
**2009 ANNUAL REPORT
CEDAR HILLS REGIONAL LANDFILL**

JULY 2010



King County

Department of Natural Resources and Parks
Solid Waste Division

2009 ANNUAL REPORT CEDAR HILLS REGIONAL LANDFILL

JULY 2010

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July 1, 2010

**2009 ANNUAL REPORT
CEDAR HILLS REGIONAL LANDFILL
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TOTAL – 9

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SECTION 1 - OVERVIEW

The King County Solid Waste Division (KCSWD) owns and operates the Cedar Hills Regional Landfill (CHRLF) in eastern King County for the disposal of municipal solid waste generated in the County, exclusive of the cities of Seattle and Milton. It is a 940-acre site located at 16645 228th Avenue Southeast, off Cedar Grove Road, three miles north of Maple Valley, six miles east of the City of Renton and about four miles south of the City of Issaquah. In addition to the landfill, the site contains the closed Cedar Hills Alcohol Treatment Center, which is being redeveloped as a transitional housing facility; a landfill gas-to energy facility owned and operated by Bio Energy (Washington) LLC; a right-of-way for a natural gas pipeline and numerous power transmission line rights-of-way.

A Final Environmental Impact Statement and Development Plan was issued for the landfill in March 1998. The adopted Plan includes the sequential development of seven refuse areas. The Municipal Solid Waste Handling Permit (Operating Permit) for the sixth refuse area, Area 6, was issued to the KCSWD on August 7, 2003 and Area 6 began receiving waste in August 2005. Although filling operations were stopped in Area 5 in August 2005, operations are intended to resume in this refuse area in the future. Area 7 has opened and is receiving waste as of June 17, 2010.

This report includes a compilation of activity summaries and system evaluations associated with the following:

- Landfill capacity;
- Financial assurance cost estimates for closure and post-closure;
- Changes to landfill operations, and
- Environmental monitoring program, including a summary of groundwater, surface water, leachate and landfill gas monitoring results and exceedances.

This annual report is submitted pursuant to the provisions of the Washington State Criteria for Municipal Solid Waste Landfills, Operating Criteria - Annual Reports (WAC 173-351-200(11)) and the Cedar Hills Regional Landfill Operating Permit, Section XII - Reporting Requirements, Part B - Annual Report and Permit Renewal Application. The Washington Department of Ecology (WDOE) form required for submittal of this report is included in this section.

The 2010 Application for Municipal Landfill Permit Renewal form was completed and transmitted to the Washington Department of Ecology and the Department of Public Health - Seattle and King County in January 2010. This document is included in Attachment C.

SECTION 2 - FACILITY INFORMATION

Facility information can be found in the attached tonnage Annual Report.



MUNICIPAL SOLID WASTE LANDFILL ANNUAL REPORT

| | | |
|---|--|------------------------------------|
| FACILITY NAME: Cedar Hills Regional Landfill | CALENDAR YEAR OF REPORT: 2009 | PERMIT NUMBER: PR0015736 |
| FACILITY LOCATION (street address): 16645 228th Ave. SE, Maple Valley, WA | COUNTY: King | |
| FACILITY CONTACT (name): Kevin Kiernan, Division Director, Solid Waste Division | FACILITY PHONE: 206-296-4490 | |
| FACILITY CONTACT MAILING ADDRESS (if different): 201 S. Jackson St, Suite 701, Seattle, WA 98104-3855 | FACILITY CONTACT PHONE (if different): 206-296-4385 | |
| OPERATOR: (Company/Business): King County Solid Waste Division | OPERATOR CONTACT (Name) Kevin Kiernan, Division Director | |

Did you operate in 2009 ?

Yes **If yes**, proceed to next section and complete the form.

No **If no**, answer the following questions, sign, date and return. This completes your reporting obligations.

When did you stop operations? _____

Do you plan to restart? No Yes When? _____

PLEASE SIGN AND DATE THIS FORM AND RETURN:

Prepared by: _____ Date: _____

AMOUNT AND TYPE OF WASTE DISPOSED PER YEAR: Please report by (check one): Cubic Yards Tons

| PLEASE CHECK IF DISPOSED | AMOUNT DISPOSED |
|--|-----------------|
| <input checked="" type="checkbox"/> Municipal/Commercial Solid Waste | 859,226 |
| <input type="checkbox"/> Construction/Demolition Waste | |
| <input type="checkbox"/> Yard Waste (disposed) | |
| <input type="checkbox"/> Food Processing Waste (disposed) | |
| <input type="checkbox"/> Landclearing Debris | |
| <input checked="" type="checkbox"/> Industrial Waste | 393 |
| <input type="checkbox"/> Inert Waste | |
| <input type="checkbox"/> Wood Waste | |
| <input type="checkbox"/> Ash (other than special incinerator ash) | |
| <input type="checkbox"/> Dredged Materials | |
| <input type="checkbox"/> Sewage Sludge | |
| <input checked="" type="checkbox"/> Asbestos | 5 |
| <input checked="" type="checkbox"/> Petroleum Contaminated Soils | 5 |
| <input checked="" type="checkbox"/> Other Contaminated Soils - <i>includes dry vector waste (street sweepings)</i> | 380 |
| <input type="checkbox"/> Tires | |
| <input checked="" type="checkbox"/> Medical Waste | 1 |
| <input checked="" type="checkbox"/> Other (specify): <i>WWTP grit, decanted vector solids and containerized liquids.</i> | 2,121 |
| <input checked="" type="checkbox"/> Other (specify): <i>Oversized materials, dead animals, wastes requiring Certificates of Destruction, other misc. waste</i> | 5,351 |
| Total | 867,481 |

(form continued on back)

| DID YOU RECEIVE MATERIALS FOR RECYCLING? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | |
|---|------------|---|--|
| ADDITIONAL INFORMATION (please check if attached): | | | |
| <input type="checkbox"/> Attach results of ground water monitoring in accordance with WAC 173-351-415(1) Quarterly groundwater monitoring results are submitted to Public Health, Seattle and King County with copies to WDOE. Most recent report was submitted January, 2009. Annual report submitted under separate cover | | | |
| <input type="checkbox"/> Attach applicable financial assurance information in accordance with WAC 173-351-600 Included in CHRLF annual nnuual report submitted under separate cover | | | |
| Are you open to the public? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | Tip fees (Attach schedule if available): Attached | |
| REMAINING PERMITTED CAPACITY: In tons: <u>6,500,000</u> Estimated Date of Closure: <u>2018, or when filled</u> | | Are you planning an expansion this year? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | |
| ENERGY RECOVERY FROM LANDFILL: Power Produced Annually <u>184,500 (2009 approx)</u> kilowatt hours <i>(Energy produced by converting landfill gas to pipeline-quality natural gas at facility owned and operated by Bio Energy (Washington) LLC. Facility began operation in May 2009 and is in the testing phase, delivering gas via pipeline to Puget Sound Energy's natural gas-fired power plants at a limited rate.)</i> | | | |
| During the reporting year, were there any changes in your management practices that would impact your operations? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify) _____ | | | |
| Are there any new solid waste activities planned at your site for this calendar year? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (specify) _____ _____ | | | |
| Planned start date: _____ | | | |
| DID YOU RECEIVE WASTE FROM: | WHERE FROM | TYPE OF WASTE | EST. AMOUNT <input type="checkbox"/> Tons or <input type="checkbox"/> Cubic Yds |
| Out of County? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | |
| | | | |
| | | | |
| | | | |
| Out of State? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | |
| | | | |
| | | | |
| Out of Country? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | |
| | | | |
| | | | |
| PREPARED BY: | | DATE: | PHONE: 206-296-4418 |

*To receive this document in alternate format, contact Ecology's Solid Waste & Financial Assistance Program
At 360-407-6900 (Voice), 711, or 1-800-833-6388 (TTY).*

SECTION 3 - LANDFILL CAPACITY ANALYSIS AND LANDFILL DEVELOPMENT STATUS

3.1 - Capacity Analysis

The current Operating Permit for the CHRLF limits the maximum elevation to 788 feet mean sea level (msl) and airspace capacity is calculated based on the maximum elevation. Attachment A provides an analysis of landfill capacity used and the remaining capacity at the site. Results of the analysis are summarized in Tables 1 and 2. Additional capacity included in Table 2 is anticipated based on observed settlement in Area 5 and extrapolated to Areas 6 and 7. Additional capacity available from recoverable cover soils is not included in this analysis.

Table 1 – AIRSPACE CAPACITY

| Waste Disposal Area | Airspace Capacity at Permitted Elevation ¹ (cubic yards) | Remaining Airspace Capacity (cubic yards) |
|--|--|--|
| Area 5 | 8,394,846 | 809,820 ² |
| Area 6 | 6,767,143 | 880,000 ² |
| Area 7 | 8,818,887 | 8,818,887 ³ |
| Total Remaining Airspace Capacity | | 10,508,707 |
| <ol style="list-style-type: none"> 1. Per the current operating permit. 2. Remaining airspace capacity based on February 18, 2010 aerial photography. 3. Area 7 airspace capacity from Area 7 Plan of Operations. | | |

Table 2 – ESTIMATED OPERATING LIFE

| Waste Disposal Area | Remaining Airspace Capacity (cubic yards) | Estimated Airspace Capacity with Settlement ¹ (cubic yards) | Remaining Operating Life ² (years) |
|--|--|---|--|
| Area 5 | 809,820 ³ | 860,000 | 0.75 |
| Area 6 | 880,000 ³ | 1,180,000 | 1.03 |
| Area 7 | 8,818,887 ⁴ | 8,920,000 | 7.78 |
| Estimated Remaining Airspace Capacity & Life | | 10,960,000 | 9.56 |
| <ol style="list-style-type: none"> 1. Settlement estimates are based on Area 5 observations. 2. Remaining Operating Life is based on refuse being placed at 1500 pounds per cubic yard and an average of 860,000 tons per year through 2018. 3. Remaining airspace capacity based on February 18, 2010 aerial photography. 4. Area 7 airspace capacity from Area 7 Plan of Operations. | | | |

3.2 - Landfill Development Status

The development status of the landfill is summarized in Table 3. Closed Areas are refuse Areas closed in accordance with pertinent regulatory requirements and not currently scheduled to

receive additional waste. The Area 5 top surface has an interim cover that will be maintained until the completion of the last remaining lift.

Table 3 – STATUS OF LANDFILL AREAS¹

| Landfill Area | Closed Area Size (acres) | Open Area Size (acres) |
|--|---|-----------------------------------|
| Main Hill | 84.4 | 0.0 |
| Southeast Pit | 9.6 | 0.0 |
| South Solid Waste Area | 30.6 | 0.0 |
| Central Pit | 5.5 | 0.0 |
| Area 2/3 | 22.2 | 0.0 |
| Area 4 | 60.4 | 0.0 |
| Area 5 | 9.2 ² 37.1 ³ | 31.1 |
| Area 6 | 25.18 ² 6.46 ³ | 32 ³ |
| Area 7 | 0.00 | 52.64 |
| 1. Areas are net final cover plan view surfaces or as otherwise noted. 2. Final cover surface area. 3. Interim final cover surface area. 4. Surface area for not yet opened Area 7. | | |

SECTION 4 - FINANCIAL ASSURANCE ANALYSIS

The KCSWD maintains a reserve account for closure, post-closure, and corrective action in accordance with WAC 173-351-600. The KCSWD reviewed the costs included in the post closure maintenance plan and updated the costs based on changes to operations. Several reductions were made to the cost forecast, including reductions in flare maintenance due to the new landfill gas to energy plant, reductions in aerator energy costs based on revised operations, reductions in costs for correcting differential settlement due to changes in filling practices and subsequent changes in the amount of settlement predicted. Detailed estimates of post closure maintenance costs are included in Attachment B and summarized in Table 4 below.

Table 4 – POST CLOSURE MAINTENANCE COST ESTIMATES

| | |
|---|-----------------------|
| Annual Post-Closure Maintenance (PCM) Cost | \$ 1,815,174 (2010\$) |
| Interest after Inflation | 3.0% |
| PCM Period | 30 years |
| Present Value (Year 0 = 2022) (Set aside value shown in Attachment B). | \$ 24,985,570 |

SECTION 5 - WASTE DISPOSAL QUANTITIES

The CHRLF received about 2,400 tons of municipal solid waste a day in 2009. Detailed information can be found on the tonnage Annual Report in Section 2.

SECTION 6 - SUMMARY OF 2009 GROUNDWATER, SURFACE WATER, LEACHATE AND LANDFILL GAS MONITORING RESULTS AND 2010 PROPOSED ENVIRONMENTAL MONITORING PROGRAM

6.1 - Summary 2009 Groundwater Monitoring Program

Groundwater monitoring is conducted in accordance with WAC 173-351-410 and reported here in compliance with WAC 173-351-415(1). A summary of groundwater data collected during the reporting year is presented in Appendix IV of Attachment D.

The Groundwater Monitoring Program is described in Section 6.2 of the May 2004 CHRLF Hydrogeologic Report and in Attachment D of this annual report. The program includes wells used for water level monitoring and for geochemical sampling. Thirty nine (39) groundwater monitoring wells are used for geochemical sampling in the regional aquifer, and nine (9) for monitoring the perched saturated zones. Eleven (11) additional wells in the perched zone are monitored only for groundwater elevations. Detection monitoring wells are located down-gradient of, or lateral to, waste placement areas. Background characterization wells are located up-gradient of waste placement areas.

6.2 - Summary Surface Water Monitoring Program

The surface water monitoring program is described in Section 6.1 of the May 2004 CHRLF Hydrogeologic Report. The goals of this program include the following elements:

- Detect changes in water quality;
- Verify the effectiveness of leachate management facilities in controlling leachate discharges to surface water;
- Monitor the effectiveness of Best Management Practices (BMPs) and the Storm Water Pollution Prevention Plan (SWPPP); and
- Evaluate compliance with the Industrial Stormwater General Permit.

Surface water quality criteria are established in WAC 173-201A, Water Quality Standards for Surface Waters of the State of Washington. Surface water quality is monitored at twelve (12) strategic locations around the landfill. Surface water samples are collected monthly for characterization, and to determine compliance with water quality standards. CHRLF is also covered by the State Industrial Stormwater General Permit (ISWGP) which establishes monitoring requirements and benchmark values for several parameters. The three discharge locations are monitored quarterly for compliance with the ISWGP. Permit compliance monitoring locations are at SW-N4 at the north end of the landfill, SW-GS1 at the south end and SW-SL3 at the discharge of the bioswale along 228th Avenue Southeast. Field and analytical surface water data is included in Appendix IV of Attachment D.

6.3 - Summary Leachate Monitoring Program

Leachate is analyzed for characterization and permit compliance. Leachate is sampled monthly at four stations for characterization and every other week at the Leachate Effluent Pump Station

discharge point for compliance with permit conditions. Leachate characterization is a critical component of detection monitoring, enabling the assessment of the potential for, and possible consequences of, groundwater contamination by leachate. Leachate characterization also serves to assess pretreatment needs prior to discharge and to evaluate the effectiveness of pretreatment. Characterization analyses include all analytes that groundwater is analyzed for plus several analytes specifically related to wastewater characterization and treatment. Permit compliance samples are analyzed for metals concentrations to monitor compliance with discharge permit requirements and to calculate loadings.

Self-monitoring discharge permit reports are generated monthly and submitted to the King County Wastewater Treatment Division. Field and analytical leachate data for 2009 is included in Appendix IV of Attachment D.

6.4 - Summary Landfill Gas Monitoring Program

Landfill gas (LFG) monitoring is performed in accordance with provisions of WAC 173-351-200(4). A network of LFG monitoring probes has been installed at strategic locations and elevation intervals below the ground surface to measure LFG composition and pressure (see Attachment E). In general, there are two categories (defined by function) of probes at the CHRLF. Migration Monitoring Probes are primarily intended to verify that methane concentrations at the property boundary are not exceeding the lower explosive limit (LEL) for methane (typically 5 percent, by volume) and whether subsurface LFG is migrating into surrounding native soils. Interior LFG Monitoring Probes are used to evaluate the performance of the LFG collection system and will indicate if any operational adjustments to the system are required.

Monitoring Probe Network: The installation history of the LFG monitoring probes at the CHRLF was described in the 2005 CHRLF Annual Report. The probes are either single or multiple completion probes. Information on the location, elevation, and installation date, and a description of each probe is provided in the Monitoring Plan included in Attachment E.

Parameters typically measured at the LFG monitoring probes include methane, oxygen and carbon dioxide concentrations and static pressure. Monitoring has been performed monthly through October of 2009 and is now performed quarterly. Monitoring data results are included in Attachment E. Results from LFG migration monitoring for 2009 indicate two exceedances of the LEL for methane were detected at the perimeter of the CHRLF. These LEL exceedances were reported to regulators and landfill gas operators. Operators assess and adjust the collection system to regain compliance.

6.5 - Proposed Environmental Monitoring Program for 2010

At this time no changes are proposed to the environmental monitoring program for 2010. The proposed environmental monitoring program is to continue as in 2009.

SECTION 7 - SUMMARY OF LANDFILL PERSONNEL TRAINING PROGRAM

The KCSWD implements a Landfill Training Program that ensures that landfill personnel comply with the Certification requirements of WAC 173-300-060. Employees with earned SWANA Landfill Certification as Manager of Landfill Operations (MOLO) are listed below in Table 5.

Table 5 – 2009 MOLO CERTIFIED STAFF

| NAME | TITLE | DATE OF CERTIFICATION |
|--------------|---|--|
| Alan Duncan | Transfer Station Operations Supervisor | 12/31/2006 Recertified through 6/30/2010 |
| John Hills | Lead Equipment Operator | 10/7/2008 |
| Lenny Kuzaro | Lead Equipment Operator | Date not available |
| Mark Knauss | Transportation Supervisor | 10/7/2008 |
| Mike McEwen | Engineer II | 6/16/2008 |
| Thea Severn | Planning and Communications Manager and Interim Operations Manager | Recertified through 3/31/2012 |
| Dean Voelker | Landfill Operations Supervisor and Interim Assistant Operations Manager | 4/6/2006; Recertified through 4/6/2012 |
| Nigel White | Transportation Supervisor | 6/28/2007 |

SECTION 8 - EVALUATION REPORTS

8.1 - Summary of Emergency or Corrective Actions Taken in 2009

No emergency or corrective actions were required during the reporting year in response to groundwater, surface water or leachate monitoring.

8.2 - Evaluation of Surface and Groundwater Monitoring Data

8.2.1 - Surface Water Monitoring Data

Monitoring Station SW-N4 monitors discharges to Issaquah Creek. According to WAC 173-201A-600 (Table 602), the creek is part of the Water Resource Inventory Area (WRIA) 8 – Cedar/Sammamish system, which is designated for “non-core Salmon/Trout Aquatic use”. The applicable water quality standards are outlined in WAC 173-201A-200.

Monitoring Station SW-SL3 monitors discharges to a series of roadside ditches that discharge to the Cedar River. Most of the storm water infiltrates along Cedar Grove Road. The Cedar River is also in WRIA 8 and the same standards referenced above apply.

Monitoring Station SW–GS1 monitors discharges to a designated King County wetland with palustrine forested, palustrine open water, and palustrine emergent wetland classes. The wetland does not discharge to any fresh waters of the State nor does it contain key aquatic life uses defined in WAC 173-201A-200(1)(a). According to procedures for applying water quality criteria (WAC 173-201A-260 (3)(i)), the antidegradation policies appropriate to maintain and protect this wetland are the Tier I provisions defined in WAC 173-201A-301 and expanded upon in WAC 173-201A-310. The provisions in Tier I do not include specific chemical numerical limits. The beneficial uses of this wetland include groundwater exchange and stormwater attenuation. The KCSWD historically has implemented Best Management Practices at the CHRLF which maintains the quality of the wetland necessary to support these beneficial uses.

Pursuant to these provisions and as indicated in Table 6 of this Annual Report, exceedances at SW – SL3 were as follows: pH, turbidity, fecal coliform and iron, and for SW-GS1 the exceedances were for turbidity, ammonia, fecal coliform, copper and iron. Monitoring station SW-N4 had exceedances for turbidity, ammonia, fecal coliform, copper, lead and zinc. KCSWD will continue to coordinate with their regulators and between Engineering and Operations to address exceedances using established protocols .

See Appendix IV of Attachment D for the related surface water monitoring data.

Groundwater data evaluation constitutes the main text of Attachment D.

Table 6 – SUMMARY OF SURFACE WATER QUALITY CRITERIA EXCEEDANCES

| Parameter | Units | Sampling Location | Sample Date | Sample Value | Regulatory Limit | Regulation |
|-------------------|------------|-------------------|--------------|--------------|------------------|------------|
| pH (Field) | Std. Units | SW-SL3 | 04/22/09 | 6.46 | >6.5 | SSWC, FC |
| Turbidity (Field) | (NTU) | SW-GS1 | 03/16/09 | 15.0 | 5 over bkgrd | SSWC |
| | | SW-GS1 | 04/15/09 | 33.3 | 5 over bkgrd | SSWC |
| | | SW-GS1 | 05/14/09 | 14.9 | 5 over bkgrd | SSWC |
| | | SW-GS1 | 10/21/09 | 18.7 | 5 over bkgrd | SSWC |
| | | SW-GS1 | 10/23/09 | 20.1 | 5 over bkgrd | SSWC |
| | | SW-GS1 | 11/16/09 | 20.3 | 5 over bkgrd | SSWC |
| | | SW-GS1 | 12/17/09 | 21.8 | 5 over bkgrd | SSWC |
| | | SW-N4 | 10/22/09 | 7.87 | 5 over bkgrd | SSWC |
| | | SW-N4 | 12/17/09 | 7.99 | 5 over bkgrd | SSWC |
| | | SW-SL3 | 01/28/09 | 10.8 | 5 over bkgrd | SSWC |
| | | SW-SL3 | 02/18/09 | 7.8 | 5 over bkgrd | SSWC |
| | | SW-SL3 | 02/19/09 | 8.0 | 5 over bkgrd | SSWC |
| | | SW-SL3 | 03/16/09 | 34.0 | 5 over bkgrd | SSWC |
| | | SW-SL3 | 04/15/09 | 17.5 | 5 over bkgrd | SSWC |
| | | SW-SL3 | 05/14/09 | 35.6 | 5 over bkgrd | SSWC |
| SW-SL3 | 11/16/09 | 10.4 | 5 over bkgrd | SSWC | | |
| Ammonia | (mg/L) | SW-GS1 | 12/17/09 | 0.012 T | 0.0013 | SSWC, FC |
| | | SW-N4 | 04/15/09 | .015 T | 0.0012 | SSWC, FC |
| | | SW-N4 | 05/14/09 | 0.0258 | 0.0034 | SSWC, FC |

| Parameter | Units | Sampling Location | Sample Date | Sample Value | Regulatory Limit | Regulation |
|---|--------------|-------------------|-------------|--------------|------------------|------------|
| | | SW-N4 | 10/22/09 | 0.109 | 0.063 | SSWC, FC |
| | | SW-N4 | 10/23/09 | 0.13 | 0.032 | SSWC, FC |
| | | SW-N4 | 11/12/09 | 0.129 | 0.042 | SSWC, FC |
| | | SW-N4 | 12/17/09 | 0.0402 | 0.0085 | SSWC, FC |
| Fecal Coliform | (CFU/100 mL) | SW-GS1 | 07/14/09 | 1300 | 100 | SSWC |
| | | SW-GS1 | 12/17/09 | 150 | 100 | SSWC |
| | | SW-N4 | 12/17/09 | 210 | 100 | SSWC |
| | | SW-SL3 | 09/30/09 | 1900 | 100 | SSWC |
| | | SW-SL3 | 09/30/09 | 2400 | 100 | SSWC |
| | | SW-SL3 | 11/09/09 | 390 | 100 | SSWC |
| Copper | (mg/L) | SW-N4 | 01/27/09 | 0.0083 | 0.006 | SSWC |
| | | SW-N4 | 10/22/09 | 0.0108 | 0.0085 | SSWC |
| | | SW-N4 | 11/12/09 | 0.0178 | 0.0065 | SSWC |
| | | SW-N4 | 12/17/09 | 0.00862 | 0.0074 | SSWC |
| | | SW-SL3 | 09/30/09 | 0.0071 | 0.0059 | SSWC |
| Iron | (mg/L) | SW-GS1 | 04/15/09 | 1.42 | 1.0 | FC |
| | | SW-GS1 | 05/14/09 | 1.77 | 1.0 | FC |
| | | SW-SL3 | 03/16/09 | 3.4 | 1.0 | FC |
| | | SW-SL3 | 05/14/09 | 1.62 | 1.0 | FC |
| Lead | (mg/L) | SW-GS1 | 12/17/09 | 0.00178 | 0.0010 | SSWC, FC |
| | | SW-N4 | 12/17/09 | 0.00135 | 0.0013 | SSWC |
| Zinc | (mg/L) | SW-N4 | 11/12/09 | 0.0671 | 0.0599 | SSWC |
| FC = Federal Chronic Surface Water Criteria | | | | | | |
| FA = Federal Acute Surface Water Criteria | | | | | | |
| SSWC = State Chronic Surface Water Criteria | | | | | | |
| SSWA = State Acute Surface Water Criteria | | | | | | |
| T = Estimated Value | | | | | | |
| Total Metals: | | | | | | |

8.2.2 - Groundwater Monitoring Data

The CHRLF site can be characterized hydrogeologically as having no significant seasonal variation in horizontal groundwater flow paths. Horizontal gradients are influenced by infiltrating precipitation in the recharge area. Vertical hydraulic gradients in the southern area are demonstrated by head differences in adjacent wells screened at different depths. Additional hydrogeologic characterization is ongoing to further delineate regional aquifer flow and to refine and streamline the detection monitoring network to ensure adequacy and eliminate redundancy. An extensive list of chemical analytes and field parameters are determined and the results evaluated by a variety of graphical and statistical methods. The groundwater data analyses presented in Attachment D describes onsite groundwater elevations, flow direction, and velocity. Further evaluation of groundwater quality, variations in chemical concentrations over time, and possible impacts to groundwater quality by surface activities are also completed.

Up-gradient groundwater quality, especially in wells nearest the recharge zone, is profoundly affected by conditions and activities that have occurred on the adjoining Queen City Farm property. Up-gradient quality manifests a high degree of spatial variation and temporal trends, which are not unexpected given the recharge area history which includes hazardous waste disposal, National Priorities Listing under Superfund, site investigations and remediation activities. Down-gradient groundwater quality also manifests a high degree of spatial variation and temporal trends. Much as responses of water level increases are dampened with distance from the source, so are the concentrations of many analytes attenuated by processes such as dispersion dilution, sorption, and degradation as groundwater flows beneath the landfill.

Analytes exceeding State Groundwater Criteria (WAC 173-200-040 Table 1) or Federal Primary drinking water standards (40 CFR Part 141) and regularly detected in up-gradient wells include arsenic, and the chlorinated volatile organic compounds (CVOC) trichloroethene and vinyl chloride. Arsenic is also regularly detected in down-gradient samples; however, trichloroethene and vinyl chloride are not.

These data indicate that the CHRLF is acting as an attenuation zone for up-gradient CVOC impacts from up-gradient sources such as the Queen City Farms Superfund site, reducing concentrations along the groundwater flowpath.

Additional analytes exceeding secondary standards are iron and manganese and pH. Secondary standards are non-mandatory Federal guidelines regarding aesthetic (taste, odor, or color) or cosmetic (causing tooth or skin discoloration) effects. Exceedances of these secondary standards occurred in both up-gradient and down-gradient wells. Exceedences are reported in quarterly reports.

Impacts from past landfilling practices have previously been recognized in several wells in the East Main Hill Perched Zone (MW-30A and MW-47) and the South Solid Waste Area Perched Zone (decommissioned wells MW-39, MW-42S and MW-42D; current well MW-101). Site improvements and engineered facilities have been effective in moderating the impacts to water quality, resulting in declining trends for most contaminants in these perched zone wells.

Investigations are underway to further evaluate residual perched zone impacts and the integrity and effectiveness of engineered facilities in closed, unlined landfill areas.

The Regional Aquifer is the first continuously saturated zone beneath the landfill and serves as the earliest path for detection monitoring. Groundwater flowing onto the CHRLF site is of a highly variable character spatially and temporally. A majority of the perimeter wells are up-gradient to waste placement.

8.3 - Evaluation of Gas Monitoring Data

See Attachment E for LFG probe monitoring data. According to WAC 173-351-200 (4) (a), the concentration of methane gas generated by the facility shall not exceed 25 percent of the lower explosive limit (LEL) for methane in facility structures (excluding gas control or recovery

system components), exceed the LEL for methane at the facility property boundary or beyond, or exceed 100 parts per million (ppm) by volume of methane in off-site structures.

The LFG compliance monitoring probes (LFG migration monitoring probes) are located along the perimeter of the landfill as shown in Attachment E. The rest of the probes are used to monitor LFG levels in the interior of the landfill and for transitional evaluation of LFG collection and extraction-specific facilities.

There were two abnormal LFG detections in the LFG migration monitoring probes in 2009. The first occurred in GP-33A in on February 3 with methane at 29.8% carbon dioxide at 0.2% and oxygen 20%, all concentrations by volume. GP-33A is a shallow completion, 6.5 feet below ground surface and yields detectable methane in about one of four samplings, usually in the tenths of % by volume concentration. The presence of high oxygen levels is indicative of an erroneous analysis in this case as methane and oxygen are inversely related in a vast majority of LFG analyses.

The second exceedance occurred in GP-35C on June 3rd. with methane at 14.5%, carbon dioxide at 14.9% and 0 % oxygen. GP-35C is a deep completion, 71.5 feet below ground surface and usually yields no detectable methane or carbon dioxide. Nearest previous and post event samplings were on May 20 and June 16 both measuring 0% methane 0% carbon dioxide and 21% oxygen.

8.4 - Evaluation of Leachate Monitoring Data and Volumes Generated

8.4.1 - Leachate Volumes

The recorded volumes of leachate discharged from the leachate aeration basins via the Leachate Effluent Pump Station (LEPS) are indicated in Table 7. The actual leachate volume generated within the landfill is not measured directly.

Table 7 – LEACHATE DISCHARGE DATA AND EXCEEDANCES FOR 2009 and 2008

| Month | 2009 Monthly Flow (million gallons) | 2009 Number of Exceedances | 2008 Monthly Flow (million gallons) | 2008 Number of Exceedances |
|---------------------------------------|--|---------------------------------------|--|---------------------------------------|
| January | 32.307 | 0 | 16.628 | 0 |
| February | 6.58 | 0 | 14.149 | 0 |
| March | 17.386 | 0 | 13.828 | 0 |
| April | 16.775 | 0 | 11.155 | 0 |
| May | 10.216 | 0 | 7.1 | 0 |
| June | 4.356 | 0 | 6.471 | 0 |
| July | 1.658 | 0 | 5.229 | 0 |
| August | 2.708 | 0 | 4.205 | 0 |
| September | 7.361 | 0 | 2.55 | 0 |
| October | 20.098 | 0 | 5.297 | 0 |
| November | 36.546 | 0 | 23.857 | 0 |
| December | 16.17 | 0 | 15.866 | 0 |
| Total Discharged | 172.161 | 0 | 126.335 | 0 |
| Average. Monthly Discharge | 14.347 | 0 | 10.528 | 0 |

Pursuant to the Industrial Waste Discharge Permit No. 7842-01, the Daily Maximum Discharge rate from the Leachate Effluent Pump Station (LEPS) is 3,500,000 gallons per day (gpd) or 3.5 million gallons per day (MGD). The Permit allows for periodic exceedance of this limit when weather conditions make it necessary. There were no exceedances of the daily limit in 2009.

8.4.2 - Leachate Monitoring Data

A statistical summary of the leachate monitoring data is included as Appendix F of Attachment D.

8.5 - Topographical Mapping and Landfill Settlement

See Attachment F for a current topographic map of the site and final grade plan of the active landfill area. Aerial topographic surveys are completed twice per year to enable the computation of the landfill airspace consumption rate and remaining capacity. Airspace utilization factors for the last nine years are summarized in Table 8.

8.5.1 - Area 5

Area 5 is permitted as a 14 lift landfill cell. As of August 10, 2005, lifts 1 through 12 had been completed and lift 13 was partially completed before operations were transitioned to Area 6. Interim cover was constructed over the top surface and settlement monitoring points were established.

8.5.2 - Area 6

Filling operations in Area 6 began on August 10, 2005 and are continuing. Area 6 is permitted as a 14 lift landfill cell. As of December 31, 2009 lift 8 was complete and lifts 9 and 10 were being filled as a single thirty foot lift. Filling is transitioning to Area 7 and interim cover will be constructed over the top surface with settlement monitoring points.

8.5.3 - Area 7

Construction of Area 7 is complete. It is permitted as a seven lift cell with each lift being thirty feet.

Table 8 – LANDFILL AIRSPACE UTILIZATION FACTORS

| Year | Tonnage¹ | Total Airspace Consumed (cy) | Airspace Utilization Short Term Density (AUSTD) (lb/cy) | Average Soil Usage (cy/day) | Average Soil/Tonnage Ratio (cy/ton) | Average Soil/Airspace (cy/cy) |
|-------------|----------------------------|-------------------------------------|--|------------------------------------|--|--------------------------------------|
| 2001 | 937,680 | 1,376,353 | 1,363 | 610 | 0.24 | 0.16 |
| 2002 | 940,731 | 1,376,353 | 1,367 | 670 | 0.26 | 0.18 |
| 2003 | 979,978 | 1,486,389 | 1,319 | 754 | 0.27 | 0.19 |
| 2004 | 1,007,547 | 1,491,868 | 1,350 | 658 | 0.24 | 0.14 |
| 2005 | 989,635 | 1,696,775 | 1,166 | 950 | 0.35 | 0.20 |
| 2006 | 998,972 | 1,564,505 | 1,277 | 490 | 0.18 | 0.11 |
| 2007 | 1,011,443 | 1,411,115 | 1,416 | 449 | 0.16 | 0.11 |
| 2008 | 939,055 | 1,273,846 | 1,474 | 480 | 0.19 | 0.14 |
| 2009 | 872,058 | 954,829 | 1,827 | 508 | 0.21 | 0.19 |

1. Tonnage from 2002 to 2005 adjusted slightly based on adjusted tonnage reports.

Average airspace utilization short term density (AUSTD) was consistent in Area 5 between 2001 and 2004 at about 1,340 pounds per cubic yard. Operations began in Area 6 in August 2005. The lower density in 2005 is attributed to lower compaction efforts applied in the early lifts to protect the underlying drainage layer. The AUSTD in 2006 was variable due primarily to the impact of materials added from the Shoreline Transfer Station construction project. The higher AUSTD from 2007 through 2009 is due to sustained use of alternative daily cover, rock recovery and improved compaction practices.

8.5.4 - Settlement

Settlement monitoring at CHRLF was started in 1992 and by 2005 seven monitoring locations had been established. More stations were added in 2007 while others were abandoned as a result of operational impacts. The effective total number of stations is currently nine. The monitoring locations, elevations, and settlement data are included in Attachment F.

Table 9 – SETTLEMENT MONITORING DATA AND PERCENT SETTLEMENT

| Station | Period | Monthly Settlement Rate¹ (ft/month) | Annual Settlement Rate¹ (%/year) |
|---|---------------|---|--|
| PP-5 NORTHING: 171402.80 EASTING: 1701398.90 Start Elevation: 717.44 ft End Elevation: 707.89 ft | 1992 | 0.180 | 2.18% |
| | 1993 | 0.076 | 1.09% |
| | 1994 | 0.072 | 1.04% |
| | 1995 | 0.068 | 0.98% |
| | 1996 | 0.065 | 0.93% |
| | 1997 | 0.061 | 0.88% |
| | 1998 | 0.058 | 0.83% |
| | 1999 | 0.054 | 0.78% |
| | 2000 | 0.050 | 0.73% |
| | 2001 | 0.047 | 0.67% |
| | 2002 | 0.043 | 0.62% |
| | 2003 | 0.039 | 0.57% |
| | 2004 | 0.036 | 0.52% |
| | 2005 | 0.032 | 0.46% |
| | 2006 | 0.029 | 0.41% |
| | 2007 | 0.025 | 0.36% |
| | 2008 | 0.021 | 0.31% |
| 2009 | 0.018 | 0.25% | |
| PP-6 ² & PP-6A NORTHING: 172212.44 EASTING: 1700700.56 Start Elevation: 736.89ft End Elevation: 722.24ft | 1992 | 0.092 | 0.84% |
| | 1993 | 0.130 | 1.41% |
| | 1994 | 0.119 | 1.29% |
| | 1995 | 0.110 | 1.19% |
| | 1996 | 0.101 | 1.09% |
| | 1997 | 0.092 | 1.00% |
| | 1998 | 0.085 | 0.92% |
| | 1999 | 0.078 | 0.85% |
| | 2000 | 0.073 | 0.79% |
| | 2001 | 0.067 | 0.73% |
| | 2002 | 0.063 | 0.68% |
| | 2003 | 0.060 | 0.65% |
| | 2004 | 0.057 | 0.62% |
| | 2005 | 0.055 | 0.60% |
| | 2006 | 0.054 | 0.59% |
| | 2007 | 0.054 | 0.58% |
| | 2008 | 0.055 | 0.59% |
| 2009 | 0.056 | 0.60% | |
| CONCBLK NORTHING: 171168.28 EASTING: 1700716.24 Start Elevation: 782.50 ft | 2003 | 0.039 | 0.32% |
| | 2004 | 0.048 | 0.45% |
| | 2005 | 0.048 | 0.44% |
| | 2006 | 0.048 | 0.44% |

| Station | Period | Monthly Settlement Rate¹ (ft/month) | Annual Settlement Rate¹ (%/year) |
|--|---------------|--|---|
| End Elevation: 779.47 ft | 2007 | 0.048 | 0.44% |
| | 2008 | 0.048 | 0.45% |
| | 2009 | 0.048 | 0.44% |
| PP-23A NORTHING: 172055.30 EASTING: 1699095.22 Start Elevation: 775.53 ft End Elevation: 758.38 ft | 2001 | 0.359 | 2.18% |
| | 2002 | 0.288 | 1.74% |
| | 2003 | 0.248 | 1.50% |
| | 2004 | 0.214 | 1.29% |
| | 2005 | 0.182 | 1.10% |
| | 2006 | 0.155 | 0.94% |
| | 2007 | 0.133 | 0.80% |
| | 2008 | 0.115 | 0.70% |
| | 2009 | 0.101 | 0.61% |
| A5SM-1 NORTHING: 170865.75 EASTING: 1699107.52 Start Elevation: 699.18 ft End Elevation: 690.61 ft | 2005 | 0.344 | 3.59% |
| | 2006 | 0.269 | 2.71% |
| | 2007 | 0.215 | 2.17% |
| | 2008 | 0.162 | 1.63% |
| | 2009 | 0.107 | 1.08% |
| A5SM-2 NORTHING: 171257.45 EASTING: 1699922.50 Start Elevation: 785.17 ft End Elevation: 771.29 ft | 2005 | 0.612 | 3.71% |
| | 2006 | 0.424 | 2.48% |
| | 2007 | 0.346 | 2.02% |
| | 2008 | 0.268 | 1.57% |
| | 2009 | 0.189 | 1.11% |
| A4SM-3 NORTHING: 172704.89 EASTING: 1699170.71 Start Elevation: 763.20 ft End Elevation: 758.93 ft | 2005 | 0.135 | 1.05% |
| | 2006 | 0.122 | 0.89% |
| | 2007 | 0.111 | 0.82% |
| | 2008 | 0.102 | 0.75% |
| | 2009 | 0.091 | 0.67% |
| 13HUB ² NORTHING: 171875.95 EASTING: 1699686.92 Start Elevation: 786.16ft End Elevation: 782.16ft | 2005 | 0.490 | 2.76% |
| | 2006 | 0.067 | 0.41% |
| AIRHUB NORTHING: 171855.47 EASTING: 1700517.68 Start Elevation: 776.48 ft End Elevation: 772.70 ft | 2004 | 0.097 | 0.74% |
| | 2005 | 0.073 | 0.62% |
| | 2006 | 0.068 | 0.57% |
| | 2007 | 0.064 | 0.54% |
| | 2008 | 0.062 | 0.52% |
| | 2009 | 0.060 | 0.51% |
| PMX20074 (NEAR 13HUB) | 2007 | 0.258 | 1.44% |

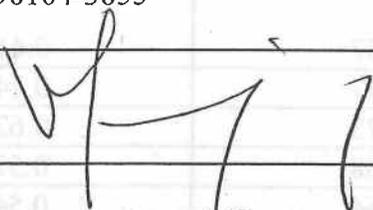
| Station | Period | Monthly Settlement Rate ¹ (ft/month) | Annual Settlement Rate ¹ (%/year) |
|---|--------|--|---|
| NORTHING: 171861.13 EASTING: 1699809.82 Start Elevation: 781.56ft End Elevation: 780.10ft | 2008 | 0.207 | 1.75% |
| | 2009 | 0.165 | 1.40% |
| 1. Monthly and annual rates are calculated from best fit curves developed from plotted data points. 2. Destroyed in 2008 | | | |

Annual settlement, which is dependent on refuse thickness and time, has varied from 0.25% to 3.71% of the refuse thickness. Total settlement at all stations was variable. It is anticipated that landfill settlement will continue, with older refuse areas settling at a comparatively slower rate than newer refuse areas.

SECTION 9 - CERTIFICATION

Annual Report and Groundwater Evaluation Certification

I certify in accordance with the requirements of WAC 173-351-400(c) (3), that the contents of Attachment D – Groundwater Evaluation of this document were prepared under my direction or supervision under a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Where applicable, some specific and related hydrogeologic portions have been duly certified by the responsible groundwater scientist. Based on my inquiry of the person(s) directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

| | | |
|---|--|--|
| Name: Dr. Victor O. Okereke, P.E., DEE | Title: Manager, Engineering Services | Date: July 1, 2010 |
| Mailing Address: Solid Waste Division Department of Natural Resources & Parks 201 South Jackson Street, Suite 701 Seattle, WA 98104-3855 | | Telephone Number: 206-296-4422 |
| Signature:  | | Date: 7/1/10 |

SECTION 10 - ATTACHMENTS

- Attachment A - Remaining Capacity Analysis
- Attachment B - Financial Assurance Estimates
- Attachment C - Waste Disposal Quantities & Fees

- Disposal Fees

Attachment D - Groundwater Data Evaluation

- Appendix I Potentiometric Groundwater Surface Maps and Groundwater Velocity Calculations
- Appendix II Time-Concentration Plots
- Appendix III Trilinear Diagrams and Ion Balance Calculations
- Appendix IV Field and Analytical Data

Attachment E - Landfill Gas Probe Monitoring Program Information

Attachment F - Landfill topography, final grades for Areas 5, 6 and 7, settlement monitoring stations and graphs of settlement data points with lines and best fit curves

