Preliminary Close Out Report
Frontier Hard Chrome
Vancouver, Washington

## I. Introduction

This Preliminary Close Out Report (PCOR) documents that the U.S. Environmental Protection Agency (EPA) has observed the completion of construction activities at the Frontier Hard Chrome Superfund Site in accordance with the "Close Out Procedures for the National Priorities List" OSWER Directive 9320.2-09A-P. EPA conducted a site inspection on September 18, 2003, and determined that the remedy had been constructed in accordance with the remedial design plans and specifications. Activities have been initiated to achieve site completion.

## II. Summary of Site Conditions

### A. Site Background

The Frontier Hard Chrome (FHC) Superfund Site is located in the southwestern part of the State of Washington, in the City of Vancouver, Washington. The address of the site is 113 Y Street, Vancouver, Washington. FHC is in an industrial area of the city directly across the Columbia River from the city of Portland, Oregon. The area is generally flat, extending south, east, and west. About one quarter mile to the north, a ridge rises steeply to where a large residential area begins. The site is approximately one-half mile north of the Columbia River and covers about one-half acre (Figure 1-1).

The site has been primarily occupied by two businesses, both engaged in the chrome plating business. Pioneer Plating operated at the site from 1958 to 1970. The site was then occupied by FHC until 1983. The property has been leased to various other businesses since 1983. Most recently, the facility was being used as a metal fabrication shop.

During the operation of Pioneer and the initial operation of FHC, chromium plating wastes were discharged to the sanitary sewer system. In 1975, the City of Vancouver determined that chromium in the wastewater from FHC was interfering with the operation of its new secondary treatment system. FHC was directed by the city and the Washington State Department of Ecology (Ecology) to cease discharge to the sewer system until an appropriate wastewater treatment system could be installed to remove the chromium at the site.

In 1976, Ecology gave the FHC facility a wastewater disposal permit for discharge of chromium-contaminated wastewater to an on-site dry well. The permit also contained a schedule for the installation of an appropriate treatment system for the FHC wastewater stream. Between 1976 and 1981, several extensions of the permit and schedule were granted, as the deadlines were passed without compliance.

In 1982, Ecology found FHC in violation of the Washington State Dangerous Waste Act for the illegal disposal of hazardous wastes. Ecology also discovered that an industrial supply well about one quarter mile southwest of FHC was contaminated with chromium at more than twice

the federal drinking water standard. FHC's wastewater permit was again modified with a new compliance date. FHC again did not comply with the permit requirements for economic reasons, and in December 1982, the site was proposed for inclusion on the National Priorities List under CERCLA or Superfund. The listing was finalized in September 1983.

In 1983, Ecology ordered FHC to stop discharge of chromium plating wastes to the dry well. FHC was also required to prepare a plan for the investigation of the groundwater. At that time, FHC closed down all operations at the site. The company did not undertake the investigation.

In March 1983, EPA and Ecology signed a Cooperative Agreement which gave Ecology the lead for investigation of the FHC site under Superfund. Ecology began the investigation in the fall of 1984.

Releases from FHC operations contaminated groundwater with chromium concentrations as high as 300,000 µg/L. At the time the contamination was first detected in 1982, a groundwater plume exceeding federal drinking water standards (50 µg/L) extended approximately 1600 feet southwest from the facility. Groundwater monitoring since initial discovery has shown that the plume had receded.

Concentrations of total chromium in surface soils collected during the RI were found as high as 5,200 mg/kg while recent surface soil samples revealed concentrations of hexavalent chromium near the FHC building as high as 42 mg/kg. Subsurface concentrations for total and hexavalent chromium have been noted as high as 31,800 mg/kg and 7,506 mg/kg respectively. Contaminated subsurface soil extended beneath the former neighboring Richardson Metal Works building (Figure 1-2).

Ecology completed a removal action in 1994 to reduce the threat of direct exposure and further impacts to groundwater from the most heavily contaminated surface soils. This action consisted of excavation and off-site disposal a limited quantity of surface soil with chromium concentrations exceeding 210 mg/kg from the eastern most portion of the site. The area of excavation was subsequently backfilled with clean material and has been developed. Development consisted of construction of a commercial office building and adjacent parking.

B. Records of Decision and Amendment

EPA issued separate RODs for the soils/source control operable unit (December 1987) and the groundwater operable unit (July 1988). The December 1987 ROD called for excavation, stabilization and replacement of 7,400 cubic yards of the [stabilized] soil - or all soils with concentrations greater than 550 mg/kg total chromium. This number was based on a site specific leachate test for protection of groundwater. The July 1988 ROD called for extraction of groundwater from the area of greatest contamination (levels of chromium in excess of 50,000 µg/L) via extraction wells, and treatment of extracted groundwater.

Bench scale evaluation of the soils remedy by EPA after the ROD was issued revealed that the chosen stabilization method was ineffective at preventing the leaching of hexavalent chromium

from site soils. Groundwater monitoring conducted after the ROD was issued indicated that the contaminated groundwater plume was decreasing in size as down-gradient industrial supply wells located at a nearby industrial facility, FMC, were taken off line. Because new, cost-effective technologies were becoming available that provided the potential for more effective groundwater remediation, EPA reevaluated the need for pump-and-treat as the most appropriate solution for groundwater cleanup.

Since the original RODs were issued, EPA continued to monitor groundwater and soils, and evaluate new, innovative cleanup technologies to address the persistently high concentrations of chromium in soils and groundwater at the FHC site. In May 2000, EPA finalized a Focused Feasibility Study (FS) which identified and evaluated several new and innovative technologies for addressing the contamination at the site. One of the promising new in-situ treatment technologies identified in the Focused FS, In-Situ Redox Manipulation, or ISRM, was further evaluated in a bench scale test in February 2001. The results of the bench scale test indicated that the technology would be appropriate for use at the FHC site.

In June 2001, EPA issued a Proposed Plan to amend the two existing RODs. The Proposed Plan identified in-situ treatment for both soils and groundwater, using reducing compounds as EPA's Preferred Alternative. The public comment period for the Proposed Plan ended on 25 July 2001. The ROD Amendment was signed in August 2001.

Cleanup levels specified in the ROD Amendment are provided in the following table.

**Summary of Cleanup Levels**

| Medium | Chemicals of Concern | Cleanup Levels | Source of Cleanup Level |
|---|---|---|---|
| Groundwater | Total Chromium | 50 µg/L | MTCA A |
| Soil | Hexavalent Chromium | 19 mg/kg | MTCA A |
| | Trivalent Chromium | 80,000 mg/kg | MTCA B |

MTCA A = Model Toxics Control Act, Method A is set by the Washington State of Department of Ecology. Values are set for unrestricted future use. A value of 100 µg/L may be used if the chromium in groundwater is trivalent chromium.

MTCA A for hexavalent chromium in soils is established for the protection of groundwater. Values are set for unrestricted future use

MTCA B for trivalent chromium is established for human health protection through direct contact.

To meet the above cleanup goals, the ROD Amendment specified the following remedy:

- *Contain Highly-Contaminated Groundwater:* Containment of the most heavily contaminated groundwater at the site, or groundwater hot spot will involve the delivery, through injection or augering/injection, of reducing compounds on the down-gradient side of the soils source area, into the groundwater and soils. The compounds delivered to the area will reduce the naturally occurring iron, thereby creating an in-situ treatment barrier which reacts directly with the chromium in groundwater. As chromium-contaminated groundwater moving down-gradient passes through the permeable reactive zone, the hexavalent chromium in the groundwater is reduced to trivalent chromium, which is insoluble, and non-mobile.
- *In-Situ Treatment of Source Area Soils and Groundwater Hot Spot:* In-situ treatment of the soils source area and the groundwater hot spot will involve the delivery of reducing compounds directly to site soils exceeding 19 mg/kg hexavalent chromium (soils source area) and contaminated groundwater with concentrations of hexavalent chromium exceeding 5,000 µg/L by augering/injecting or through injection wells.
- Once the source area for soils (exceeding 19 mg/kg hexavalent chromium) and groundwater (exceeding 5,000 µg/L hexavalent chromium) have been treated, remaining groundwater exceeding the state groundwater cleanup standard of 50 µg/L (MTCA Method A, total chromium) is expected to disperse and dilute. Regular monitoring of down-gradient groundwater to ensure dilution and dispersion of affected groundwater outside of the source area would be conducted until all remaining groundwater meets state standards for groundwater cleanup.
- Institutional controls and monitoring will be implemented to protect human health and the environment during the time required for dispersion and dilution to reduce chromium concentrations in plume areas outside of the hot spot. Monitoring of existing wells will also be needed to track the concentrations in groundwater over time. EPA and Ecology will also work with the Health Department to ensure that groundwater is not utilized in or near the groundwater plume. Deed notices will be placed on the parcels of property where source area treatment took place including EPA notice of any excavation of soil on the property.

C. Remedial Action

Remedial Action took place in several phases: building demolition to clear the source area for later treatment, ISRM wall installation to contain any chrome leaving the source area during and after treatment, and source area treatment for the hot spot itself. These three phases are discussed below.

<u>Building Demolition</u>

Frontier Hard Chrome and Richardson Building (Figure 1-2) materials were characterized for hazardous materials prior to demolition. A lead based paint and asbestos survey was completed by a company certified to perform both surveys.

Concrete floor samples were collected from both buildings and analyzed for Total Petroleum Hydrocarbons (TPH), Polychlorinated Biphenyls (PCBs) and metals (totals and TCLP). TPH was analyzed using Method NWTPH-Dx. PCBs were analyzed using EPA Method 8082. Metals were analyzed using Method 6010B/7471A.

The Frontier Hard Chrome Building had approximately 6,800 square feet of floor slab. Twenty-one (21) samples were collected from the floor slab to characterize it for disposal. The Richardson Building had approximately 10,100 square feet of floor slab. Nine (9) concrete samples were collected for disposal characterization. Floor samples were collected where evidence of contamination was present. TCLP analyses were run where the totals metals concentrations were such that the materials could have the toxicity characteristic. TCLP lead analyses were also run on the metal siding of the Richardson Building that tested high in lead. None of these siding samples failed TCLP. Based on the sample results, the extent of the hazardous floor slab concrete and other building materials was well defined and passed scrutiny of the receiving landfills.

Dust was minimized by controlling debris during demolition and using water when needed. Real time dust monitoring was completed; although there were times when the instantaneous dust level exceeded the 2.5 $mg/m^3$ target level, the time weighted average concentration was well below the target level. The maximum 8 hour time weighted average dust concentration during building demolition was 0.63 $mg/m^3$.

Particulate air samples were collected and analyzed to ensure dust controls were adequate to control exposure to the surrounding industrial facilities. All samples were below levels of concern.

In addition to the hazardous materials disposed of off-site, over 1180 tons of non hazardous concrete and metal debris were recycled. Work took place between January 29 and May 14, 2003.

ISRM Wall

A pilot scale test of the ISRM technology was completed to determine design information. Prior to wall installation, baseline sampling was performed (June 2002) in the area where the pilot scale test was to be completed. The 3 wells with the highest groundwater hexavalent chromium content had concentrations ranging from 2,000 to 4,500 ug/L. Approximately 2 months after the pilot scale test was completed (December 2002), the final round of pilot scale test performance groundwater sampling was performed. Concentrations of hexavalent chromium in these same wells were non-detectable.

Seven pairs of injection wells were installed during ISRM Wall Installation. These wells were installed by Washington State licensed well drillers in accordance with WAC 173-162 Regulation and Licensing of Well Contractors and Operators.

Each pair of wells included a deep well (screened from 28 to 33 feet below ground surface) and a shallow well (screened from 23 to 28 feet below ground surface). Each well screen was carefully measured during installation; the screens were installed to within 3-8 inches of their desired location. The horizontal distance between wells was also carefully measured during installation. Each well was installed to within 1 foot of its desired location. The seals in one well pair failed during testing; the replacement well pair was installed approximately 4 feet south of its design location.

Each well pair was injected with 5,000 gallons of sodium dithionite reagent. The reagent was mixed with water prior to injection such that a total of approximately 40,000 gallons were injected into each well pair (the total quantity of diluted reagent varied from well pair to well pair depending on permeation rates). Conductivity and sampling probes were installed in monitoring wells surrounding the injection wells to evaluate the radial penetration of the reagent. The injection and associated monitoring was completed by Pacific Northwest National Laboratory (PNNL), the technology developer. PNNL completed the technical aspects of the ISRM wall installation to ensure quality control and performance requirements were met.

Installation of the ISRM Treatment Wall met performance requirements. Based on monitoring during installation, no significant gaps in the treatment zone are present. The treatment wall is approximately 240 feet long and greater than 33 feet deep. The treatment zone extends from approximately 22 feet below ground surface to the bottom of the wall. The exact bottom of the treatment zone is not known due to sinking of the reagent but is likely significantly deeper than the 33 foot installation depth.

Recovery of the injected reagent was initially attempted. Recoveries of approximately 5 to 15 percent were achieved. Recovery efforts were abandoned after the first two well pair injections due to the high cost and little benefit gained.

Work on the ISRM wall was completed between April 21 and August 10, 2003. Based on the current available field information and the pilot scale test that was conducted, EPA believes that the wall is working appropriately and that it will allow for the attainment of the groundwater cleanup levels and the remedial action objectives for the site.

Source Area Treatment

A number of reducing reagents were successfully tested on the bench scale with site soils and groundwater prior to commencing full scale treatment and selection of a reagent. Treatment of hexavalent chromium in the source area soil and groundwater was completed by using in-situ

soil mixing equipment to mix a proprietary reducing agent into the subsurface soils and groundwater. Treatment areas were located and staked using survey equipment.

Treatment depths varied from 20 to 33 feet below ground surface. The stem of the auger had depths marked in 1 foot increments. Attainment of the desired treatment depth was confirmed by checking the penetration depth using the depth markings. Weston Solution Inc. continuously checked the work and maintained a daily log progress. Quality control checks consisted of treatment location, depth and quantity of reagent used.

Confirmatory soil and groundwater sampling was also performed. This sampling was done to confirm treatment requirements were met. Sampling was performed using a Geoprobe rig for a minimum of 4 days after treatment occurred to allow equilibrium of subsurface conditions.

Samples were collected at a minimum rate of one soil sample for approximately 500 cubic yards of soil treated. Sample depths varied and samples were generally collected at a depth of 1/3 and 2/3 in the treated column. Groundwater samples were collected in the middle of the water column at a frequency of every 1600 square feet. In several areas, groundwater was not present in the area treated. This likely was the result of the cement added to the treated soil which made the soil much less permeable as well as the dry summer which lowered the water table.

Overall, the technology performed as required. Sampling data from the source area indicate that the soil treatment goals set out by the amended ROD for soil and groundwater were met. Only one area had to be retreated due to failure of treatment criteria. Area O19 initially had a hexavalent chromium concentration of 26 mg/kg after treatment; the area was retreated and resampled. Hexavalent chromium in the area after retreatment was not detected. Samples were analyzed using Hach field colorimetric test kits. Duplicate samples were sent to an off-site laboratory for confirmation.

Source area treatment work was completed between June 9 and September 15, 2003. At completion, soils in the treated area were compacted and graded to allow for ease of redevelopment of the property. There are redevelopment plans for the property contingent on a perspective purchaser agreement, which has not yet been signed.

Institutional Controls

Deed notices are being put in place at this time to ensure that EPA is notified if subsurface soils are disturbed and to require approval for work requiring any off-site disposal. It is expected that a number of years of groundwater monitoring will need to take place along with public notices regarding the status of the plume as well as periodic checks to ensure that the groundwater is not being utilized in the nearby area. Through ongoing monitoring of the groundwater plume, EPA will determine when the RAO is met for groundwater.

In conclusion, the physical construction of all cleanup actions are complete and the data

available indicate that the treatment of the source area has been successful. In addition, the ISRM wall offers redundancy to the treatment approach utilized for the hot spot to ensure that nothing other than routine adjustments and monitoring will be necessary for this remedial action.

## III. Demonstration of Cleanup Activity Quality Assurance and Quality Control (QA/QC)

The remedial actions for the site were consistent with the RODs as amended. Work Plans issued to contractors for design and construction for remedial actions included Quality Assurance Project Plans, which included EPA quality assurance and quality control procedures and protocols. Weston, EPA's contractor, the EPA site manager, and the Ecology site manager performed oversight of remedial actions conducted to ensure the work was in conformance with approved plans and specifications. Oversight included onsite observations of work and review of project submittals.

## IV. Activities and Schedule for Site Completion

A chronology of events planned for the Frontier Hard Chrome Site is provided below**.**

| Task | Estimated Completion | Responsible Organization |
|---|---|---|
| Groundwater Monitoring | Groundwater monitoring will begin quarterly thru approximately September 2005; then be reduced to biannually thru September 2007, and lastly be performed annually until RAOs are met. | EPA (prior to O&F) / Ecology (after O&F) |
| Operational and Functional determination / Interim Remedial Action Report | 2004 | EPA/Ecology |
| Institutional Controls | Being put in place now; 2005 | EPA/Ecology/County Health Department |
| Five Year Review | January 2008 | EPA |
| Final Remedial Action Report | 2013 | EPA |
| Final Close Out Report | 2013 or later | EPA |
| Site Deletion | 2014 or later | EPA |

## V. Summary of Remediation Costs

Project design and construction costs are summarized below.

| Item | Cost ($) |
|---|---|
| Design | 185,000 |
| ISRM Bench and Pilot Scale Test | 250,000 |
| Property Purchase | 200,000 (est.) |
| Building Demolition | 310,000 |
| ISRM Wall Installation | 1,178,000 (est.) |
| Source Area Treatment | 2,931,000 (est.) |
| Total Cost | 5,054,000 |

Costs are in 2003 dollars

Total estimated project costs compared to the ROD estimates are provided below.

| Cost Item | ROD Estimate[A] (2000 $$) | ROD Estimate[B] (2003 $$) | Actual Cost (2003 $$) |
|---|---|---|---|
| Design | 177,000 | 193,400 | 185,000 |
| RA Capital Cost | 3,143,200 | 3,435,600 | 4,869,000 |
| RA Operating Cost | 0 | 0 | 0 |
| Total RA Cost | 3,320,200 | 3,629,000 | 5,054,000 |
| Projected O&M Costs | 306,600 | 335,100 | 212,000[C] |
| Total Cost | 3,626,800 | 3,964,100 | 5,267,000 |

Notes:

A: Cost breakdown obtained from the Focused Feasibility Study.

B: 2003 costs were adjusted from 2000 to 2003 using a 3% annual inflation rate.

C: Groundwater monitoring costs. Based on quarterly sampling for the first 2 years and annual sampling for the remaining 15 years.

The actual project cost was approximately 33% greater than the Record of Decision estimate. Actual project cost variations from the Record of Decision estimate is primarily due to the following factors:

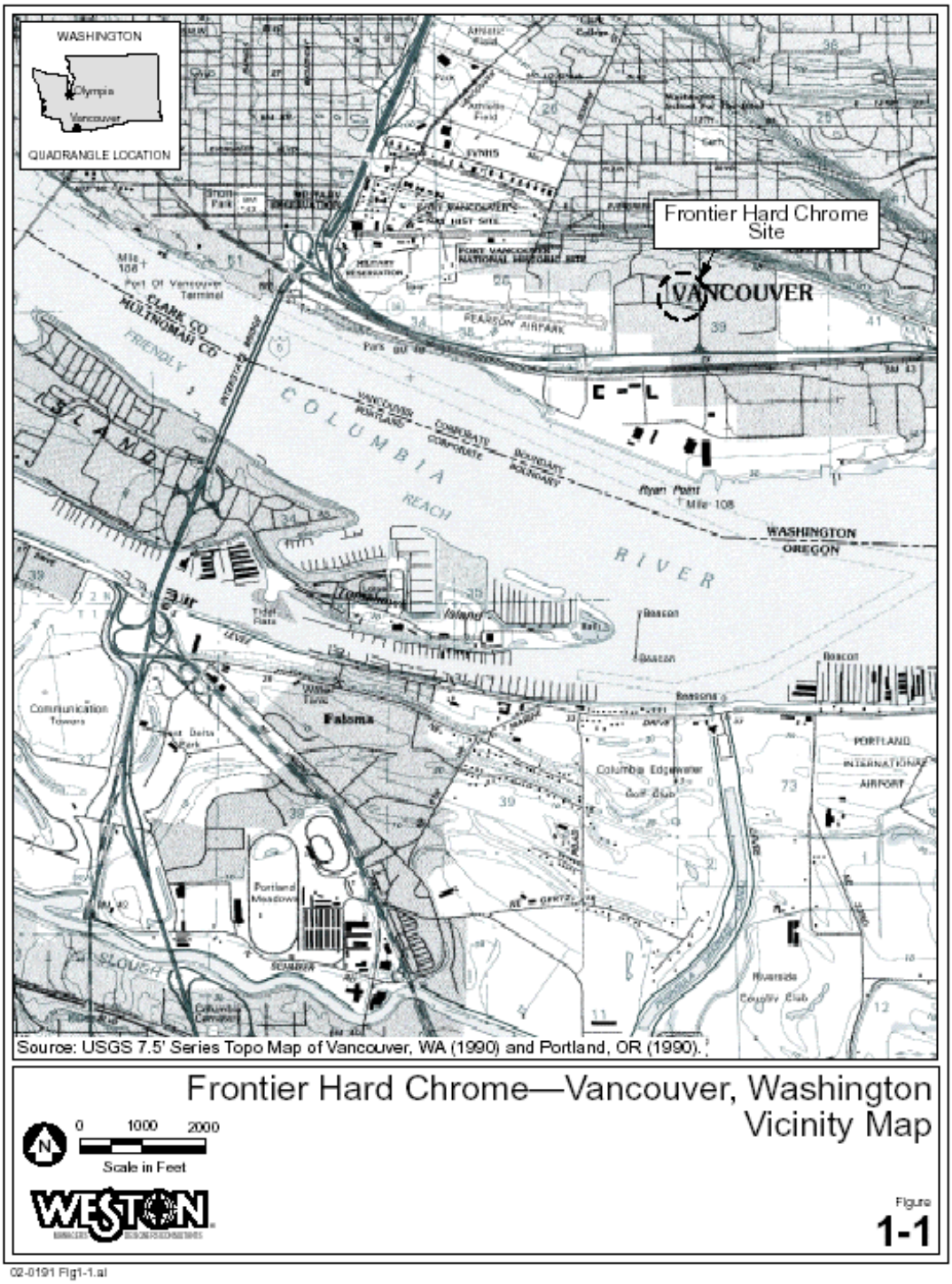
- An ISRM pilot scale test was performed during the design phase which was not included in the ROD estimate.
- A significant portion of the FHC building was hazardous waste which increased disposal costs. In addition, building demolition was performed as an environmental project requiring stricter controls than a standard demolition project.
- Complications in treating the Source Area soil and groundwater due to buried debris were underestimated. Buried debris removal and disposal costs were not considered significant in the ROD.
- Acceleration of the project schedule to ensure completion during the 2003 construction season added a project constraint which may have increased cost.

## VI. Five Year Review

Upon completion of this remedy, hazardous substances will remain on site above levels that allow for unrestricted use and unrestricted exposure. Thus, Five-Year Reviews will be conducted pursuant to OSWER Directive 9355.7-03B-P "Comprehensive Five-Year Review Guidance," dated June 2001. A Five-Year Review will be conducted by January 2008.

_____//s//_____ ____September 22, 2003_____
Michael F. Gearheard, Director Date
Office of Environmental Cleanup

## FIGURES

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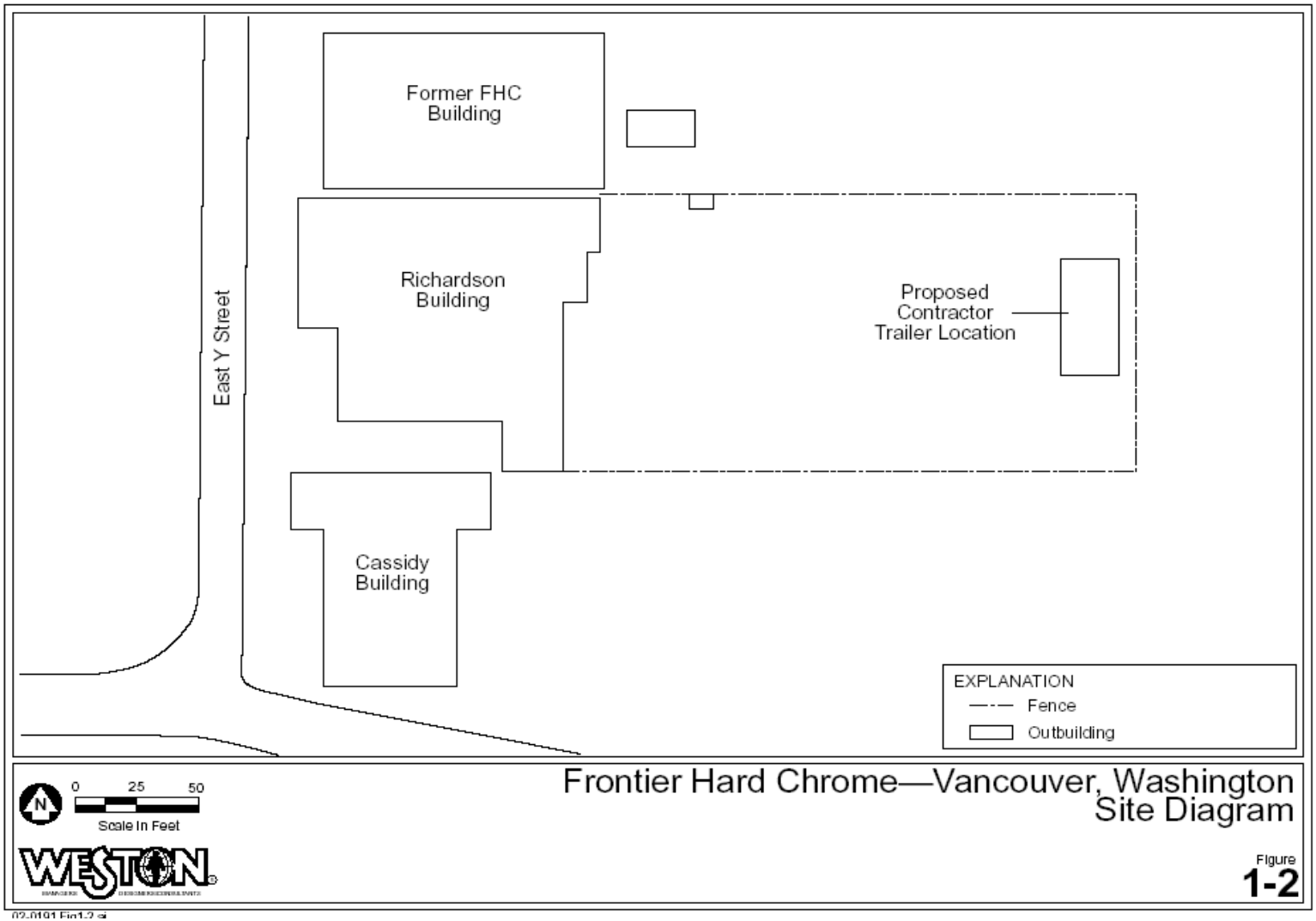
Former FHC
Building
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Contractor
Trailer Location
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EXPLANATION
Fence
Outbuilding
N
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25
50
Scale In Feet
WESTON
Frontier Hard Chrome—Vancouver, Washington
Site Diagram
Figure
1-2

**FHC Preliminary Closeout Report Concurrence**

| | Sheldrake | Byrne | Croxton | Fonseca |
|---|---|---|---|---|
| **Initial** | | | | |
| **Date** | | | | |

**EXHIBIT 3-3, Preliminary Close Out Report Summary**

| SECTION | CONTENTS |
|---|---|
| I. Introduction | • Include general statement indicating date of pre-final inspection and a statement that contractors or agencies have constructed the remedies in accordance with remedial design plans and specifications. |
| II. Summary Of Site Conditions | • Provide background summary of site location, site description, and NPL listing information.<br>• Describe any removal action activities at the site.<br>• Include remedies selected, date RA initiated, method used to implement RA (e.g., consent decree, contract, cooperative or other agreement), and date and description of pre-final inspections used to determine that construction is complete.<br>• If implemented, summarize details of the institutional controls (e.g., the type of institutional control, who will maintain the control, who will enforce the control).<br>• Describe redevelopment potential at the site, or any planned or ongoing redevelopment work. |
| III. Demonstration Of Cleanup Activity QA/QC | • Document that the construction quality assurance / quality control plan was implemented and that construction completion is consistent with the ROD and remedial design plans and specifications. |
| IV. Activities And Schedule For Site Completion | • Identify activities remaining in order to:<br>- Assure effectiveness of the remedy (e.g., institutional controls, work plan for operation and maintenance),<br>- Assure consistency with the NCP (e.g., joint EPA / State inspection, operational and functional determination),<br>- Satisfy requirements for site completion (e.g., Final RA Report).<br>• Specify the organization responsible for implementation of each activity.<br>• Set dates for completion of the activities and elements required to satisfy NCP and procedural requirements for issuing a FCOR and reaching site completion. |
| V. Summary of Remediation Costs | • Report for each operable unit:<br>- ROD estimate of capital costs and annual O&M costs,<br>- Construction contract award amount. |
| VI. Five-Year Review | • State whether a five-year review is required, what type of review is required (statutory or policy), and when scheduled. |