



SECOND PERIODIC REVIEW REPORT FINAL

**Centralia Landfill
Facility Site ID#: 1154**

**1411 South Tower Road
Centralia, Washington 98531**

**Southwest Region Office
TOXICS CLEANUP PROGRAM**

January 2016

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1.0 INTRODUCTION

This document is a review by the Washington State Department of Ecology (Ecology) of post-cleanup site conditions and monitoring data at the Centralia Landfill. The Washington State Department of Ecology (Ecology) is the lead agency for cleanup of Centralia Landfill as stipulated by an agreement with Region 10 of the Environmental Protection Agency (EPA). Accordingly, cleanup at this Site was implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC)

The purpose of this periodic review is to determine whether the cleanup remedy at the City of Centralia's Landfill Superfund Site (Site) continues to be protective of human health and the environment. The first periodic review for this Site was conducted in September 2010.

Cleanup activities at this Site were completed under Cleanup Action Plan Consent Decree No. C91-5100 (T) WD (CD) between Ecology, Lewis County, the City of Chehalis, the City of Centralia, the City of Morton, the City of Mossyrock, the Town of Pe Ell, and the City of Vader, as executed in 2001. Additional filings were made under this Consent Decree to include a Remedial Investigation/Feasibility Study (RI/FS) and Cleanup Action Plan (CAP). The cleanup actions were necessary because of arsenic and manganese concentrations in groundwater. In addition, the remedy involved the containment of hazardous materials typically found in municipal solid waste landfills. Contaminants remaining at the Site exceed MTCA cleanup levels. The MTCA cleanup levels for soil are established under WAC 173-340-740. The MTCA cleanup levels for groundwater are established under WAC 173-340-720.

WAC 173-340-420 (2) requires that Ecology conduct a periodic review of a site every five years under the following conditions:

- (a) Whenever the department conducts a cleanup action.
- (b) Whenever the department approves a cleanup action under an order, agreed order or consent decree.
- (c) Or, as resources permit, whenever the department issues a no further action opinion (NFA).
- (d) and one of the following conditions exists:
 - 1. Institutional controls or financial assurance are required as part of the cleanup.
 - 2. Where the cleanup level is based on a practical quantitation limit.
 - 3. Where, in the department's judgment, modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors the department shall consider include [WAC 173-340-420(4)]:

- (a) The effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the Site.
- (b) New scientific information for individual hazardous substances or mixtures present at the Site.
- (c) New applicable state and federal laws for hazardous substances present at the Site.
- (d) Current and projected Site use.
- (e) Availability and practicability of higher preference technologies.
- (f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

The department shall publish a notice of all periodic reviews in the Site Register and provide an opportunity for public comment.

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site Operational History

The Centralia Landfill is a closed municipal solid waste landfill located in the City of Centralia, Lewis County, Washington, in Section 17, Township 14N, and Range 2W of the Willamette Meridian. A vicinity map is available as Appendix 6.1. The unlined Landfill operated from 1958 until April 1, 1994. Originally, the Landfill encompassed adjacent property that is currently owned by the Centralia Christian School [formally owned by the Centralia Holding Corporation (CHC)] and Harold and Mary Vassar (Vassar), as well as the City of Centralia]. Because refuse has been placed on all three parcels of land, this area constitutes the Site.

The City of Centralia began operating the unlined Landfill in 1958. The closed Northend portion of the Landfill was filled from 1958 to 1965 using the "trench fill" method. With this method, trenches were excavated an estimated 40 feet wide by 300 feet long by 7 feet below ground surface (bgs). Waste was placed in the trenches and covered with 2 to 3 feet of soil. After completion of filling in the closed Northend area, the trench fill method continued in the northeast, southeast, and southwest areas and a final cover was placed over these areas in 1978; subsequently the operation was changed to an "area fill" method. With this method, waste was placed in lifts 3 to 8 feet thick above the ground surface, compacted, and covered with daily or intermediate cover soil of 0.5 to 1 foot thick. The area fill method continued over all of the Final Cover Area until the Site stopped accepting waste on April 1, 1994. A total of about 55 acres of the 87-acre Site have received the solid waste. The Final Cover Area encompasses about 46 acres and the Closed Northend area consists of about 12 acres. A Site plan is available as Appendix 6.2.

The Closed Northend Landfill refers to the northernmost fill area of the Site and is a separate fill area from the Final Landfill Closure Area. Filling in the Closed Northend Landfill area was completed prior to promulgation of solid waste regulations by Ecology in 1972 (Chapter 173-301 WAC). Lewis County Environmental Services determined in 1987 that this area was closed in compliance with WAC 173-301-611 for abandoned disposal sites. When the Landfill stopped accepting the waste in 1994, it received final closure with a permanent cover system.

To accommodate waste disposal after closure of the Landfill, the Lewis County Central Transfer Station facility was constructed on the Closed Northend Landfill and began operation in 1994. In addition to the transfer station, the facility includes an administrative office building and a moderate risk waste facility (Hazo-Hut). Administrative Building No.1 and the Hazo-Hut were completed in 1996 and 1997, respectively. During the operational history of the Site, two other structures were built on or adjacent to the Closed Northend Landfill. In 1977, the City of Centralia sold 5 acres of Landfill property to United Graphics, Inc. On this property, a building was constructed immediately north of the waste boundary of the Closed Northend Landfill to house a check printing facility that operated until its closure in 1997. The Centralia Christian School purchased the property in March 1999 and opened a school. In about 1980, the City sold 1-2/3 acres of the Closed Northend Landfill property to Harold and Mary Vassar. The Vassar's

constructed a metal-framed building on the east side of the property and began operating a petroleum equipment servicing and underground storage tank removal company.

2.2 Regulatory History

Several regulatory actions led to the negotiation of a CD with Ecology requiring completion of a RI/FS and a CAP for the Centralia Landfill. These actions included:

- **Preliminary Assessment.** A potential hazardous waste Site Preliminary Assessment (PA) was conducted in October 1985 by Ecology in conjunction with the U.S. Environmental Protection Agency (EPA) to make an initial evaluation of the potential risk posed by the Site and to recommend possible additional actions.
- **Site Inspection.** EPA conducted a site inspection (S1) in 1986 because the PA screening indicated additional information was required to accurately profile the impact from landfill-derived contaminants on adjacent surface water and ground water.
- **Preliminary Health and Resource Assessment.** The U.S. Public Health Service Agency for Toxic Substances and Disease Registry (ATSDR) visited the Landfill on March 16, 1989, and issued a preliminary health assessment in April 1990.
- **National Priorities List.** On the basis of the PA and SI, the Centralia Landfill was scored in accordance with the federal Hazard Ranking System (HRS) and was determined to be a hazardous waste site resulting in the placement of the Site on the federal National Priorities List (NPL) and the Washington State Hazardous Sites List (HSL) in August 1990. At this time, Ecology was designated the lead agency for Site cleanup.

After the Centralia Landfill was listed on the NPL and HSL, Ecology, the Centralia Landfill Closure Group (CLCG), Vassar, and CHC entered into two consent decrees for the completion of interim actions and an RI/FS. The CLCG was formed under an inter-local agreement to oversee the remediation of the Site and is composed of the following jurisdictions: Lewis County, the City of Centralia, the City of Chehalis, the City of Morton, the City of Mossyrock, the City of Vader, and the Town of Pe Ell. In 1991, the CLCG, Vassar, and CHC entered into a CD (C91-5100) with Ecology to implement an interim action (hereafter termed the First Interim Action), which involved installing a temporary geomembrane cover and utilizing existing low-permeability soil cover over portions of the landfill that had achieved final grade, installing a landfill gas collection system and temporary exhaust flare facility, installing a temporary leachate seep collection system associated with the temporary cover, upgrading surface water and erosion-control facilities, and constructing a fence around most of the Landfill property. In addition, a comprehensive leachate study was developed and conducted in 1992 and 1993 pursuant to the First Interim Action. The purpose of this study was to identify and evaluate near- and long-term leachate treatment and disposal options.

In March 1993, the CLCG, Vassar, and CHC entered into the RI/FS Consent Decree with Ecology. The RI/FS CD specifies the process whereby the CLCG is to conduct the RI/FS and

Ecology prepared a CAP for the Centralia Landfill. Ecology and the CLCG mutually agreed to delay the work on RI/FS to focus on completing the Landfill final cover system.

In 1994 the Landfill stopped accepting waste, and Ecology, the CLCG, Vassar, and CHC amended the Interim Action CD to include the implementation of a permanent landfill cover system over the Final Cover Area, as an interim cleanup action at the Landfill. The final cover system was designed and construction was completed by the end of 1995. The Landfill final cover system consists of a low-permeability composite cap placed over the refuse and associated engineering controls necessary to protect its integrity. These controls address:

- Surface water run-on/runoff and erosion
- Landfill gas collection and treatment
- Access restrictions

Remedial Investigation began in May 1996 and continued through June 1997. The field investigations included the installation of seven new groundwater monitoring wells, and sampling and analysis of groundwater, surface water, and sediment at the Site. A domestic well use survey was performed to determine the number and location of domestic supply wells within a one-mile radius of the Landfill. Five domestic wells located downgradient and/or cross gradient from the Landfill were sampled. The quality of groundwater from these wells did not appear to be impacted by Centralia Landfill. However, elevated levels of inorganic water quality parameters and metals were present in surface water and groundwater at the Site. Quarterly groundwater, surface water, and landfill gas monitoring are continuing at the Site in accordance with the Washington State Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC).

2.3 Landfill Closure

The final landfill cover was placed in 1994 as an Interim Action. The final landfill cover consisted of a composite geomembrane and low-permeability soil barrier layer, a drainage layer, and a vegetative soil layer. The final cover system was designed to eliminate infiltration of precipitation into refuse at the Site, and direct clean surface water runoff into a wetland enhancement and mitigation area south of the Landfill. In addition to the final cover system, a permanent landfill gas collection system was installed beneath the final cover, and a permanent landfill gas flare system was installed adjacent to the Landfill entrance facilities for gas treatment. Perimeter fencing was completed around the Landfill to enclose all of the Final Cover Area and much of the Closed Northend Landfill. The Landfill was closed according to the requirements of the Washington State Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC). In addition, closure of the Landfill was an interim remedial action under MTCA.

The final remedial action was selected in 1999 as part of the CAP prescribed in the CD. The selected action determined that the closed Landfill would continue to be managed as required by the Washington State Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC) and the Ecology approved operation & maintenance (O&M) manual. Post-closure activities include continued O&M of the landfill gas control system, maintenance of the final cover and surface

water control systems, and monitoring of groundwater and surface water. In addition, a wetlands mitigation plan would continue to be implemented. The selected action also provided for institutional controls and compliance monitoring. Institutional controls included establishment of Ecology-approved restrictive deed covenants to protect the final cover system and associated engineering controls. Monitoring would include the preparation and implementation of an Ecology-approved compliance monitoring plan that meets MTCA requirements and includes supplemental background groundwater monitoring.

2.4 Cleanup Levels

Cleanup levels for surface water and groundwater were established using MTCA Method B (WAC 173-340-705) which references to applicable, relevant and appropriate requirements (ARARs) based on applicable state and federal laws in addition to providing methods for calculating cleanup levels on the basis of toxicity or carcinogenic risk.

2.4.1 Surface Water Cleanup Levels

A surface water cleanup level for arsenic of 0.27 micrograms per liter ($\mu\text{g/l}$) was calculated based on background concentrations. However, 0.27 $\mu\text{g/l}$ is less than the practical quantitation limit (PQL). The PQL is the lowest concentration that can be reliably measured during routine laboratory operating conditions, using Ecology approved methods. In these cases when the cleanup level is less than the PQL, the cleanup level may be considered to be attained if the parameter is undetected at the PQL. The current PQL for arsenic is 0.5 $\mu\text{g/l}$, and is defined as the compliance level for arsenic in surface water. Iron and manganese are other contaminants of concern for surface water at the Site. Since there are no surface water ARARs for iron or manganese, surface water cleanup levels are not needed for these parameters. A table of cleanup levels is available in Appendix 6.3.

2.4.2 Surface Water Point of Compliance

MTCA requires that the point of compliance for surface water be the point at which hazardous substances are released to surface waters of the state [WAC 173-340-730 (6)]. For the Centralia Landfill, the point of compliance for surface water is monitoring station SW-14, which is located in Weyerhaeuser Ditch at the southwest corner of the Site. This location is at a point just before flows into Weyerhaeuser Ditch pass the Site property boundary and discharge into the Salzer Creek.

2.4.3 Groundwater Cleanup Levels and Point of Compliance

Under WAC 173-340-720(1)(a), cleanup levels for groundwater are established on the basis of the highest beneficial use of the affected groundwater and the reasonable maximum exposure expected to occur under both current and potential future Site use conditions. The highest beneficial use of groundwater from both the Upper Unit and the Lower Unit is for drinking water. Therefore, cleanup levels are established based on exposure to hazardous substances via ingestion of drinking water. In addition, contaminant concentrations in the Upper Unit must also

protect nearby surface water because Upper Unit groundwater discharges to Weyerhaeuser Ditch and Salzer Creek. Cleanup levels for contaminants in the Upper Unit are established using MTCA Method B for groundwater and surface water [WAC 173-340-720(3) and WAC 173-340-730(3)]. Cleanup levels for contaminants in the Lower Unit are established using MTCA Method B for groundwater [WAC 173-340-720(3)].

2.4.3.1 Upper Unit Cleanup Levels

Since this unit discharges into surface water near the Site, surface water and groundwater ARARs were considered to establish cleanup levels. Surface water ARARs were more stringent than groundwater ARARs for arsenic and were used to establish the cleanup level for arsenic. As discussed above, a compliance level of 0.5 µg/l is used for arsenic. Groundwater ARARs are the most stringent ARARs for the other contaminants. Cleanup levels for chloride, manganese, pH, sulfate, total dissolved solids, iron and zinc are established based on federal and state secondary maximum contaminant levels (MCLs) for drinking water, which are the most stringent groundwater ARARs for these parameters. A list of cleanup levels for the Site is available as Appendix 6.3.

2.4.3.2 Lower Unit Cleanup Levels

Since this unit does not discharge to surface water near the Site, only groundwater ARARs were used to establish cleanup levels. Cleanup levels for manganese and iron are established based on federal and state secondary MCLs for drinking water. Since there is only one background monitoring well in the Lower Unit, continued and expanded background monitoring is needed to determine if background contaminant concentrations are higher than the cleanup levels established for the Lower Unit. If background concentrations of arsenic, iron, and/or manganese are higher than cleanup levels, background based alternative cleanup levels will be established in accordance with MTCA guidance. A table of cleanup levels is available in Appendix 6.3.

2.1.1.3 Groundwater Point of Compliance

The point of compliance for groundwater cleanup at the Centralia Landfill will be the existing property boundary.

2.5 Surface and Groundwater Conditions

2.5.1 Surface Water Conditions

Salzer Creek receives surface water discharge from the Weyerhaeuser Ditch, which receives runoff from the landfill surface. As per the requirements of cleanup action plan (CAP)/CD, surface water sampling is being done biannually, first in March during the wet season and then again in September during the dry season.

During the latest monitoring event (September 2014), surface water was not sampled at SW 14, the point of compliance location. No water was present this dry season in the Weyerhaeuser Ditch. However, during the previous biannual wet season sampling event (February 2014), the surface water was sampled at SW 14 location. Monitoring in Salzer Creek upstream and downstream of the Landfill has not revealed impacts from the Landfill. The wet season sampling results of surface water monitoring in Weyerhaeuser Ditch indicated elevated levels of total and soluble arsenic, total and soluble iron, and total and soluble manganese at SW 14, the point of compliance, down gradient of the landfill. The detected total and dissolved arsenic concentrations of 0.00103 mg/l and 0.00103 mg/l, respectively at the point of compliance, exceeded its cleanup level of 0.00027 mg/l as well as the compliance level of 0.0005 mg/l. There are no surface water cleanup levels/ARARs for iron or manganese. Total mercury was not detected (below the laboratory detection limit of 0.00002 mg/l) during this sampling event. However, mercury was detected only once during the RI but is a concern because it has been sporadically detected during historical surface water sampling and testing. Potential risks to aquatic organisms were identified for total mercury.

Historical Weyerhaeuser Ditch surface water monitoring data show that there are concentrations of total cadmium, total copper, total lead, total silver, and total zinc. However, the ARARs for these metals apply to the soluble form of the metal. Soluble metals concentrations have exceeded ARARs on only rare occasions. However, continued monitoring is being conducted on Ecology approved frequency to ensure that these metals are not present in concentrations that are an environmental concern.

The Table 1 below contains surface water parameters from the most recent surface water sampling event at SW-14 in March 2014:

Table 1: March 2014 Surface Water Data

Parameters	Units	SW-14
Dissolved Alkalinity (as CaCO ₃)	mg/l	100
Total Organic Carbon	mg/l	16
Chemical Oxygen Demand	mg/l	19
Chloride	mg/l	15
Dissolved Hardness (CaCO ₃)	mg/l	110
Ammonia Nitrogen	mg/l	0.022
Nitrate + Nitrite Nitrogen	mg/l	< 0.02
Total Dissolved Solids	mg/l	140
Sulfate	mg/l	1.86
pH		6.82
Temperature	degrees C	12.7
Conductivity	umhos/cm	250
Dissolved Oxygen	mg/l	7.78
Dissolved Metals		
Arsenic	mg/l	0.000839
Calcium	mg/l	21.7
Iron	mg/l	0.601

Mercury	mg/l	< 0.00002
Potassium	mg/l	0.909
Magnesium	mg/l	13.1
Manganese	mg/l	0.377
Sodium	mg/l	10.6
Zinc	mg/l	< 0.001

Total Metals		
Arsenic	mg/l	0.00103
Calcium	mg/l	21
Iron	mg/l	2.39
Mercury	mg/l	< 0.00002
Potassium	mg/l	1
Magnesium	mg/l	13
Manganese	mg/l	0.421
Sodium	mg/l	10.
Zinc	mg/l	0.0021

2.5.2 Groundwater Conditions

2.5.2.1 Upper Groundwater Unit

The results of groundwater monitoring in the Upper Unit during the RI indicated elevated levels of conductivity, chloride, and soluble arsenic, iron, and manganese downgradient of the Landfill. Of these contaminants, arsenic and manganese were identified as potential risks to human health from the consumption of groundwater. An analysis of risks associated with groundwater flow into surface water indicate that arsenic also poses potential risks to human health in surface water through the consumption of water and organisms. Soluble arsenic is present in upgradient Upper Unit groundwater monitoring wells, but at lower concentrations than those detected downgradient of the Landfill.

Historically, mercury has been inconsistently detected in Upper Unit groundwater monitoring wells. During the RI, four rounds of groundwater monitoring were performed. No mercury was detected in any Upper Unit monitoring wells during round 1 and round 2 of monitoring. However during round 3, mercury was detected in eight monitoring wells (including all 3 upgradient wells) at concentrations at or just above the method detection limit of 0.1 µg/l. During round 4, mercury was detected only in one well at a concentration of 0.11 µg/l. Since the RI was completed, mercury was detected only one time at a concentration exceeding the cleanup level. In May 2000, mercury was detected in monitoring well B-1S at 160 µg/l. All other sampling events at B-1S have not detected mercury above laboratory detection limits.

2.5.2.2 Lower Groundwater Unit

The results of groundwater monitoring in the Lower Unit during the RI identified elevated levels of soluble arsenic, manganese, and iron in both upgradient and downgradient monitoring wells. The range of concentrations for these contaminants is similar for upgradient and downgradient

monitoring wells. During the third round of RI groundwater monitoring, mercury was detected at or just above the 0.1 µg/l method detection limit in four of the five Lower Unit monitoring wells (including the upgradient monitoring well).

Five private supply wells identified during the domestic well use survey were sampled and analyzed during the RI. Total metals concentrations in these supply wells near the Site (two located downgradient, and three cross gradient of the Landfill) were compared to maximum contaminant levels (MCLs) for drinking water. Total iron exceeded the 300 µg/l secondary MCL in all of the water supply wells during each RI monitoring round, and total manganese exceeded the 50 µg/l secondary MCL in all but one of the water supply wells during each RI monitoring round. Total cadmium exceeded the 5 µg/l MCL in one well during one monitoring round, but was undetected during the other three rounds of RI monitoring. In addition to the five private supply wells sampled, six additional private supply wells located upgradient of the landfill were sampled and analyzed for total and soluble arsenic. Arsenic concentrations in all monitoring and supply wells exceed the 0.06 µg/l MTCA Method B cleanup level. The range of concentrations of soluble arsenic and manganese is similar in both the supply wells and Lower Unit monitoring wells. However, there appears to be higher soluble iron concentrations in the water supply wells than in Lower Unit monitoring wells. Of the contaminants identified in Lower Unit groundwater, arsenic and manganese were identified as potential risks to human health.

During the third round of RI groundwater monitoring, mercury was detected at or just above the 0.1 µg/l method detection limit in two supply wells, both located cross gradient of the Landfill. Mercury concentrations detected in Lower Unit monitoring and supply wells are well below the 2 µg/l primary MCL, which is the applicable ARAR for Lower Unit ground water.

2.6 Latest Round of Groundwater and Landfill Gas Monitoring

During the most recent biannual dry season groundwater sampling was conducted in September 2014. A total of 17 groundwater monitoring wells (11 shallow Upper Aquifer and 6 Lower Aquifer) were sampled. In addition, as part of Landfill gases monitoring a total of 14 perimeter probe locations were sampled.

As discussed in section 2.4.3 above, cleanup levels were established in the Upper and Lower Units saturated zones (aquifers) for both primary and secondary water quality standards. Results of the latest groundwater sampling for the Shallow/Upper Unit and Lower Unit are briefly discussed below:

2.6.1 Shallow/Upper Unit

- Soluble arsenic was detected in all 11 shallow monitoring wells. Arsenic concentrations in 9 wells exceed both the primary cleanup and compliance standards of 0.27 µg/l and 0.5 µg/l, respectively.

-
- Mercury was not detected at a laboratory detection limit of 0.02 µg/l in any of the wells during this round of sampling. The primary mercury cleanup level is 2 µg/l.
 - The soluble iron concentration was exceeded in four wells. Monitoring well CNE1S had the highest value of 24.7 mg/l. The soluble iron has a secondary cleanup level of 0.3 mg/l.
 - Soluble manganese was detected in all 11 wells. However, the manganese concentrations were only exceeded in 7 wells with respect to its cleanup level of 50 µg/l. The maximum manganese concentration was detected in monitoring well MW2S.
 - Conductivity was exceeded in three wells (MW2SU, CNE1S and MW2S) compared to its cleanup level of 700 umhos/cm. The maximum conductivity value (1670 umhos/cm) was detected in monitoring well MW2SU.
 - The total dissolved values of 1000 mg/l and 1200 mg/l in monitoring well MW2SU and MW2S exceeded the cleanup level of 500 mg/l.
 - Results of other parameters; chloride, sulfate, nitrate and zinc were all either below the laboratory detection limits or below their cleanup levels.

2.6.2 Lower Unit

- Dissolved arsenic was detected in all six wells. However, arsenic concentrations in three (MW3D, CNE1D and B8DR) of the six wells exceeded the cleanup level of 5 µg/l.
- The soluble iron concentration of 0.638 mg/l in monitoring well MW3D exceeded the cleanup level of 0.3 mg/l.
- Manganese concentration in all six wells exceeded the cleanup level of 50 µg/l.

The groundwater exceedences in the Shallow/Upper and Lower Units, and locations of groundwater monitoring wells are included as Appendix 6.4. The time series graphs for the parameters that exceeded the primary or secondary cleanup levels (arsenic, iron, manganese, total dissolved solids, conductivity and pH) are included as Appendix 6.5.

2.6.3 Landfill Gas Monitoring

The landfill gas collection system is composed of gas trenches, extraction wells, and collection manifolds that carry the gas to a flare facility for destruction. Gas monitoring probes located around the perimeter of the Site provide feedback on the effectiveness of the gas collection system and off site gas migration. The gas probe monitoring program includes the measurement of gas below the surface of the landfill and probes located off the Site. All 32 of gas production wells (the vertical wells and the horizontal trenches that are part of the collection system including the flare facility) still consistently produce

gas, but at much lower rate than the gas production when the landfill was closed. The landfill gas monitoring program includes the sampling of a total of fourteen perimeter probes (which indicate lateral landfill gas migration) on a quarterly basis. Only five out of fourteen perimeter probes recorded very low readings and the readings in the other nine probes were zero. Perimeter gas data collected in June and September 2014 are included as Appendix 6.6.

2.7 Environmental Covenant

An environmental covenant (EC) was recorded for the Site in 2001. It was determined that contamination at the Site posed a limited threat to human health and the environment that could be mitigated by the use of institutional controls in the form of an EC. The EC imposes the following limitations:

Section 1

- a. Existing fencing shall not be removed and shall be maintained to prevent unauthorized access to the Property.
- b. No groundwater may be extracted for any use from the Property except as groundwater removal as part of monitoring activities associated with an Ecology-approved compliance monitoring plan.
- c. An area of the Property has been designated as a wetland enhancement area. The Owner of the Property must give thirty (30) day advance written notice to Ecology of any activities that may impact the wetland enhancement area and must obtain the written approval of Ecology and other agencies of jurisdiction prior to commencement of any such activities.
- d. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Cleanup Action, or that may create a new exposure pathway, is prohibited. Such activities are permissible only if: (1) they are part of routine maintenance system requirements performed in accordance with the Centralia Landfill Second Interim Action Final Cover System Post-Closure Operations and Maintenance Manual; (2) they are allowed or required under the Centralia Landfill Cleanup Action Plan; (3) they are part of monitoring activities associated with an Ecology approved compliance monitoring plan, (4) immediate actions are necessary in response to emergency situations; or (5) Ecology provides prior written approval for such activities.
- e. No new structures shall be constructed on areas of the Property where solid waste has deposited without the written approval of Ecology and written approval by the local agency or agencies of jurisdiction.
- f. The Property shall be used only for industrial or commercial land uses, as described in WAC 173-340-740(1)(c), and defined in and allowed under the City of Centralia [or Lewis County] zoning regulations.

Section 2: Any activity on the Property that may interfere with the integrity of the Cleanup Action and continued protection of human health and the environment is prohibited without prior written approval from Ecology.

Section 3: The Owner of the Property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Cleanup Action on the Property.

Section 4: The Owner must restrict leases to uses and activities consistent with the EC and notify all lessees of the restrictions herein on the use of the Property.

Section 5: The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this EC. Ecology may approve an inconsistent use only after an opportunity for public notice and comment is provided.

Section 6: The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Cleanup Action; to take samples, to inspect remedial actions conducted at the Property, and to inspect records that are related to the Cleanup Action.

Section 7: The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and comment, concurs.

The EC is available as Appendix 6.7.

3.0 PERIODIC REVIEW

Effectiveness of completed cleanup actions

3.1.1 Soil and Direct Contact

Based upon the site visit conducted on May 27, 2015, the landfill cover appears in excellent condition. Site personnel regularly perform well-head maintenance, vegetation control on the cap surface, fence maintenance and Site security control.

The landfill cap continues to eliminate direct exposure pathways (ingestion, contact) to contaminated soils. No repair, maintenance or contingency actions have been required. A photo log is available as Appendix 6.8.

The EC for the Site was recorded and is in place. This EC prohibits activities that will result in the release of contaminants contained as part of the cleanup without Ecology's approval, and prohibits any use of the property that is inconsistent with the Covenant. The Covenant also requires fencing to restrict public access to the Site and restricts groundwater for any use other than compliance monitoring. This EC serves to assure the long term property use and integrity of the property surface.

3.1.2 Groundwater

Remedial actions at the Site appear generally protective of human health and the environment. Only arsenic exceeds primary groundwater standards at the Site. Three wells contain arsenic at a maximum concentration of 0.013 mg/L which exceeds the primary standard of 0.01 mg/L.

Many wells exceed secondary groundwater standards at the Site for chloride, iron, manganese pH and total dissolved solids (TDS). Below is a discussion of each individual contaminant of concern.

3.1.2.1 Arsenic

All wells exceed the secondary groundwater standard of 0.00005 mg/L. However, arsenic concentration in only two wells exceeded the Primary Drinking Water Standard of 0.01 mg/l. Of those wells with detectable concentrations, up-gradient and cross gradient wells contained arsenic levels equal to those down-gradient from the landfill.

3.1.2.2 Iron

Iron exceeds secondary groundwater standard of 0.3 mg/L in four wells at the Site with a maximum concentration of 24.7 mg/L. Three of the wells are on the western edge of the down-gradient pathway of the landfill and one well on the eastern edge of the landfill. As recently as March 2014, several other wells within the footprint of the landfill have exceeded the secondary standard for iron, nonetheless current concentrations remained similar without significant variation.

3.1.2.3 Manganese

Manganese exceeds secondary groundwater standards in all onsite wells except monitoring wells MW1S, MW3S, and B2SU. Up-gradient wells MW1D and MW3D, exceed the manganese secondary groundwater standard of 0.05 mg/L with concentrations of 0.5554 mg/l and 1.091 mg/l, respectively. The maximum manganese concentration detected at the Site was 8.861 mg/L in MW-2S. Manganese does not present a human health or ecological risk at the concentrations present in ground water at the Site, but could cause aesthetic problems such as staining of porcelain fixtures.

3.1.2.4 pH

pH levels were below the secondary groundwater standard in 6 wells at the Site with a minimum pH level of 5.38 (MW3S). One of the six wells (MW3S) is located up-gradient of the landfill.

3.1.2.5 Total Dissolved Solids

TDS concentrations in two wells at the Site exceeded the secondary groundwater standard of 500 mg/L with a maximum concentration of 1200 mg/L in MW-2SU. All the wells are located on the western edge of the down-gradient pathway of the landfill. Several wells down-gradient from these three wells did not contain TDS concentrations exceeding the secondary ground water standard.

Concentrations of contaminants of concern in groundwater at the Site have generally shown a downward trend since the final closure plan was implemented. Those contaminants that appear stable at elevated concentrations also appear stable at similar concentrations in up-gradient wells. Additionally, the most down-gradient wells near the property boundary that serve as points of compliance only exceed groundwater standards for arsenic and manganese, which are the same contaminants that are found in up-gradient wells at concentrations exceeding secondary ground water standards.

3.1.3 Summary

The remedy at the Centralia Landfill can be considered protective of human health and the environment with respect to refuse encapsulation, landfill gas control, surface water quality maintenance, leachate capture, and groundwater quality protection.

The presence of engineered controls in the form of fencing and a landfill cap, combined with institutional controls in the form of an EC serves to protect human health and the environment from soil or ground water contamination remaining at the Site at concentrations exceeding regulatory standards.

New scientific information for individual hazardous substances for mixtures present at the Site

Cleanup levels at the site were based on regulatory standards rather than calculated risk for chemicals and/or media. These standards were sufficient to be protective of site-specific conditions.

New applicable state and federal laws for hazardous substances present at the Site

Cleanup levels at the Site are based on current primary and secondary groundwater standards. There are no new relevant state or federal standards applicable to the Site.

Current and projected site use

The southern portion of the Site is currently occupied by the closed Centralia Landfill and the northern portion of the Site is occupied by a solid waste transfer station and commercial building. These uses are not likely to change and have a negative impact on the risk posed by hazardous substances contained at the Site.

Availability and practicability of higher preference technologies

The remedy implemented included containment of hazardous substances and it continues to be protective of human health and the environment. While higher preference cleanup technologies may be available, they are still not practicable at this Site.

Availability of improved analytical techniques to evaluate compliance with cleanup levels

The current analytical method (EPA 200.9 - Graphite Furnace Atomic Absorption Spectrometry) has a minimum MDL of 0.0005 mg/L for arsenic, which exceeds the secondary groundwater standard of 0.00005 mg/L. There are no other methods accepted for drinking water analysis with lower MDLs. The presence of improved analytical techniques would not affect decisions or recommendations made for the site.

4.0 CONCLUSIONS

- The cleanup actions completed at the Site appear to be protective of human health and the environment.
- Groundwater cleanup levels have not been met at the Site; however, under WAC 173-340-740(6) (d), the cleanup action is determined to comply with cleanup standards, since the long-term integrity of the containment system is ensured and the requirements for containment technologies in WAC 173-340-360(8) have been met.

Since the Site was a Municipal Landfill accepting only the solid waste, the model remedy, capping was selected as the remedial action. Hence the CAP does not establish cleanup levels for soil; it only establishes cleanup levels for groundwater and surface water.

- The EC for the property is in place and will be effective in protecting public health from exposure to hazardous substances and protecting the integrity of the cleanup action.

Based on this review, Ecology has determined that the remedial actions conducted at the Site continue to be protective of human health and the environment. The requirements of the EC are being satisfactorily followed and no additional remedial actions are required at this time. It is the property owner's responsibility to continue to inspect the Site to assure that the integrity of the cap is maintained. Additionally, the property owner should arrange for the collection and analysis of groundwater samples from all wells located at the Site as per the required schedule.

Next Review

The next review for the site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

5.0 REFERENCES

Ecology. *Consent Decree No. C91-5100T*. August 13, 1991.

CH2MHill. *Field Sampling Plan*. April 1996.

Ecology. *Cleanup Action Plan*. September 1999.

United States Environmental Protection Agency. *Analytical Methods Support Document For Arsenic in Drinking Water*. December 1999.

Ecology. *Cleanup Action Plan Consent Decree No. C91-5100*. May 30, 2001.

Ecology. *Restrictive Covenant*. July 28, 2001.

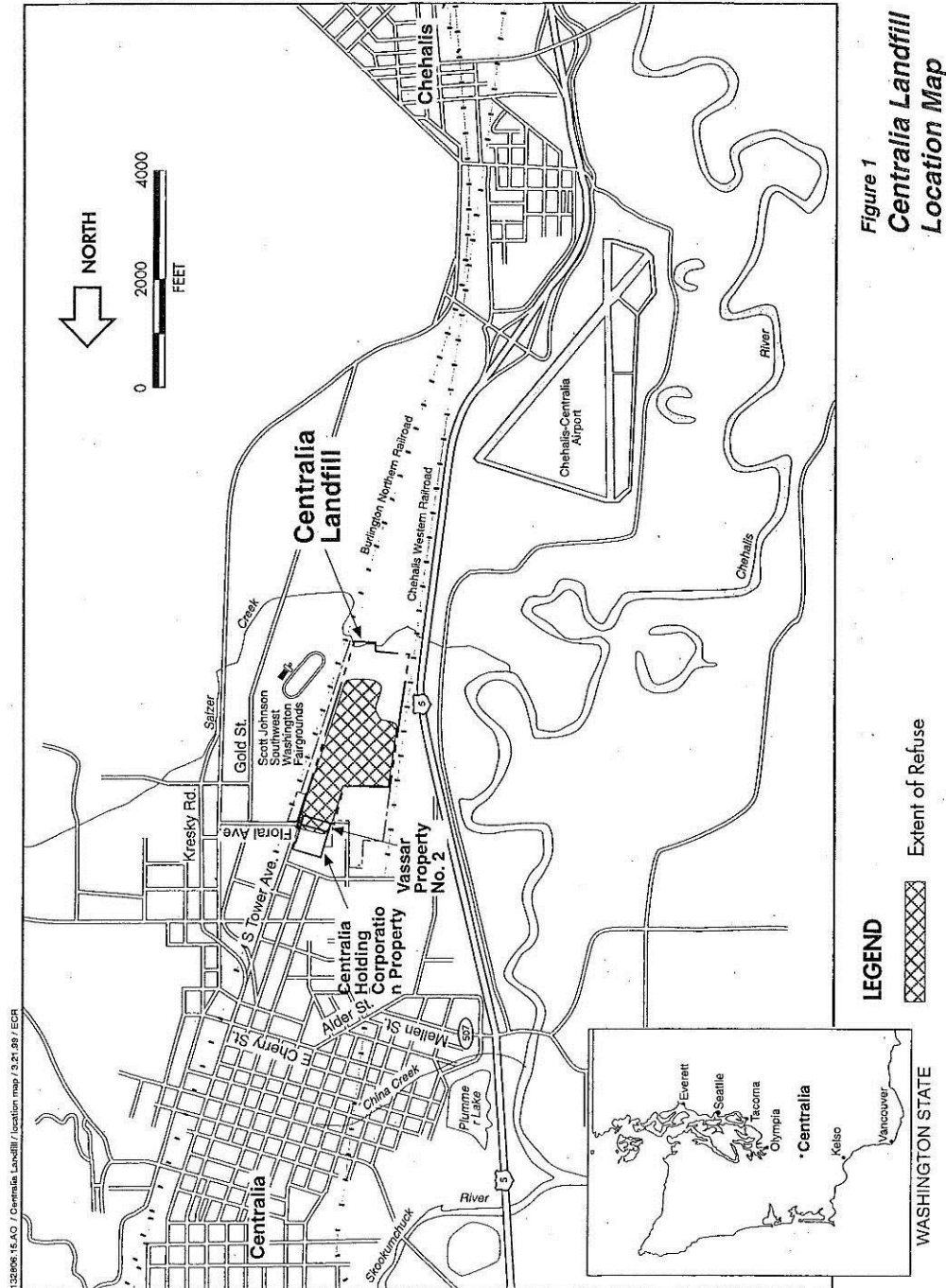
CH2MHill. *Centralia Landfill 2000 Wetland Mitigation Report*. November 26, 2001.

Centralia Public Works. *Interim Monitoring Report for the Centralia Landfill*. September 1, 2009.

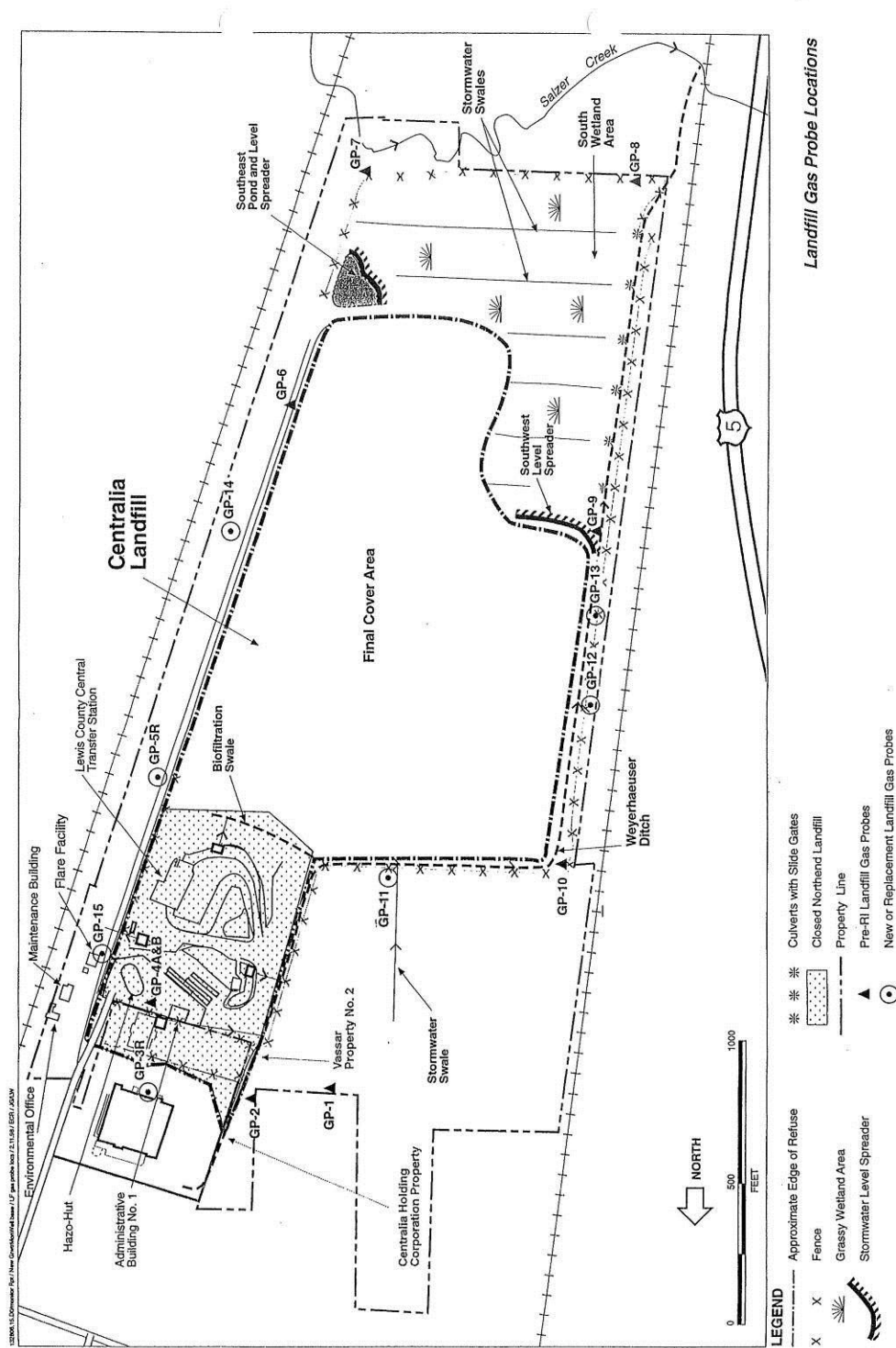
Ecology. *Site Visit*. May 27, 2015.

6.0 APPENDICES

6.1 Vicinity Map



6.2 Site Plan



6.3 Cleanup Levels

Ground Water Primary Standards:

- Arsenic has two standards: a primary drinking water standard of 0.01 mg/L and a state ground water quality standard of 0.00005 mg/L. The Washington State Primary Drinking Water standard for Arsenic changed to 10 ug/L in 2006.
- Mercury has a primary standard of 0.002 mg/L.
- Nitrate has a primary standard of 10 mg/L.

Ground Water Secondary Standards:

- Chloride has a secondary standard of 250 mg/L.
- Iron has a secondary standard of 0.3 mg/l.
- Manganese has a secondary standard of 0.05 mg/l.
- pH has a regulatory range of 6.5 to 8.5.
- Sulfate has a secondary standard of 250 mg/l.
- TDS has a secondary standard of 500 mg/l.
- Zinc has a secondary standard of 5 mg/l.

Surface Water Standards

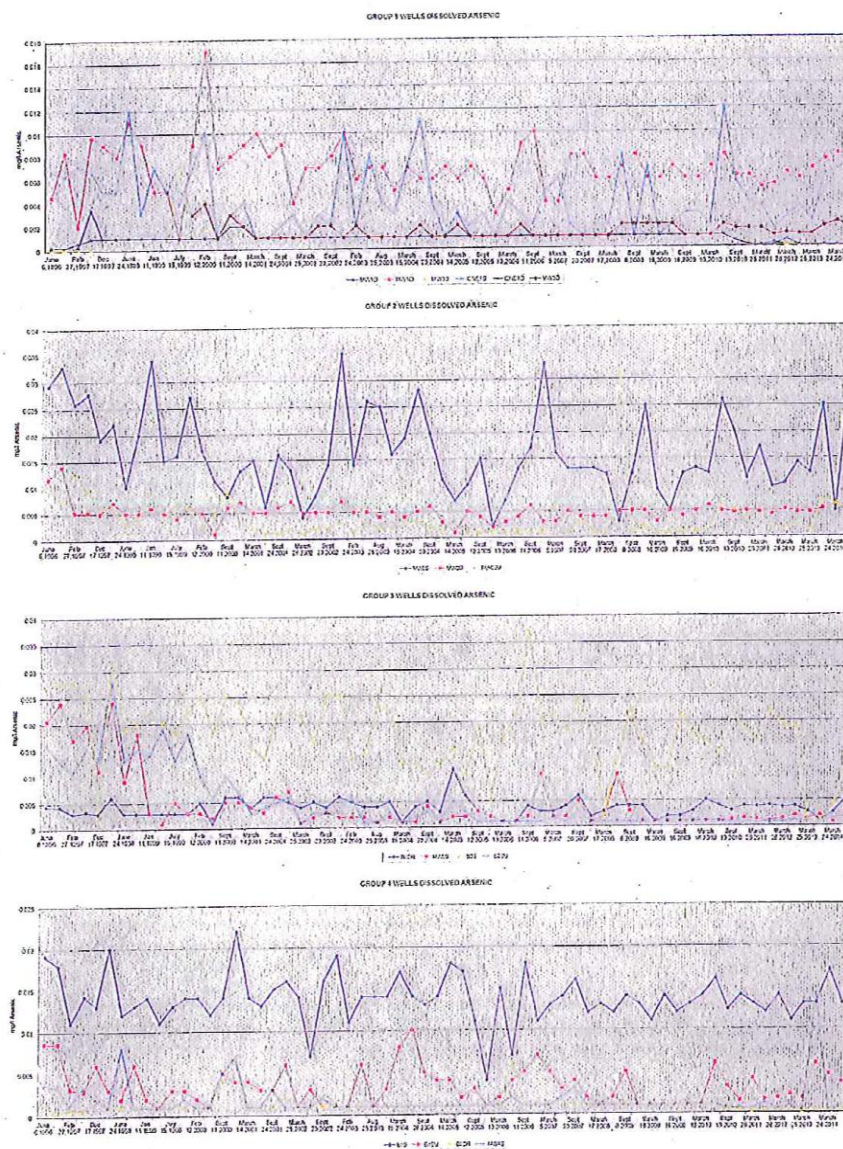
- Arsenic has a calculated surface water standard of 0.27 ug/L, based on background concentrations. However, the practical quantitation limit of arsenic is 0.5 ug/L. In cases where the cleanup level is less than the PQL, the cleanup level may be considered to be attained if the parameter is undetected at the PQL. Therefore, the compliance level for arsenic in surface water is 0.5 ug/L.

Exceedences of Primary and Secondary Standards in Groundwater Wells											
	pH	Conductivity	TDS	Chloride	Sulfate	Nitrate + Nitrite	Arsenic	Iron	Mercury	Manganese	Zinc
Primary Drinking Water Standard	6.5 - 8.5		500 mg/l	250 mg/l	250 mg/l	10 mg/l	0.01 mg/l	0.3 mg/l	0.02 mg/l	0.05 mg/l	5 mg/l
Secondary Standard	6.5 - 8.5	CAP cleanup levels 700 umhos/cm	500 mg/l	250 mg/l	250 mg/l		0.0005 mg/l	0.3 mg/l	0.02 mg/l	0.05 mg/l	5 mg/l
Groundwater Standard											
MW1D	6.92	292	210	5.78	<0.1	<0.02	0.0079	0.019	<0.00002	0.5554	<0.001
MW1S	6.02	206	200	2.24	40	3.9	0.0001	<0.009	<0.00002	<0.0005	0.004
MW3S	5.38	173	150	5.25	22.3	1.5	0.0002	<0.009	<0.00002	0.0089	0.003
MW3D	6.24	235	180	6.2	<0.1	<0.02	0.0016	0.638	<0.00002	1.091	0.007
CNE1S	5.72	1010	610	67.7	1.45	<0.02	0.0073	24.7	<0.00002	2.873	<0.001
CNE1D	7.08	282	160	6.5	<0.1	<0.02	0.0058	0.053	<0.00002	0.2255	0.003
MW2D	7	329	200	9.37	<0.1	<0.02	0.0028	0.02	<0.00002	0.8272	<0.001
MW2S	6.34	1330	1000	215	1.92	<0.02	0.005	6.79	<0.00002	8.851	0.002
MW2SU	6.3	1670	1200	232	1.55	<0.02	0.005	24.2	<0.00002	8.855	<0.001
MW3S	6.37	495	150	4.74	3.44	<0.02	0.0031	0.286	<0.00002	0.5272	0.007
BDR	6.97	270	180	7.96	<0.1	<0.02	0.0091	0.266	<0.00002	0.61	<0.001
B2SU	6.59	315	220	2.54	3.83	0.028	0.0018	<0.009	<0.00002	0.0046	0.003
B2S	6.28	167	220	8.3	1.73	<0.02	0.003	<0.009	<0.00002	1.146	0.007
B1SU	6.59	639	380	29.1	0.79	<0.02	0.003	0.887	<0.00002	3.633	<0.001
B1S	6.45	142	190	9.14	0.84	0.024	0.0015	0.028	<0.00002	0.7325	<0.001
MW4S	6.72	212	120	2.23	8.94	<0.02	0.0068	0.069	<0.00002	0.1213	0.01
BDR	7.37	429	250	5.08	15.6	<0.02	0.0003	0.085	<0.00002	0.2555	<0.001

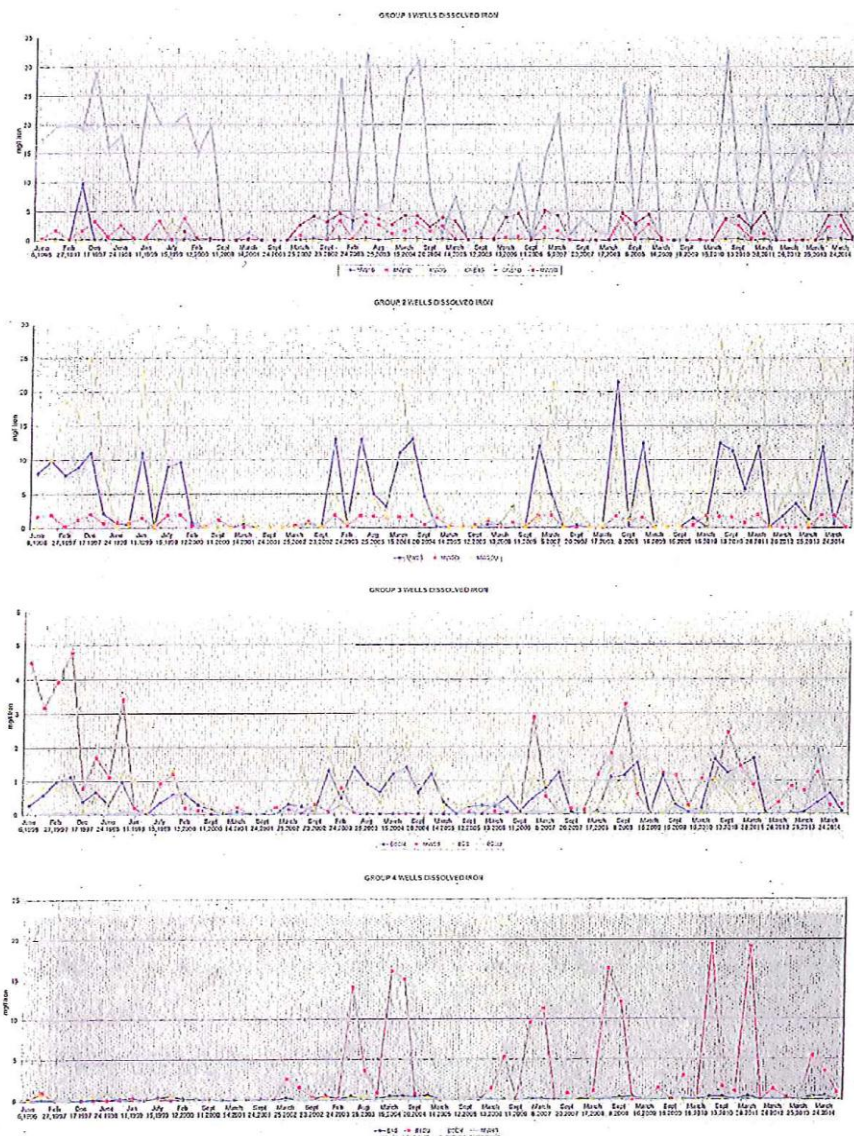
6.5 Perimeter Gas Probes Monitoring Data

Date	Probe Number	Time	Barometric Pressure	Probe Pressure Inches W. C.	% LEL	% Oxygen
6/6/2014	GP2	1130	29.98	0	0	17.1
6/6/2014	GP1	1135	29.98	0	0	20.5
6/6/2014	GP4A	1142	29.98	0	5	20.4
6/6/2014	GP4B		29.98	probe flooded		
6/6/2014	GP15	1042	29.98	0	1	5.4
6/6/2014	GP11	1046	29.98	0	0	20.9
6/6/2014	GP10	1050	29.98	0	0	19.2
6/6/2014	GP12	1055	29.98	0	0	20.9
6/6/2014	GP9	1100	29.98	0	0	20.9
6/6/2014	GP13	1105	29.98	0	0	13
6/6/2014	GP8	1110	29.98	0	0	20.9
6/6/2014	GP7	1115	29.98	0	1	20.6
6/6/2014	GP14	1117	29.98	0	0	20.9
6/6/2014	GP5R	1120	29.98	0	0	20.9
9/16/2014	GP2	1048	29.75	0	0	20.9
9/16/2014	GP1	1055	29.75	0	0	19.4
9/16/2014	GP4A	1103	29.75	0	5	0
9/16/2014	GP4B	1108	29.75	0	0	19.8
9/16/2014	GP15	935	29.75	0	0	14
9/16/2014	GP11	944	29.75	0	0	19.9
9/16/2014	GP10	950	29.75	0	0	19.8
9/16/2014	GP12	955	29.75	0	0	16.8
9/16/2014	GP9	958	29.75	0	0	18.9
9/16/2014	GP13	1010	29.75	0	0	20.7
9/16/2014	GP8	1014	29.75	0	0	19.5
9/16/2014	GP7	1021	29.75	0	0	20.9
9/16/2014	GP14	1027	29.75	0	0	18.1
9/16/2014	GP5R	1031	29.75	0	5	0.1

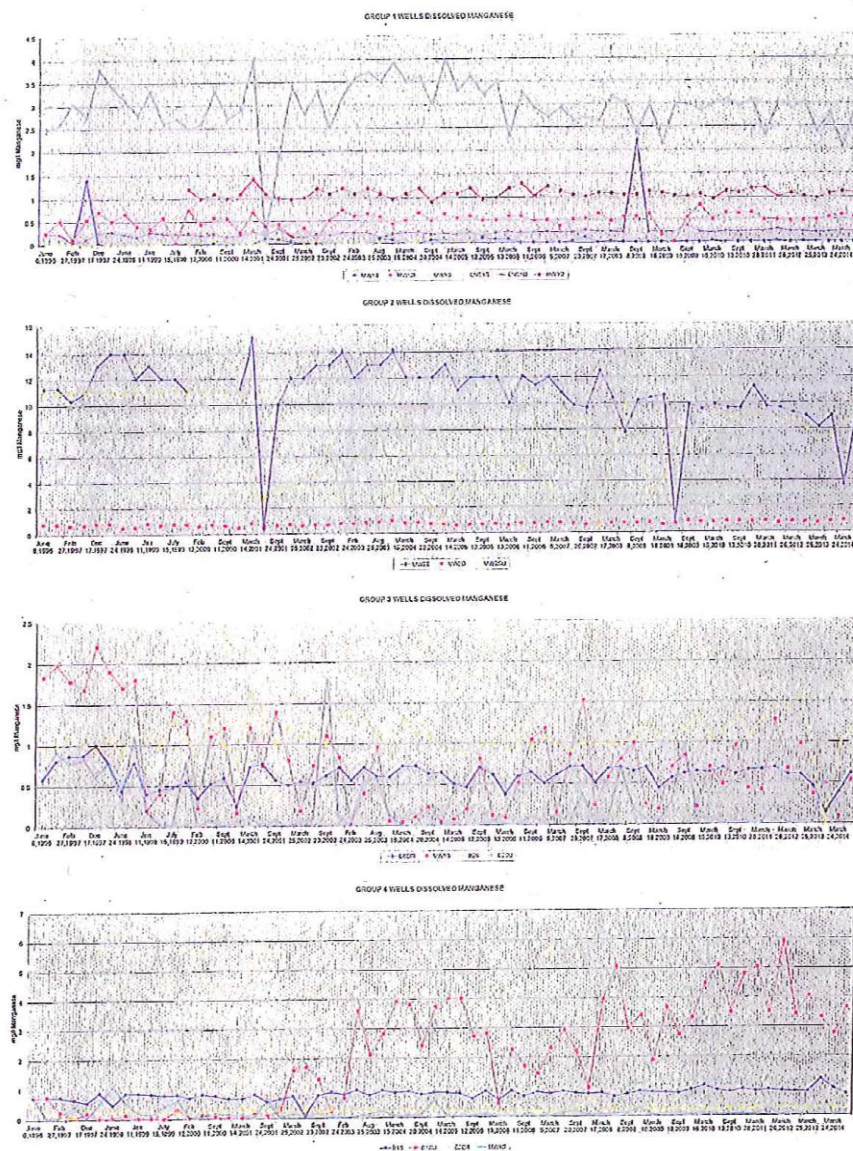
6.6 Time Series Graph: Arsenic



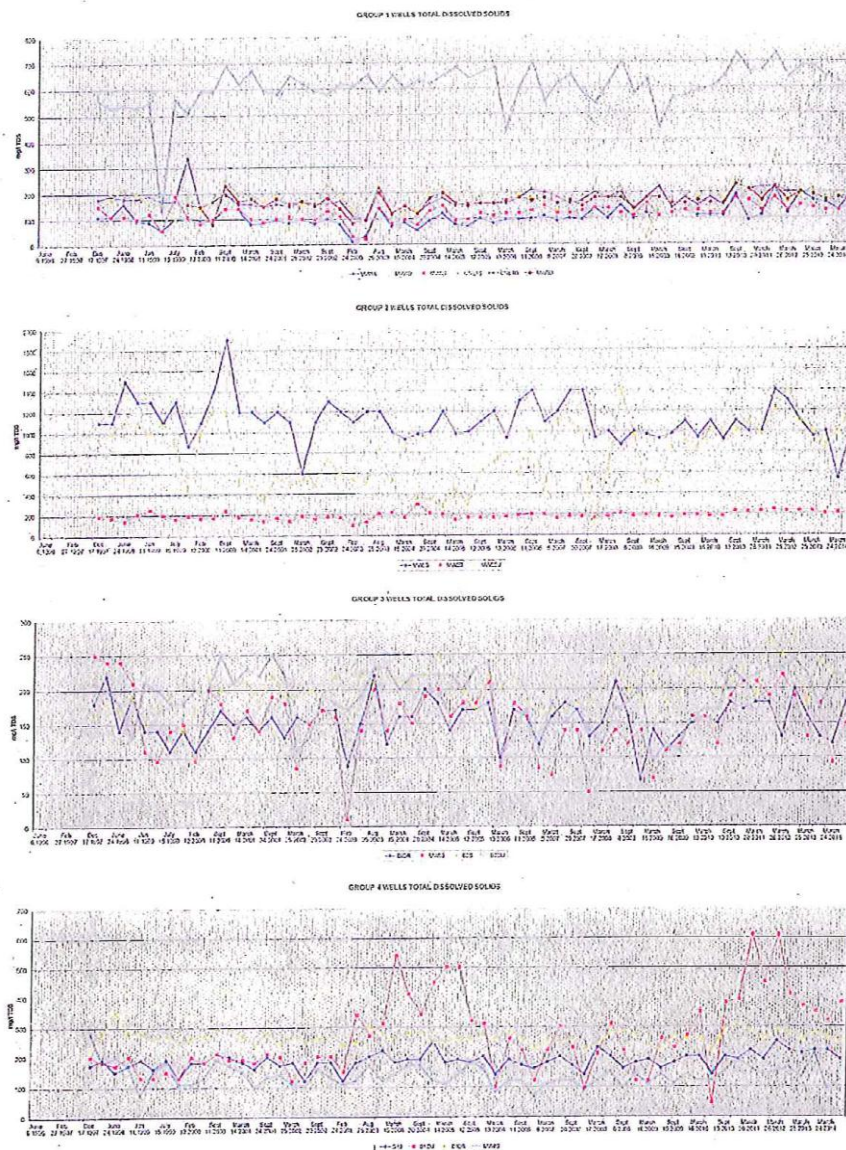
Time Series Graph: Iron



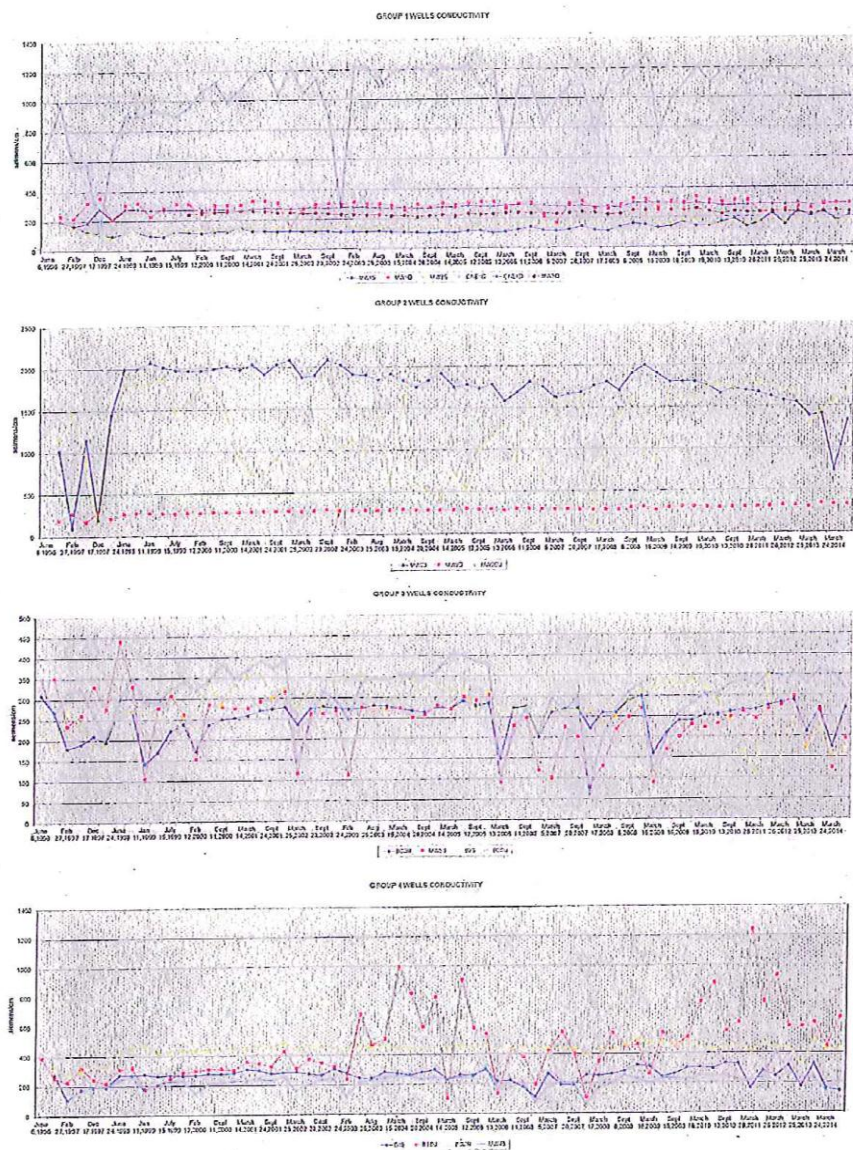
Time Series Graph: Manganese



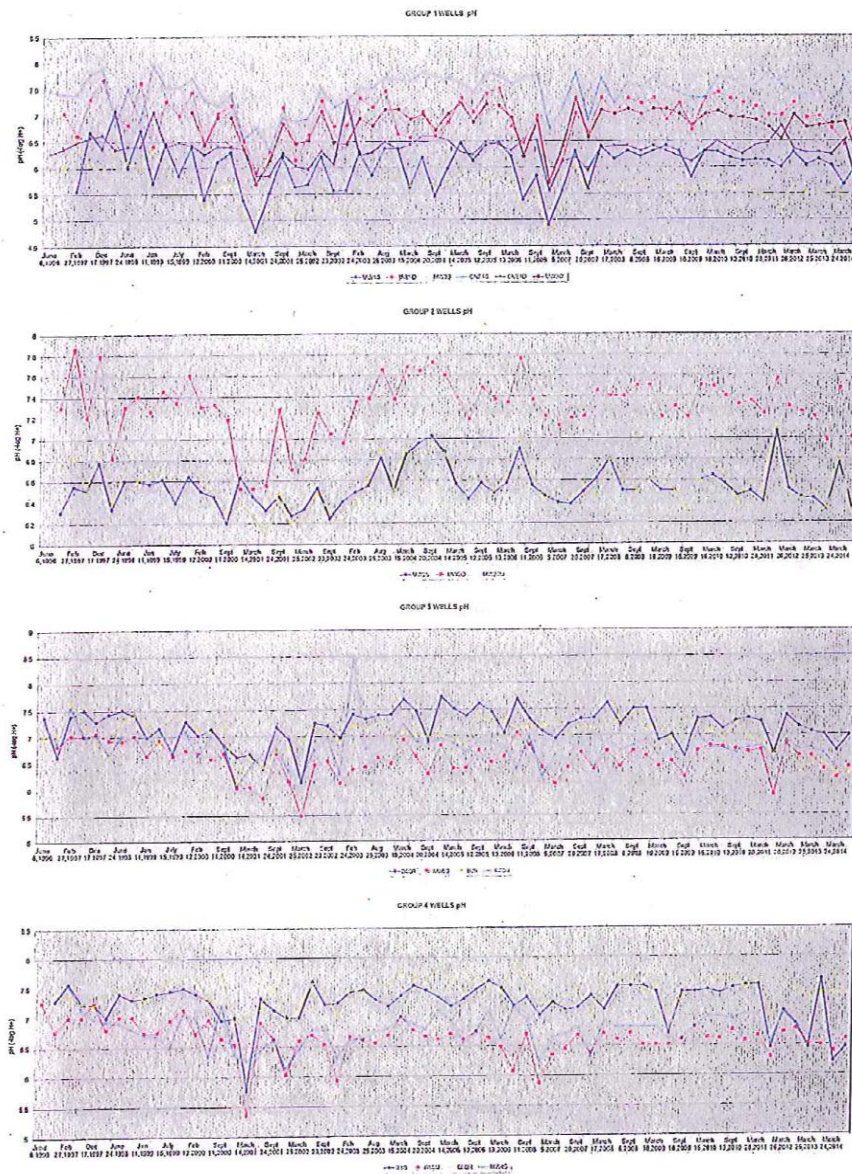
Time Series Graph: Total Dissolved Solids



Time Series Graph: Conductivity



Time Series Graph: pH



6.7 Environmental Covenant

EXHIBIT D RESTRICTIVE COVENANT CENTRALIA LANDFILL

Pursuant to the Model Toxics Control Act, Chapter 70.105D RCW, a remedial action was conducted at the property that is the subject of this Restrictive Covenant. The work that will be done to remediate the property and conduct long-term operation and maintenance (hereafter the "Cleanup Action") is described in the Consent Decree entered in State of Washington Department of Ecology v. Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader, United State District Court – Western District of Washington Cause No. C91-5100(T) WD, and in attachments to the Consent Decree and in documents referenced in the Consent Decree.

The Cleanup Action conducted at the property is described in the following documents:

Centralia Landfill Cleanup Action Plan, Washington State Department of Ecology, Southwest Regional Office, September 1999.

Centralia Landfill Feasibility Study Report, CH2M HILL, Inc., April 1998.

Centralia Landfill Remedial Investigation Report, CH2M HILL, Inc., April 1998.

Centralia Landfill Second Interim Action Final Cover System Post-Closure Operations and Maintenance Manual, CH2M HILL, Inc., September 1995.

Centralia Landfill As-Built Report for the Construction of the Final Cover System, CH2M HILL, Inc., September 1995.

Centralia Landfill Second Interim Action Cover System Engineering Report, CH2M HILL, Inc., March 1994.

These documents are on file at Ecology's Southwest Regional Office.

This Restrictive Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader (hereafter the "Defendants" or "Centralia Landfill Closure Group" or "CLCG"), their successors and

assigns, and the Washington State Department of Ecology (hereafter "Ecology"), its successors and assigns.

This Restrictive Covenant is required by Ecology under WAC 173-340-440 because the Cleanup Action resulted in hazardous substances remaining on the property beneath a final cover system, and because groundwater concentrations of hazardous substances exceed Method B cleanup levels established under WAC 173-340-720.

The undersigned, [NAME OF PROPERTY OWNER], is the fee owner of real property (hereafter "the Property") in the County of Lewis, State of Washington that is subject to this Restrictive Covenant. The property is legally described in Exhibit A to the Consent Decree entered in State of Washington Department of Ecology v. Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader, United State District Court – Western District of Washington Cause No. C91-5100(T) WD, and that legal description is hereby incorporated by reference.

The undersigned, [NAME OF PROPERTY OWNER], makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereafter "Owner").

Section 1.

- a. Existing fencing shall not be removed and shall be maintained to prevent unauthorized access to the Property.
- b. No groundwater may be taken for any use from the Property unless the groundwater removal is part of monitoring activities associated with an Ecology-approved compliance monitoring plan.
- c. An area of the Property has been designated as a wetland enhancement area. The Owner of the Property must give thirty (30) day advance written notice to Ecology of any activities that may impact the wetland enhancement area and must obtain the written approval of Ecology and other agencies of jurisdiction prior to commencement of any such activities.

- d. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Cleanup Action, or that may create a new exposure pathway, is prohibited. Such activities are permissible only if: (1) they are part of routine maintenance system requirements performed in accordance with the Centralia Landfill Second Interim Action Final Cover System Post-Closure Operations and Maintenance Manual; (2) they are allowed or required under the Centralia Landfill Cleanup Action Plan; (3) they are part of monitoring activities associated with an Ecology-approved compliance monitoring plan, (4) immediate actions are necessary in response to emergency situations; or (5) Ecology provides prior written approval for such activities.
- e. No new structures shall be constructed on areas of the Property where solid waste has deposited without the written approval of Ecology and written approval by the local agency or agencies of jurisdiction.
- f. The Property shall be used only for industrial or commercial land uses, as described in WAC 173-340-740(1)(c), and defined in and allowed under the City of Centralia [or Lewis County] zoning regulations.

Section 2. Any activity on the Property that may interfere with the integrity of the Cleanup Action and continued protection of human health and the environment is prohibited without prior written approval from Ecology.

Section 3. The Owner of the Property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Cleanup Action on the Property.

Section 4. The Owner must restrict leases to uses and activities consistent with the Restrictive Covenant and notify all lessees of the restrictions herein on the use of the Property.

Section 5. The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this Restrictive Covenant. Ecology may approve an inconsistent use only after an opportunity for public notice and comment is provided.

Section 6. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Cleanup Action; to take samples, to inspect remedial actions conducted at the Property, and to inspect records that are related to the Cleanup Action.

Section 7. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and comment, concurs.

[NAME OF PROPERTY OWNER]

[DATE SIGNED]

[NOTE: The Property Owner must have this Restrictive Covenant notarized.]

6.8 Photo log

Photo 1: Landfill Entrance w/ Cap to the Right – from the North



Photo 2: Cap Surface with Monitoring Wells and Gas Collection Points – from the North



Photo 3: Western Edge of Landfill Cap (Drainage System)- from the North



Photo 4: South End of Landfill w/ Wetland to the Right – from the West



Photo 5: Downgradient Groundwater Monitoring Wells – Western Edge of the Landfill



Photo 6: Gas Flares – from the South

