Plume Projection Analysis Reports will be delegated to Ecology on a mutually agreeable schedule.

The analysis will be based on groundwater chromium concentration trends over time. The analysis should consider trends in groundwater sampling analytical results, natural attenuation mechanisms, and effects of withdrawals from local water supply wells. The specific approach will be determined by EPA.

The initial plume baseline report will be prepared by EPA following completion of the remedial action (September 2003), and preparation and implementation of the Long Term Monitoring Plan. The initial round of Long Term Monitoring sampling is tentatively scheduled for first quarter 2004.

Fact Sheets—Fact sheets should be developed to inform property owners, businesses, and residents in the area of interest about the progress of remedial activity at the FHC site, the potential health threats from contaminated groundwater in the area of interest, and the results of the 5-year reviews. The fact sheets may also solicit input to the 5 year reviews as well as desire for public meetings.

Fact sheets may be developed at the following milestones: completion of the remedial action and following each 5-year review. The fact sheet following completion of the remedial action and the 5 year review is anticipated to be prepared by EPA; follow-on fact sheets are expected to be prepared by Ecology. If Ecology takes over monitoring responsibility prior to preparing the 5 year review fact sheet, Ecology will submit any site observation information and/or data to EPA for use in preparing the fact sheet.

3.5.2.3.2 Public Meetings

A public meeting may be offered following adoption of this Institutional Controls Program plan by the implementing agencies. The need for a public meeting will be based on input and responses received from the public after review of the first few fact sheets. The status of the FHC site and the objectives and elements of this plan may be presented during the public meeting, if held.

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3.5.3 Prevent Human Exposure to Contamination

3.5.3.1 Potential Exposure Pathways and Receptors

Contaminated media at the FHC site consisted of soil and groundwater. Little soil or groundwater contamination (i.e., hexavalent chromium) is currently anticipated to exist onsite as a result of completing the remedial action in September 2003. Groundwater is the contaminated media of concern off-site.

Potential off-site groundwater contaminant exposure pathways consist of ingestion. Off-site groundwater ingestion could occur from drinking water from a well that has been impacted with contaminants from the FHC site. This water could come from an existing well or a newly installed well. However, this is unlikely at present since area water is supplied via Vancouver's water system. Significant dermal contact with off-site groundwater is also considered unlikely due to the depth of groundwater (15 to 20 feet below ground surface).

There is no significant off-site soil contaminant exposure pathways since the impacted soil was confined to on-site locations. Offsite perimeter sampling at the conclusion of the remedial action has indicated that hexavalent chromium adjacent to the site is not present at detectable concentrations (<5 mg/kg) and average total chromium concentrations adjacent to the site are less than 180 mg/kg. Chromium concentrations in soil further away (due to activities associated with FHC) are anticipated to be less than the 180 mg/kg measured in the vicinity of the site.

3.5.3.2 Evaluation of Existing Institutional Controls

This section evaluates current institutional controls to determine their adequacy in preventing human exposure to contaminants at the FHC site and surrounding area of interest.

State regulations (WAC 173-160) require notices to be sent to Ecology when a new well is proposed for construction. This notice must be submitted at least 72 hours in advance of well installation. These permits are not reviewed to determine if the area where the well will be installed is contaminated nor are they reviewed to determine if there are any restrictions placed on well installation in that particular area. It is unlikely that these notices could be used to prevent well installation in the contaminated area of the FHC site.

WAC 173-160 does not permit the installation of a well within 100 feet of known contamination. However, most well drillers are not cognizant of the location of groundwater contamination nor do they strive to gain this information. It is unlikely that a well driller would act as an effective deterrent to installation of a well within the contaminated groundwater plume.

Ecology could impose a "basin closure" on the aquifer under the FHC site. This is very difficult to do and takes a long period of time. The boundaries of this closure may also be hard to delineate exactly and once closed, it is difficult to change the status. It is unlikely that Ecology would be willing to enact a closure and because of the time required, this control is not likely to be effective.

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City of Vancouver policy P90 does not permit private wells within the Vancouver urban area. However, there is no mechanism to prevent the installation of a well on an existing development by an uninformed resident. Policy P91 indicates private wells should be abandoned and converted to public water when it comes available. However, this policy is not enforced and monitored by the city. These policies would be ineffective in preventing the installation of a well by an unknowing resident.

City of Vancouver procedures require a building permit for new construction. Construction may range from installation of a new water line to building construction. The permit applicant is required to submit the plans and a permit application to the city. At this point, the city reviews the drawings. One of the items reviewed is the proposed source of potable water. Per city policy, water can only be provided by the city water supply system within the water service area. If another source is proposed or if a source is not shown, the permit would not be granted. In addition, the reviewers check for "lock holder" notices prior to issuing the permit. These notices flag any conditions on the property or any other circumstances that may be pertinent in granting the permit. It appears that use of a "lock holder" notice would be effective in preventing and/or warning of activities that may result in human exposure to soil or groundwater contaminants.

CCHD has been delegated responsibility for inspecting, tagging and decommissioning wells by Ecology. CCHD must inspect a minimum of 40 percent of the wells. CCHD does not currently review the location of the proposed wells to determine if they are in an impacted area. With changes to this process, it is likely that installation of a well in an impacted are could be prevented by CCHD.

New construction in the county (i.e., areas outside of Vancouver city boundaries) requires a building permit from the county. Before a permit is issued, the source of potable water must be sampled to confirm quality. This process will not prevent installation of a well in an impacted area, however, it will identify a problem with the well and require a new source of potable water. Wells installed in an area where no permit is pending have no precautions to forewarn of contaminated groundwater. These regulations will protect human health from exposure to groundwater contaminants in new developments outside the city limits. Since the FHC impacted area is inside the city, it is unlikely that this CCHD requirement would be effective unless the plume moves outside city boundaries into undeveloped areas, which is unlikely.

Records can be placed in the auditor's files (i.e., deed notices) by the CCHD. However, their authority allows these notices to be placed only for illegal drug labs. CCHD has not placed records that provide information regarding soil or groundwater contamination from other sources. Given the lack of precedent and the need to involve the current owners of impacted or threatened properties, it is unlikely that this mechanism would be timely.

3.5.3.3 Sampling of Private Wells

Sampling of selected private wells in the vicinity of the plume may be performed to aid in plume tracking and to assess impact to groundwater in these areas. These wells may be sampled initially during the first quarter of 2004 after the Long Term Monitoring Plan is completed.

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Further sampling will be based on the need for information from these wells for plume tracking or to protect human health.

Specific private wells that will be sampled will be identified in the Long Term Monitoring Plan.

3.5.3.4 Recommendations for Additional Institutional Controls to Protect Human Health

Based on the above evaluation, there are several mechanisms where inadvertent exposure to contaminants could occur. **Table 3-3** lists these mechanisms and provides suggestions regarding additional institutional controls that should be implemented.

3.5.3.5 Drinking Water Well Abandonment

City policy endorses abandoning wells within the city limits. Resource protection wells and industrial production wells that existed within the area of interest are shown in **Table 3-1** and **Figures 2-16 and 2-19**. Records indicate these wells have been abandoned.

No drinking water wells have been identified within the area of interest. If drinking water wells are identified in this area, notices will be sent to the owners of these wells requesting consent to abandon the wells and the reason for this request. Once written consent is granted, EPA may abandon the wells.

3.6 FIVE-YEAR REVIEW

According to the Model Toxics Control Act (MTCA) 173-340-420, when institutional controls are required as part of the cleanup action the responsible agency shall review the cleanup action at least every 5 years after the initiation of the cleanup to assure human health and the environment are being protected. Since the ROD for this site (EPA 2001) requires institutional controls as part of the cleanup action, a 5-year review will be performed.

Agencies that will be asked to participate in this review will include the

- Clark County Health District
- Washington State Department of Ecology—Southwest Regional Office Toxics Cleanup Program
- EPA

The following topics should be addressed in the 5-year review:

1. *Groundwater Plume Location*—Groundwater data from periodic monitoring events should be plotted and maps showing the location of concentration contours generated. The maps should show the plume location year-by-year. These plume maps should also be analyzed

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to determine trends in contaminant migration and the likelihood of contaminated groundwater migrating into the river or into areas where drinking water wells exist.

2. *Attenuation of Groundwater Contaminant Concentrations*—Groundwater concentrations should be analyzed to determine the rate of natural attenuation. This rate should be evaluated to ensure the natural remedy is still protective of human health and meets the restoration timeframe desired by EPA and Ecology.
3. *Need for Additional Corrective Measures*—The occurrence of groundwater natural attenuation should be reviewed to ensure it is protective of human health and the environment. It should be determined if additional corrective measures are required to provide the desired protectiveness.
4. *Effectiveness of the Institutional Controls*—The effectiveness of the institutional controls should be evaluated to determine if exposure to contaminants in groundwater is occurring above acceptable levels. A review of well installations should be completed to determine if new wells in the area have been installed and, if so, if they are in an area of potential or known groundwater contamination. Permits for construction on the FHC and other source area properties should be reviewed. A review of mailings to residences, businesses and property owners should be performed to ensure they have been kept informed and have received mailings on an adequate frequency. Mailing lists should be updated. It should be verified that the institutional controls implemented by this plan are still in effect.
5. *Need for Additional Institutional Controls*—If deficiencies in the institutional controls are found, additional institutional controls or changes to the existing ones should be evaluated.
6. *Effectiveness of the Remedy*—The remedy should be evaluated to determine its effectiveness in preventing groundwater contamination from migrating offsite. Chromium concentrations in groundwater downgradient of the remedy should be reviewed with a goal of achieving the maximum contaminant level of 50 ug/L.

Information that should be evaluated during the 5-year review includes groundwater data and annual reports, a list of past mailings and the distribution list, any inspection reports and maintenance records, photographs, and other information related to the above topics. The responsibility of each agency during the 5 year review will be discussed well ahead of the 5 year review date.

Information obtained by Ecology regarding well installations, site observations, monitoring data and any other site related data not in possession of EPA should be submitted to EPA 90 days prior to the 5 year review unless otherwise agreed.

An action item list will be generated in the 5 year review report, if necessary. The 5 year review report will specify which agency is responsible for each item (if applicable), and a projected due date for that item to be completed.

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SECTION 4

SUMMARY

Soil and groundwater contaminated with hexavalent chromium within the site boundary has been treated to less than 5 mg/kg and 800 ug/L, respectively. Note: These values were the field method detection limits; actual concentrations are likely much less than 5 mg/kg and 800 ug/L given site reducing conditions.

Contaminated groundwater migrated off-site prior to implementation of the remedial action. Potential exposure pathways to groundwater contaminants offsite (which originated from the FHC site) are present. The location of this contaminant plume is relatively well known.

There are City of Vancouver policies in place that do not permit residents or businesses to use groundwater as drinking water within the water service area. However, there is currently no process in place that will prevent an unknowing resident from installing a well and using the water as drinking water.

There are currently no processes in place that warn construction workers of impacted soil on the FHC site. However, based on data obtained during the remedial action, there does not appear to be a health threat associated with chromium in soil.

Several controls are suggested to reduce the potential for inadvertent exposure to groundwater contaminants. EPA will take responsibility for implementing these controls. These controls are:

Groundwater

- Institute a policy that requires all new well notices received by the CCHD to be reviewed to determine if their location coincides with the FHC site.
- Mail fact sheets and/or notices to property owners and residents in the general area of the groundwater plume notifying them of the potential groundwater contamination, and informing them not to install wells in the area without CCHD review.

Soil

- After treatment of source area soil, the hexavalent chromium concentrations should not present a human health risk. Hexavalent and trivalent chromium concentrations are below MTCA Method B Standards for unrestricted land use (i.e., 240 and 120,000 mg/kg, respectively).

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SECTION 5

REFERENCES

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Maul Foster & Alongi, Inc. 1997. Supplemental Phase 2 Environmental Site Assessment, Columbia Shores, Lot 4, Vancouver, Washington. Prepared for Mortgage Investment Real Estate. Vancouver, Washington. 2 May.

Radian Corporation. 1991. Remedial Analysis Report. Prepared for the U.S. Army Corps of Engineers.

Shump, K. 1998. CH2M Hill. Letter to R. Jensen, Roy F. Weston, Inc., regarding status of monitoring wells at Columbia Business Center. 4 February.

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URS Greiner 2000. Final Focused Feasibility Study Frontier Hardchrome Superfund Site. Prepared for U.S. EPA, Region X, Seattle, WA. July.

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Weston (Weston Solutions, Inc.). 2003. Final Data Evaluation Report, Frontier Hard Chrome, Vancouver, Washington. Prepared for U.S. EPA, Region X, Seattle, WA. Weston Solutions, Inc., Seattle, WA. February.

Weston (Roy F. Weston, Inc.). 1999. Site Conditions Technical Memorandum, Frontier Hard Chrome, Vancouver, Washington. Prepared for U.S. EPA, Region X, Seattle, WA. Roy F. Weston, Inc., Seattle, WA.

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TABLES

Table 3-1—Details of Abandoned Wells Near the FHC Site

Well Reference	Location Designator	Construction Date	Abandoned Date	Well Diameter (inch)	Depth (feet)
Buffalo Electric-Chem MW 1	BEC/FMC	10/8/51	1/22/99	26	96
Buffalo Electric-Chem MW 2	BEC/FMC	11/8/51	1/22/99	26	85
Buffalo Electric-Chem MW 3	BEC/FMC	8/5/49	1/22/99	26	140
Food Machinery/Chemical	FMC	6/23/60	1/22/99 (?)	26	84
Schnitzer MW-1	SN	Unknown	10/26/98	2	34.5
Schnitzer MW-2	SN	Unknown	10/26/98	2	32.7
Schnitzer MW-3	SN	Unknown	10/26/98	2	34.3
Schnitzer MW-4	SN	Unknown	10/26/98	2	30
Schnitzer MW-5	SN	Unknown	10/26/98	2	30
Schnitzer MW-6	SN	Unknown	10/26/98	2	32
Quad Investment MW-1	QD	8/12/93	7/94	2	18.5
Quad Investment MW-2	QD	8/12/93	7/94	2	18.5
Quad Investment MW-3	QD	8/12/93	7/94	2	34
Warehouse #5 (6 wells)	WH	Unknown	Unknown	Unknown	Unknown
Columbia Shores B-100	B-100	1/13/92	3/4/99	2	13
Columbia Shores B-100A	B-100A	1/8/92	3/4/99	2	40
Columbia Shores B-102	B-102	1/18/92	3/4/99	2	13
AGI-1	AGI-1	7/15/86	Unknown	Unknown	34.5
AGI-2	AGI-2	7/16/86	Unknown	Unknown	33.5
AGI-3	AGI-3	7/17/86	Unknown	Unknown	34
AGI-4	AGI-4	7/18/86	?	Unknown	34.5
CT-1	CT-1	Unknown	Unknown	Unknown	Unknown
CT-2	CT-2	Unknown	Unknown	Unknown	Unknown
CT-3	CT-3	Unknown	Unknown	Unknown	Unknown

NA: Not Applicable

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Table 3-2—Agency Contacts

Agency/Organization	Contact Name, Title, and Phone and Fax Numbers	Address	Responsibility/Expertise
Department of Ecology *Water Resources*	Dick Szymarek 360-407-6648 360-407-6972 (Fax)	P.O. Box 47600 Olympia, WA 98504-7600	Well Regulations, Water Rights, Basin Closure Procedures
City of Vancouver *Engineering Division-Water System Design and Planning*	Pat Easley Civil Engineer 360-696-8223 360-696-8460 (Fax)	P.O. Box 1995 Vancouver, WA 98668	City Water Supply Regulations, Water System Design, New Development Water Supply Requirements
City of Vancouver *Department of Community Development*	Linda Devlin Information Technology Coordinator 360-735-8873	P.O. Box 1995 Vancouver, WA 98668	Building Permits, Plan Reviews, Construction Regulations, New Development Regulations
City of Vancouver *City Attorney*	Ted Gathe Vancouver City Attorney 360-696-8251 360-696-8250 (Fax)	210 East 13th Street P.O. Box 1995 Vancouver, WA 98668	Laws, Penalties, Policies and Enforcement
Clark County Health Department (CCHD)	Mike McNickel Environmental Health Supervisor 360-397-8167	2000 Fort Vancouver Way Vancouver, WA 98663	Health Regulations, District Permits, Water Supply Regulations, Well Inspections, Water Well Requirements
CCHD	Thomas White Environmental Health Specialist 360-397-8153 360-397-8084 (Fax)	1950 Fort Vancouver Way P.O. Box 9825 Vancouver, WA 98666	Toxics Program, Hazardous Wastes
CCHD	Joe Ellingson Environmental Health Specialist 360-397-8065 360-397-8084 (Fax)	1950 Fort Vancouver Way P.O. Box 9825 Vancouver, WA 98666	Deed Notices, Records Modification
CCHD	Dr. Karen Steingart Health Officer 360-397-8412	2000 Fort Vancouver Way Vancouver, WA 98663	Health Advisories, Regional Health Issues, Toxicity Information

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Table 3-3—Institutional Control Recommendations

Exposure Mechanism	Recommendations	Comments
1. On-site intrusive construction work	• Place a "lock holders notice" with the city permitting department to warn of contaminated soil at the FHC site.	Permits are required for most construction work.
2. Installation of a groundwater well on-site for drinking or process water	• Institute a policy that requires all new well notices received by the CCHD to be reviewed to determine if their location coincides with the FHC site or plume boundary. • Mail notices or fact sheets to property owners/residences in the local area warning of contamination at FHC, and not to install wells without CCHD review.	Although city policy does not permit wells to be installed within city limits, no mechanism is in place to prevent this from occurring.
3. Installation or use of a groundwater well off-site for drinking water purposes at an existing residence or development	• Institute a policy that requires all new well notices received by the CCHD to be reviewed to determine if their location coincides with the contaminated groundwater plume. • Mail notices or fact sheets to property owners/residences in the local area warning of the groundwater contamination, and not to install wells without CCHD review. • Mail fact sheets to property owners and residents in the general area of the plume warning of groundwater contamination.	Although city policy does not permit wells to be installed within city limits, no mechanism is in place to prevent this from occurring at an existing residence. Well installation associated with new building construction would be prevented. EPA would prepare the fact sheets.

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APPENDIX A

PROPERTY OWNER/OCCUPANT INFORMATION

Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
030800-000	1	City of Vancouver	210 East 13th Street Vancouver, WA 98660	105 East Reserve Street Vancouver, WA 98661
030848-000	1	City of Vancouver	210 East 13th Street Vancouver, WA 98660	#10 Ryan DLC 35.91A
030850-000	1	City of Vancouver	210 East 13th Street Vancouver, WA 98660	#22 WM Ryan DLC 10.6A
038279-914	1	City of Vancouver	210 East 13th Street Vancouver, WA 98660	1105 East 5th Street Vancouver, WA 98663
502320-000	1	No Record Found	No Record Found	No Record Found
033810-000	2	(b) (6)		2605 East 5th Street Vancouver, WA 98661
033815-000	2			312 East Y Street Vancouver, WA 98661
033818-000	2			Blurock HD Lots #8 Lot 2
033829-000	3	(b) (6)		Blurock HD Lots #5 Lots 4 & 5 0.85A
033830-010	3			2305 East 5th Street Vancouver, WA 98661
033828-000	4			2424 East 2nd Street Vancouver, WA 98661
033824-001	5			Blurock HD Lots #14 Lot 2 .14A
033791-000	6a			2621 East 5th Street Vancouver, WA 98661
033793-000	6b			2611 East 5th Street Vancouver, WA
033814-000	7			2609 East 5th Street Vancouver, WA 98661
033827-000	8	Vancouver Roofing & Sheet Metal	P.O. Box 8951 Vancouver, WA 98668	217 X Street Vancouver, WA 98661
033816-000	9	(b) (6)		300 East Y Street Vancouver, WA 98661
033819-000	9			107 SE Grand Boulevard Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
033823-000	9	(b) (6)		Blurock HD Lots #12 Lots 2 & 3
033824-000	9			113 Y Street Vancouver, WA 98661
033790-000	10			200 SE Grand Boulevard Vancouver, WA 98661
033821-000	11			109 Y Street Vancouver, WA 98661
033822-000	12			2428 East 1st Street Vancouver, WA 98661
031066-000	13			110 Y Street Vancouver, WA 98661
031072-000	13			2313 East 2nd Street Vancouver, WA 98661
031071-000	14			116 Y Street Vancouver, WA 98661
031027-000	15	Dekas L.L.C.	6901 SE Topper Drive Vancouver, WA 98664	2300 East 1st Street Vancouver, WA 98661
031045-000	16	Kahn-Mathis Company, Inc.	2200 East 1st Street Vancouver, WA 98661	2200 East 1st Street Vancouver, WA 98661
031037-000	17	(b) (6)		115 V Street Vancouver, WA 98661
033842-000	18	D.J.R. Development LLC	218 V Street Vancouver, WA 98661	Blurock HD Lots #4 Lots 7 & 8
033841-000	19	(b) (6)		218 V Street Vancouver, WA 98661
033830-020	20			2320 East 2nd Street Vancouver, WA 98661
033831-000	20			2300 East 2nd Street Vancouver, WA 98661
033830-000	21	Port of Vancouver Road Easement	PO Box 1180 Vancouver, WA 98666	Blurock HD Lots #1 Lots 5 & 6

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
031031-000	22	Kiewit Construction Co.	1000 Kiewit Plaza Omaha, NE 68131	2200 East Columbia House Boulevard Vancouver, WA 98661
031088-000	23	Clark Associates	PO Box 24848 Seattle, WA 98124	2311 East 1st Street Vancouver, WA 98661
031001-000	24	Campbell Equities L.L.C.	PO Box 180 Vancouver, WA 98666	206 Grand Boulevard Vancouver, WA 98661
031026-000	24	Campbell Equities L.L.C.	PO Box 180 Vancouver, WA 986668	206 Grand Boulevard Vancouver, WA 98661
030841-000	25	Columbia Machine, Inc.	PO Box 8950 Vancouver, WA 98668	#3 of WM Ryan DLC 0.92A M/L
031019-000	25	Columbia Machine, Inc.	PO Box 8950 Vancouver, WA 98668	107 Grand Boulevard Vancouver, WA 98661
031034-000	25	Columbia Machine, Inc.	PO Box 8950 Vancouver, WA 98668	#276 of WM Ryan DLC 1.00A
031035-000	25	Columbia Machine, Inc.	PO Box 8950 Vancouver, WA 98668	107 Grand Boulevard Vancouver, WA 98661
031039-000	26	Quad Investments	200 Dubois Court Vancouver, WA 98661	107 Grand Boulevard Vancouver, WA 98661
031073-000	26	Quad Investments	200 Dubois Court Vancouver, WA 98661	#315 WM Ryan DLC 1.96A
031065-000	27	(b) (6)		2818 East 1st Street Vancouver, WA 98661
031030-000	28	True World Foods, Inc.	1501 South 92nd Place #D Seattle, WA 98108	301 Grand Boulevard Vancouver, WA 98661
031061-000	29	(b) (6)		315 Grand Boulevard Vancouver, WA 98661
031075-000	30	West Coast Bank	349 Grand Boulevard Vancouver, WA 98661	349 Grand Boulevard Vancouver, WA 98661
031053-000	31	(b) (6)		#295 of WM Ryan DLC .54 A
031029-000	32			2801 East 5th Street Vancouver, WA 98661
031032-000	32			2717 East 5th Street Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
031052-000	33	(b) (6) [redacted]	[redacted]	353 Grand Boulevard Vancouver, WA 98661
031051-000	34	(b) (6) [redacted]	[redacted]	351 Grand Boulevard Vancouver, WA 98661
031068-000	35	G.F. Webb, Inc.	351 Grand Boulevard Vancouver, WA 98660	#310 WM Ryan DLC .32A
031069-000	35	G.F. Webb, Inc.	351 Grand Boulevard Vancouver, WA 98660	#311 WM Ryan DLC .23A
031070-000	35	G.F. Webb, Inc.	351 Grand Boulevard Vancouver, WA 98660	351 Grand Boulevard Vancouver, WA 98661
700425-000	36	No Record Found	No Record Found	No Record Found
502310-000	37	USA	PO Box 3621 Portland, OR 97208	Tideland Tax Lot No. 502310
502330-003	38	CSV Ltd Partnership	1111 Main Street Suite 600 Vancouver, WA 98660	1401 SE Columbia Way Vancouver, WA 98661
031086-000	39	Pomajevich Properties, et al	510 SE Columbia Shores Boulevard Vancouver, WA 98661	510 SE Columbia Shores Boulevard Vancouver, WA 98661
031090-000	40	(b) (6) [redacted]	[redacted]	2119 SE Columbia Way Vancouver, WA 98661
031090-001	40	[redacted]	[redacted]	#332 WM Ryan DLC 1.34A
031091-000	40	[redacted]	[redacted]	600 SE Maritime Avenue Vancouver, WA 98661
031091-001	40	[redacted]	[redacted]	600 SE Maritime Avenue Vancouver, WA 98661
031092-000	40	[redacted]	[redacted]	2301 SE Hidden Way Vancouver, WA 98661
031092-001	40	[redacted]	[redacted]	#334 WM Ryan DLC 6.83A

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
031092-002	40	Christensen Shipyards Ltd.	4400 SE Columbia Way Vancouver, WA 98661	4420 SE Columbia Way Vancouver, WA 98661
031093-000	40	(b) (6)		503 SE Maritime Avenue Vancouver, WA 98661
031093-001	40			#335 WM Ryan DLC 2.09A
031094-000	40			#336 WM Ryan DLC 5.06A
031095-000	40			#337 WM Ryan DLC 3.57A
031096-000	40			2501 SE Columbia Way Vancouver, WA 98661
031096-001	40			2501 SE Columbia Way Vancouver, WA 98661
031097-000	40			#339 WM Ryan DLC 3.78A
031098-000	40			2303 SE Hidden Way Vancouver, WA 98661
031098-001	40			2303 SE Hidden Way Vancouver, WA 98661
031099-000	40			2503 SE Hidden Way Vancouver, WA 98661
031099-001	40			#341 WM Ryan DLC 8.71A
031100-000	40			2801 SE Columbia Way Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
031101-000	40	(b) (6)		#343 WM Ryan DLC 2.99A
031101-001	40			#343 WM Ryan DLC 2.99A
031102-000	40			611 SE Kaiser Avenue Vancouver, WA 98661
031102-001	40			#344 WM Ryan DLC 4.43A
031103-000	40			2625 SE Hidden Way Vancouver, WA 98661
031103-001	40			#345 WM Ryan DLC 5.43A
031104-000	40			#346 WM Ryan DLC 13.42A
031105-000	40			3000 SE Hidden Way Vancouver, WA 98661
031105-001	40			604 SE Victoria Avenue Vancouver, WA 98661
031106-000	40			2111 SE Columbia Way Vancouver, WA 98661
031106-001	40			#348 WM Ryan DLC 6.74A
502350-000	40			Tideland Tax Lot No. 502350
502360-000	40			2000 Columbia Way Vancouver, WA 98661
503041-000	40			Tidelands of 1st Class

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
503042-000	40	(b) (6)		Tidelands of 1st Class
030980-000	41	State of Washington Dept of Transportation	MS KF-01 Olympia, WA 98504	#216 WM Ryan DLC .35A
502340-000	41	Washington State	No Record Found	Tideland Tax Lot No. 502340
031078-000	42	No Record Found	No Record Found	No Record Found
502330-000	42	No Record Found	No Record Found	No Record Found
031078-005	43	CSV Lot 3 Ltd Partnership	701 SE Columbia Shores Boulevard Vancouver, WA 98661	701 SE Columbia Shores Boulevard Vancouver, WA 98661
030912-000	44	Columbia Shores 1999 LP	4010 Lake Washington Boulevard NE Kirkland, WA 98033	1898 SE Columbia River Drive Vancouver, WA 98661
035771-224	45 Condo	(b) (6)		1477 SE Columbia River Dr. A-1 Vancouver, WA 98661
035771-226	45 Condo			01475 SE Columbia Way A-2 Vancouver, WA 98661
035771-228	45 Condo			01473 SE Columbia Way A-3 Vancouver, WA 98661
035771-230	45 Condo			01471 SE Columbia River Dr. A-4 Vancouver, WA 98661
035771-232	45 Condo			01469 SE Columbia River Dr. A-5 Vancouver, WA 98661
035771-234	45 Condo			01467 SE Columbia Way A-6 Vancouver, WA 98661
035771-236	45 Condo			01465 SE Columbia Way A-7 Vancouver, WA 98661
035771-238	45 Condo			01463 SE Columbia Way B-1 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-240	45 Condo	(b) (6)		01461 SE Columbia Way B-2 Vancouver, WA 98661
035771-242	45 Condo			01459 SE Columbia Way B-3 Vancouver, WA 98661
035771-244	45 Condo			01457 SE Columbia Way B-4 Vancouver, WA 98661
035771-246	45 Condo			01455 SE Columbia River Dr. B-5 Vancouver, WA 98661
035771-248	45 Condo			01453 SE Columbia Way B-6 Vancouver, WA 98661
035771-250	45 Condo			01451 SE Columbia Way B-7 Vancouver, WA 98661
035771-252	45 Condo			01449 SE Columbia Way C-1 Vancouver, WA 98661
035771-254	45 Condo			14477 SE Columbia Way C-2 Vancouver, WA 98661
035771-256	45 Condo			01445 SE Columbia Way C-3 Vancouver, WA 98661
035771-258	45 Condo			01443 SE Columbia Way C-4 Vancouver, WA 98661
035771-260	45 Condo			01441 SE Columbia Way C-5 Vancouver, WA 98661
035771-262	45 Condo			01439 SE Columbia Way C-6 Vancouver, WA 98661
035771-264	45 Condo			01437 SE Columbia Way C-7 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-266	45 Condo	(b) (6)		01435 SE Columbia Way C-8 Vancouver, WA 98661
035771-268	45 Condo			01433 SE Columbia Way D-1 Vancouver, WA 98661
035771-270	45 Condo			01431 SE Columbia Way D-2 Vancouver, WA 98661
035771-272	45 Condo			01429 SE Columbia Way D-3 Vancouver, WA 98661
035771-274	45 Condo			01427 SE Columbia Way D-4 Vancouver, WA 98661
035771-276	45 Condo	Racker Investment LLC	01425 SE Columbia River Dr. D-5 Vancouver, WA 98661	01425 SE Columbia Way D-5 Vancouver, WA 98661
035771-278	45 Condo	(b) (6)		01423 SE Columbia Way D-6 Vancouver, WA 98661
035771-280	45 Condo			01421 SE Columbia Way D-7 Vancouver, WA 98661
035771-282	45 Condo			01419 SE Columbia Way D-8 Vancouver, WA 98661
035771-284	45 Condo			01417 SE Columbia Way E-1 Vancouver, WA 98661
035771-286	45 Condo			01415 SE Columbia Way E-2 Vancouver, WA 98661
035771-288	45 Condo			01413 SE Columbia Way E-3 Vancouver, WA 98661
035771-290	45 Condo			01411 SE Columbia Way E-4 Vancouver, WA 98661

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Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-292	45 Condo	(b) (6)		01409 SE Columbia Way E-5 Vancouver, WA 98661
035771-294	45 Condo			01407 SE Columbia Way E-6 Vancouver, WA 98661
035771-296	45 Condo			01405 SE Columbia Way E-7 Vancouver, WA 98661
035771-298	45 Condo			01403 SE Columbia Way E-8 Vancouver, WA 98661
035771-300	45 Condo			01401 SE Columbia Way E-9 Vancouver, WA 98661
035771-302	45 Condo			520 SE Columbia River Dr #122 Vancouver, WA 98661
035771-304	45 Condo			520 SE Columbia River Dr #123 Vancouver, WA 98661
035771-306	45 Condo			520 SE Columbia River Dr #124 Vancouver, WA 98661
035771-308	45 Condo			520 SE Columbia River Dr #126 Vancouver, WA 98661
035771-310	45 Condo			520 SE Columbia River Dr #127 Vancouver, WA 98661
035771-312	45 Condo			520 SE Columbia River Dr #128 Vancouver, WA 98661
035771-314	45 Condo			520 SE Columbia River Dr #129 Vancouver, WA 98661
035771-316	45 Condo			520 SE Columbia River Dr #130 Vancouver, WA 98661

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Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-318	45 Condo	(b) (6)		520 SE Columbia River Dr #131 Vancouver, WA 98661
035771-320	45 Condo			520 SE Columbia River Dr #132 Vancouver, WA 98661
035771-322	45 Condo			520 SE Columbia River Dr #133 Vancouver, WA 98661
035771-324	45 Condo			520 SE Columbia River Dr #134 Vancouver, WA 98661
035771-326	45 Condo			520 SE Columbia River Dr #135 Vancouver, WA 98661
035771-328	45 Condo			520 SE Columbia River Dr #222 Vancouver, WA 98661
035771-330	45 Condo			520 SE Columbia River Dr #223 Vancouver, WA 98661
035771-332	45 Condo			520 SE Columbia River Dr #224 Vancouver, WA 98661
035771-334	45 Condo			520 SE Columbia River Dr #226 Vancouver, WA 98661
035771-336	45 Condo			520 SE Columbia River Dr #227 Vancouver, WA 98661
035771-338	45 Condo			520 SE Columbia River Dr #228 Vancouver, WA 98661
035771-340	45 Condo			520 SE Columbia River Dr #229 Vancouver, WA 98661
035771-342	45 Condo			520 SE Columbia River Dr #230 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-344	45 Condo	(b) (6)		520 SE Columbia River Dr #231 Vancouver, WA 98661
035771-346	45 Condo			520 SE Columbia River Dr #232 Vancouver, WA 98661
035771-348	45 Condo			520 SE Columbia River Dr #233 Vancouver, WA 98661
035771-350	45 Condo			520 SE Columbia River Dr #234 Vancouver, WA 98661
035771-352	45 Condo			520 SE Columbia River Dr #235 Vancouver, WA 98661
035771-354	45 Condo			520 SE Columbia River Dr #322 Vancouver, WA 98661
035771-356	45 Condo			520 SE Columbia River Dr #323 Vancouver, WA 98661
035771-358	45 Condo			520 SE Columbia River Dr #324 Vancouver, WA 98661
035771-360	45 Condo			520 SE Columbia River Dr #326 Vancouver, WA 98661
035771-362	45 Condo			520 SE Columbia River Dr #327 Vancouver, WA 98661
035771-364	45 Condo			520 SE Columbia River Dr #328 Vancouver, WA 98661
035771-366	45 Condo			520 SE Columbia River Dr #329 Vancouver, WA 98661
035771-368	45 Condo			520 SE Columbia River Dr #330 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-370	45 Condo	(b) (6)		520 SE Columbia River Dr #331 Vancouver, WA 98661
035771-372	45 Condo			520 SE Columbia River Dr #332 Vancouver, WA 98661
035771-374	45 Condo			520 SE Columbia River Dr #333 Vancouver, WA 98661
035771-376	45 Condo			520 SE Columbia River Dr #334 Vancouver, WA 98661
035771-378	45 Condo			520 SE Columbia River Dr #335 Vancouver, WA 98661
035771-380	45 Condo			520 SE Columbia River Dr #421 Vancouver, WA 98661
035771-382	45 Condo			520 SE Columbia River Dr #422 Vancouver, WA 98661
035771-384	45 Condo			520 SE Columbia River Dr #423 Vancouver, WA 98661
035771-386	45 Condo			520 SE Columbia River Dr #424 Vancouver, WA 98661
035771-388	45 Condo			520 SE Columbia River Dr #425 Vancouver, WA 98661
035771-390	45 Condo			520 SE Columbia River Dr #426 Vancouver, WA 98661
035771-392	45 Condo			520 SE Columbia River Dr #427 Vancouver, WA 98661
035771-394	45 Condo			520 SE Columbia River Dr #428 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-396	45 Condo	(b) (6)		520 SE Columbia River Dr #429 Vancouver, WA 98661
035771-398	45 Condo			520 SE Columbia River Dr #430 Vancouver, WA 98661
035771-400	45 Condo			520 SE Columbia River Dr #431 Vancouver, WA 98661
035771-402	45 Condo			520 SE Columbia River Dr #432 Vancouver, WA 98661
035771-404	45 Condo			520 SE Columbia River Dr #433 Vancouver, WA 98661
035771-406	45 Condo			520 SE Columbia River Dr #110 Vancouver, WA 98661
035771-408	45 Condo			520 SE Columbia River Dr #111 Vancouver, WA 98661
035771-410	45 Condo			520 SE Columbia River Dr #112 Vancouver, WA 98661
035771-412	45 Condo			520 SE Columbia River Dr #113 Vancouver, WA 98661
035771-414	45 Condo			520 SE Columbia River Dr #114 Vancouver, WA 98661
035771-416	45 Condo			520 SE Columbia River Dr #115 Vancouver, WA 98661
035771-418	45 Condo	CSV Ltd Ptnsp	No Record Found	520 SE Columbia River Dr #116 Vancouver, WA 98661
035771-420	45 Condo	(b) (6)		520 SE Columbia River Dr #117 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-422	45 Condo	(b) (6) [redacted]	[redacted]	520 SE Columbia River Dr #118 Vancouver, WA 98661
035771-424	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #120 Vancouver, WA 98661
035771-426	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #121 Vancouver, WA 98661
035771-428	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #210 Vancouver, WA 98661
035771-430	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #211 Vancouver, WA 98661
035771-432	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #212 Vancouver, WA 98661
035771-434	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #213 Vancouver, WA 98661
035771-436	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #213 Vancouver, WA 98661
035771-438	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #215 Vancouver, WA 98661
035771-440	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #216 Vancouver, WA 98661
035771-442	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #217 Vancouver, WA 98661
035771-444	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #218 Vancouver, WA 98661
035771-446	45 Condo	[redacted]	[redacted]	520 SE Columbia River Dr #220 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-448	45 Condo	(b) (6) [redacted]		520 SE Columbia River Dr #221 Vancouver, WA 98661
035771-450	45 Condo			520 SE Columbia River Dr #310 Vancouver, WA 98661
035771-452	45 Condo			520 SE Columbia River Dr #311 Vancouver, WA 98661
035771-454	45 Condo			520 SE Columbia River Dr #312 Vancouver, WA 98661
035771-456	45 Condo			520 SE Columbia River Dr #313 Vancouver, WA 98661
035771-458	45 Condo			520 SE Columbia River Dr #314 Vancouver, WA 98661
035771-460	45 Condo			520 SE Columbia River Dr #315 Vancouver, WA 98661
035771-462	45 Condo	Racker Investment LLC	No Record Found	520 SE Columbia River Dr #316 Vancouver, WA 98661
035771-464	45 Condo	(b) (6) [redacted]		520 SE Columbia River Dr #317 Vancouver, WA 98661
035771-466	45 Condo			520 SE Columbia River Dr #318 Vancouver, WA 98661
035771-468	45 Condo			520 SE Columbia River Dr #320 Vancouver, WA 98661
035771-470	45 Condo			520 SE Columbia River Dr #321 Vancouver, WA 98661
035771-472	45 Condo			520 SE Columbia River Dr #410 Vancouver, WA 98661

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Table A-1—Parcel Owner List

Parcel Number	Owner ID[a]	Owner Name	Owner Address	Property Address or Legal Description
035771-474	45 Condo	(b)(4) copyright		520 SE Columbia River Dr #411 Vancouver, WA 98661
035771-476	45 Condo			520 SE Columbia River Dr #412 Vancouver, WA 98661
035771-478	45 Condo			520 SE Columbia River Dr #413 Vancouver, WA 98661
035771-480	45 Condo			520 SE Columbia River Dr #414 Vancouver, WA 98661
035771-482	45 Condo			520 SE Columbia River Dr #415 Vancouver, WA 98661
035771-484	45 Condo	Sm Realty LLC	No Record Found	520 SE Columbia River Dr #416 Vancouver, WA 98661
035771-486	45 Condo	(b) (6)		520 SE Columbia River Dr #417 Vancouver, WA 98661
035771-488	45 Condo			520 SE Columbia River Dr #418 Vancouver, WA 98661
035771-490	45 Condo			520 SE Columbia River Dr #419 Vancouver, WA 98661
035771-492	45 Condo			520 SE Columbia River Dr #420 Vancouver, WA 98661
502330-002	46	No Record Found	No Record Found	No Record Found
033832-000	47	Iron Gate Partners 2 LLC	2225 East 5th Street Vancouver, WA 98661	2225 East 5th Street Vancouver, WA 98661

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