
**2011 ANNUAL REPORT
CEDAR HILLS REGIONAL LANDFILL**

APRIL 2012



King County

Department of Natural Resources and Parks
Solid Waste Division

2011 ANNUAL REPORT CEDAR HILLS REGIONAL LANDFILL

APRIL 2012

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**2010 ANNUAL REPORT
CEDAR HILLS REGIONAL LANDFILL
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EXECUTIVE SUMMARY

This 2011 Annual Report for Cedar Hills Regional Landfill addresses the requirements for Annual Reports in WAC 173-351-200. The main body of the report provides facility information, analysis of the remaining capacity, financial assurance for closure and post closure, and a summary and evaluation of the environmental monitoring and settlement at the site. The final section of the main body provides the certification for the report. Attachments to the report provide more information and detail to support the analyses summarized in the main body of the report. This report follows the format of reports produced since 2005.

In the fall of 2011 methane was detected at two landfill gas probes on the west property boundary. In response, offsite structures near the probes were monitored and no methane was detected. Adjustments were made to the extraction system and a response plan was developed. The plan called for the installation of extraction wells, to be completed in 2012.

The groundwater quality summary is provided in the Executive Summary in Attachment D, 2011 Groundwater Data Evaluation.

Other corrective action responses are described in this report in response to identified issues on Department of Public Health, Seattle King County inspection reports and Air Operating Permit conditions deviations.

The capacity analysis indicates that the remaining capacity of Cedar Hills Regional Landfill at the current tonnage forecast is 14.8 years. The financial assurance section identifies the funding plan through closure and 30 years of post-closure maintenance.

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 Passage Point, 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.

The Final Environmental Impact Statement and 2010 Development Plan was issued for the landfill in July 2010. The Department of Public Health – Seattle & King County (DPHSC) issued a conditional approval in May 2010 to begin filling Area 7 and the area began receiving waste in June 2010. Although filling operations were stopped in Area 6 in August 2010, 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.

Purpose

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 2012 Application for Municipal Landfill Permit Renewal form was completed and transmitted to the DPHSC in January 2012. This document is included in Attachment C.

SECTION 2 - FACILITY INFORMATION

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



ANNUAL REPORT

MUNICIPAL SOLID WASTE LANDFILL

FACILITY NAME: <p style="text-align: center;">Cedar Hills Regional Landfill</p>	CALENDAR YEAR OF REPORT: 2011	PERMIT NUMBER: <p style="text-align: center;">PR0015736</p>	FACILITY ID: <p style="text-align: center;">385</p>
FACILITY LOCATION (street address): <p style="text-align: center;">16645 228th Ave. SE, Maple Valley, WA</p>	COUNTY: <p style="text-align: center;">King</p>		
FACILITY CONTACT (name): <p style="text-align: center;">Kevin Kiernan, Division Director, Solid Waste Division</p>	FACILITY PHONE: 206-296-4466		
FACILITY CONTACT MAILING ADDRESS (if different): <p style="text-align: center;">201 S. Jackson St, Suite 701, Seattle, WA 98104-3855</p>	FACILITY CONTACT PHONE (if different):	FACILITY CONTACT EMAIL: <p style="text-align: center;">Kevin.kiernan@kingcounty.gov</p>	

Did you operate in 2011 ?

- Yes ***If yes***, proceed to next section and complete the form.
- No ***If no***, answer the following questions, sign and date the last page, and submit. This completes your reporting obligations.
- When did you stop operations? _____
- Do you plan to restart? No Yes When? _____

AMOUNTS AND TYPES OF WASTE DISPOSED PER YEAR

PLEASE CHECK IF DISPOSED	AMOUNT DISPOSED
	Please check: <input type="checkbox"/> Cubic Yards or <input checked="" type="checkbox"/> Tons
<input checked="" type="checkbox"/> Municipal/Commercial Solid Waste	807,978
<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	275
<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	16
<input checked="" type="checkbox"/> Petroleum Contaminated Soils	2
<input checked="" type="checkbox"/> Other Contaminated Soils - <i>includes dry vector waste (street sweepings)</i>	218
<input type="checkbox"/> Tires (disposed)	
<input checked="" type="checkbox"/> Medical Waste	1
<input checked="" type="checkbox"/> Other (specify): <i>WWTP grit, decanted vector solids, containerized liquids.</i>	1919
<input checked="" type="checkbox"/> Other (specify): <i>Oversized materials, dead animals, wastes requiring Certificates of Destruction, other misc. waste</i>	2275
Total	812,684

DID YOU RECEIVE MATERIALS FOR RECYCLING? Yes (Please specify on pages 3-4.) No

ADDITIONAL INFORMATION (please check if attached):

- 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 February, 2012. Annual report submitted under separate cover**
- Attach applicable financial assurance information in accordance with WAC 173-351-600 **Included in CHRLF annual report submitted under separate cover**

Are you open to the public? Yes No

Tip fees (Attach schedule if available):
Enclosed

REMAINING PERMITTED CAPACITY:

In tons: Approx 15,165,000 tons

Estimated Date of Closure: 2024 or when filled

Are you planning an expansion this year?

Yes No

ENERGY RECOVERY FROM LANDFILL:

Power Produced Annually Used ~347,850 MMBTU equivalent landfill gas Jan – March 2011, and ~181,848 MMBTU from April - December 2011 * kilowatt hours

** Energy produced by converting landfill gas to high BTU pipeline-quality natural gas at facility owned and operated by Bio Energy (Washington) LLC (BEW). Facility delivers gas via pipeline to Puget Sound Energy's natural gas-fired power plants. Some landfill gas is converted to electricity for use by BEW onsite. Plant was shut down for major repairs April - December 2011 and has not produced electricity or natural gas during this time but has used landfill gas to keep some processing units in working condition.*

During the reporting year, were there any changes in your management practices that would impact your operations?

No Yes (specify) Continued filling in Area 7 of the landfill.

Are there any new solid waste activities planned at your site for this calendar year? No Yes (specify) _____

Planned start date: _____

DID YOU RECEIVE MATERIALS FOR DISPOSAL FROM:	WHERE FROM	TYPE OF WASTE	ESTIMATE AMOUNT
			<input type="checkbox"/> Tons or <input type="checkbox"/> Cubic Yards
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			

NOTE: Please ONLY fill in this chart if you collected materials for RECYCLING or COMPOSTING

AMOUNTS AND TYPES OF MATERIALS COLLECTED FOR RECYCLING OR COMPOSTING

PLEASE CHECK IF RECEIVED FOR <u>RECYCLING or COMPOSTING</u>	COMMERCIAL Please check: <input type="checkbox"/> Cubic Yards/Year or <input checked="" type="checkbox"/> Scaled Tons/Year	RESIDENTIAL Please check: <input type="checkbox"/> Cubic Yards/Year or <input checked="" type="checkbox"/> Scaled Tons/Year	TOTAL AMOUNT RECEIVED Please check: <input type="checkbox"/> Cubic Yards/Year or <input checked="" type="checkbox"/> Scaled Tons/Year
<input type="checkbox"/> Newspaper			
<input type="checkbox"/> Corrugated Paper			
<input type="checkbox"/> Mixed Waste Paper			
<input type="checkbox"/> Container Glass			
<input type="checkbox"/> PET Plastics			
<input type="checkbox"/> HDPE Plastics			
<input type="checkbox"/> LDPE Plastics			
<input type="checkbox"/> Other Recyclable Plastics			
<input type="checkbox"/> Aluminum Cans			
<input type="checkbox"/> Tin Cans			
<input type="checkbox"/> Ferrous Metals (iron, steel)			
<input type="checkbox"/> Nonferrous Metals (excluding aluminum cans)			
<input type="checkbox"/> Appliances (white goods)			
<input type="checkbox"/> Electronics (computers, CPUs, hard drives)			
<input type="checkbox"/> Electronics (monitors, TVs)			
<input type="checkbox"/> Tires (collected)			
<input type="checkbox"/> Asphalt			
<input type="checkbox"/> Concrete			
<input type="checkbox"/> Construction/Demolition			
<input type="checkbox"/> Wood Waste			
<input type="checkbox"/> Landclearing Debris			
<input type="checkbox"/> Yard Debris			
<input type="checkbox"/> Food/Food Scraps			
<input type="checkbox"/> Textiles (rags, clothing)			
<input type="checkbox"/> Co-Mingled Recyclables (specify):			
<input type="checkbox"/> Other (specify):			
Total			

NOTE: Please ONLY fill in this chart if you collected materials for RECYCLING or COMPOSTING

DESTINATION AND FINAL USE OF OUTGOING MATERIALS COLLECTED FOR RECYCLING or COMPOSTING

MATERIAL	OUTGOING AMOUNT Please specify tons or cubic yards.	DESTINATION FACILITY Please specify name, city, state.	FINAL USE Please specify: disposed, recycled, reused, composted, treated, burned for energy, stockpiled, etc.
PREPARED BY: Marilyn Monk, Environmental Scientist III	DATE: 3/15/11	PHONE: 206-296-4418	
EMAIL: marilyn.monk@kingcounty.gov			

*If you need this publication in another format, please call the Waste 2 Resources Program at 360-407-6900.
Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

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	727,000 ^{2,3}
Area 6	6,767,143	600,000 ²
Area 7	8,818,887	8,005,000 ²
Total Remaining Airspace Capacity		9,332,000
<ol style="list-style-type: none"> 1. Per the current operating permit. 2. Remaining airspace capacity is based on the August 25th, 2011 aerial photography compared with the final grading plan for Areas 5, 6 and 7. Due to the timing of flights, more recent aerial photography was not available when this report was written. Total remaining airspace has decreased by 502,000 cubic yards in the 8 months represented between these reports. 3. Last year's report included more of the sideslope in Area 5 that was included in Area 7 in this report. That accounts for the decrease in airspace in Area 5 between the 2010 and 2011 annual reports. 		

Table 2 – ESTIMATED OPERATING LIFE

Waste Disposal Area	Current Remaining Airspace Capacity (cubic yards)	Estimated Airspace Capacity with Anticipated Future Settlement ¹ (cubic yards)	Remaining Operating Life (years)
Area 5	727,000	800,000	0.6 ²
Area 6	600,000	650,000	0.5 ²
Area 7	8,005,000	8,130,000	7.1 ²
Area 8	8,500,000 ⁴	8,627,500	6.6 ³
Estimated Remaining Airspace Capacity & Life		18,207,500	14.8
<ol style="list-style-type: none"> 1. Estimated Airspace Capacity with Anticipated Future Settlement includes additional airspace that is expected to be gained due to settlement between now and the time that the area is filled. 2. Through 2018 the Operating Life is based on refuse being placed at 1500 pounds per cubic yard and an average of 860,000 tons per year. 3. From 2019 to 2026 the Operating Life is based on refuse being placed at 1500 pounds per cubic yard and an average of 990,000 tons per year. 4. Area 8 airspace capacity from the Final Environmental Impact Statement 2010 Site Development Plan. 			

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	31.4
Area 6	25.18 ² 37.4 ³	30.1
Area 7	0.00	55.5
Area 8	Not Developed	Not Developed
1. Areas are net final cover plan view surfaces or as otherwise noted. 2. Final cover surface area. 3. Interim final cover surface area.		

SECTION 4 - FINANCIAL ASSURANCE ANALYSIS

The KCSWD maintains a landfill reserve fund (LRF) account for new area development, closure, post-closure, and corrective action in accordance with WAC 173-351-600. The LRF receives monthly transfers from the KCSWD operating fund, which obtains about 94% of its revenue each year from customers paying the waste disposal fee for MSW brought into the KCSWD solid waste system. The transfer amount is set annually and varies based on KCSWD future plans. In 2011, KCSWD proposed a new disposal rate, which was approved by the King County Council. The LRF contribution for 2012 in the new disposal rate is \$9.21 per ton.

Historically, a uniform 3% discount rate and 3% interest rate are used for each year until landfill closure. In 2009, a 6% discount rate was used, but has since returned to the historical 3% discount rate. As of 2011, based on recommendation of King County Auditor's Office, the policy has been changed to use the King County Office of Economic and Financial Analysis (OEFA) forecast for the interest rate, which is -1.212% for 2012. The interest rate will vary each year in accordance with the most recent forecast.

The current LRF rate of \$9.21/ton for 2012 is based on current status at the time the rate was adopted:

- [a] The current tonnage forecast.
- [b] A -1.212% interest rate on any monies invested over any future years in the fund.
- [c] The projected costs in each future year, for Closure, New Area Development, and Facility Improvements.
- [d] The assumption that waste receipt will stop in June of 2025, and final closure completed in 2027.
- [e] The prediction from the previous year that the requirement, at the completion of final closure will be \$1,815,174 per year, if there is zero future inflation, to maintain the landfill for 30 years.
- [f] This annual funding need can be met with a trust fund of about \$35,500,000 as of December 2027.

The new area development costs and closure costs are forecast based on historical per acre costs. The schedule of activities for new area development and area closures is provided in Attachment B. The forecasted cost for corrective action includes in the near years the forecasted costs for currently planned activities. The forecasted cost of unplanned future activities is included at a flat rate of \$200,000 annually.

In 2012, the KCSWD conducted a more extensive review of the post closure cost estimates. The contribution to the LRF to cover this change will be incorporated in the 2013 rate contribution. A two year rate request is currently being prepared. The King County Council will consider the proposal in 2012. The revised PCM estimate is in internal review at this time. The PCM estimate used in the 2010 Annual Report is included for this report. Detailed estimates of post closure maintenance costs are included in Attachment B.

KCSWD is currently determining the correct internal process to provide certification of the LRF funding and will inform DPHSKC and WDOE by April 30, 2012 when the certification will be available.

SECTION 5 - WASTE DISPOSAL QUANTITIES

The CHRLF received about 2,225 tons of municipal solid waste a day in 2011. Detailed information can be found on the tonnage Annual Report in Section 2.

SECTION 6 - SUMMARY OF 2011 GROUNDWATER, SURFACE WATER, LEACHATE AND LANDFILL GAS MONITORING RESULTS AND 2011 PROPOSED ENVIRONMENTAL MONITORING PROGRAM

6.1 - Summary 2011 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 2004 CHRLF Hydrogeologic Report and in Attachment D of this annual report. Thirty nine (39) groundwater monitoring wells are used for monitoring groundwater elevations and 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:

- Monitor 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) per 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 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 detection of any potential for groundwater contamination by leachate. Leachate characterization also serves to assess pretreatment needs prior to discharge and to evaluate the effectiveness of pretreatment. Characterization includes 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 2011

are 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 and manage 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 for compliance with WAC 173-351, and monthly for operational indicators. In the first half of 2011, only the quarterly compliance monitoring results were reported. Beginning with the third quarter report, the monthly monitoring data is included. Monitoring data results are included in Attachment E. Results from LFG migration monitoring for 2011 are discussed in Sections 8.1 and 8.3 of this report.

6.5 - Proposed Environmental Monitoring Program for 2012

At this time no changes are proposed to the environmental monitoring program for 2012. The proposed environmental monitoring program is to continue as in 2011.

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 – 2011 MOLO CERTIFIED STAFF

NAME	TITLE	DATE OF CERTIFICATION
John Hills	Lead Equipment Operator	Certified until 10/7/2011 – currently working to recertify
Lenny Kuzaro	Lead Equipment Operator	Certified until 2013
Mark Knauss	Transportation Supervisor	Certified until 10/7/2011 – currently working to recertify
Thea Severn	Planning and Communications Manager	Recertified through 3/31/2012
Dean Voelker	Landfill Operations Manager	4/6/2006; Recertified through 4/6/2012
Nigel White	Transportation Supervisor	Certified until 6/28/2013
Steve Smith	Shop Supervisor	Certified until 2013
Wally Grant	Senior Landfill Gas Operator	Certified until 2013

SECTION 8 - EVALUATION REPORTS

8.1 - Summary of Emergency or Corrective Actions Taken in 2011

8.1.1 Landfill Gas Corrective Action

LFG was detected above 5% methane by volume at gas probes GP-33C in June, August and September monthly monitoring. After the June measurement, the LFG extraction system was adjusted and the exceedance did not recur. However with the two consecutive exceedances in August and September, KCSWD responded with the following actions:

- Notification to DPHSKC and WDOE
- Adjustments to the extraction system to enhance collection
- Daily monitoring of probes along the west perimeter of the property
- Monitoring of offsite structures within 1000 feet of the probes with exceedances
- Development of a response plan

Operational review of the extraction system was undertaken and modifications were implemented to enhance extraction from unlined areas and under liner spaces that could potentially act as gas conveyance pathways.

Daily monitoring of LFG migration probes located along the western property line began on October 20th and continued through the end of the year. Elevated methane concentrations were limited to two probes, GP-30B and GP-33C.

Between October 24th and November 18th, monitoring of offsite structures was initiated at parcels within 1000 feet of the non-compliant probes. Nineteen residences were identified, and ten participated in methane monitoring conducted in crawl spaces and ambient air. No methane was detected at any residence or any other offsite structure, except for 2 gas utility meters.

The response plan, *Cedar Hills Regional Landfill Mitigation Plan for Landfill Gas* was completed and sent to the DPHSKC and the WDOE on November 21st 2011.

In preparation of the response plan, geologic conditions along the western perimeter were evaluated and it was determined that LFG could be migrating through higher permeability, unsaturated sediments that were characterized as either the stratified drift or advance outwash deposits. The plan targets the potential zone of LFG migration in the native sediments with seven LFG extraction wells. The necessity of additional completions to ensure migration control will be determined after installation and performance evaluation of the system.

Drilling began on January 10, 2012 and was completed February 24, 2012. All of the seven new LFG extraction wells have been connected to the LFG extraction system.

8.1.2 Leachate Discharge Permit Corrective Action

In November 2011, King County Wastewater Treatment Division Industrial Waste staff collected a sample at the leachate aeration ponds that resulted in a nickel loading of 1.05 lb/day, which is an exceedance of the Wastewater Discharge Permit loading limit. The cause of the exceedance was determined to be related to a soil erosion event in a short term high intensity storm that sent turbid runoff to the contaminated stormwater system. The erosion area was repaired shortly following the storm event. No further corrective actions were required. The Industrial Waste staff resampled and inspected the site and found no other exceedances. Industrial Waste cleared the event with no further action required.

8.1.3 Inspection Reports Responses

In 2011, inspection reports from DPHSKC identified 3 violations at the site. These identified violations and the corrective actions taken are identified below.

- | | | | |
|---|-------------------|--|--|
| • | March 26, 2011 | Litter on the surface of Area 6 | Increased litter crew activity in specific area |
| • | August 17, 2011 | Leachate weep in Area 6 attracting vectors (flies) | Contractor repaired weep area |
| • | September 6, 2011 | Ponding in aeration pond service boat | Emptied water from the boat and stored upside down |

8.1.4 Title V Deviation Reports

KCSWD reports deviations from the Title V Air Operating Permit in monthly Deviation Reports. In 2011, KCSWD filed 4 Deviation Reports, in April, October, November and December. None of these deviations resulted in violations. The deviation and preventative measures taken for each event is listed below.

- | | | | |
|---|--------------|--|--|
| • | April 2011 | Oxygen and Nitrogen concentrations exceeded in several wells
High temperature in gas well | Adjusted flow rate to control for infiltration
Continue to monitor and maintain; increase flow rate |
| • | October 2011 | Oxygen and Nitrogen concentrations exceeded in several wells
High temperature in gas well | Adjusted flow rate to control for infiltration
Continue to monitor and maintain; increase flow rate |

- November 2011 Oxygen and Nitrogen concentrations exceeded in several wells Adjusted flow rate to control for infiltration
- High temperature in gas well Continue to monitor and maintain
- December 2011 Methane leak from flex hose at gas well Replaced flex hose

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: turbidity, fecal coliform, ammonia, dissolved oxygen, copper and lead and zinc; for SW-GS1 the exceedances were for turbidity, fecal coliform, ammonia, copper, lead and iron. Monitoring station SW-N4 had exceedances for ammonia, copper and zinc. Following exceedances of the Industrial Stormwater General Permit benchmarks, KCSWD Engineering and Operations inspect the site to determine the source of the exceedance. Identified failures of control systems are promptly corrected. These exceedances are in bold in Table 6.

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
Fecal Coliforms	(CFU/100mL)	SW-GS1	6/13/11	230	100	SSWC, FA, FC
		SW-GS1	7/20/11	1100	100	SSWC, FA, FC
		SW-GS1	8/8/11	1600	100	SSWC, FA, FC
		SW-GS1	11/17/11	1500	100	SSWC, FA, FC
		SW-SL3	5/10/11	120	100	SSWC
		SW-SL3	5/11/11	780	100	SSWC, FA, FC
		SW-SL3	7/14/11	680	100	SSWC, FA, FC
		SW-SL3	8/23/11	8900	100	SSWC, FA, FC
		SW-SL3	9/19/11	7500	100	SSWC, FA, FC
		SW-SL3	11/17/11	560	100	SSWC, FA, FC
		SW-SL3	11/17/11	470	100	SSWC, FA, FC
		SW-SL3	12/19/11	140	100	SSWC
Turbidity (Field)	(NTU)	SW-GS1	01/25/11	8.15	5 over bkgrd	SSWC
		SW-GS1	02/16/11	19.30	5 over bkgrd	SSWC
		SW-GS1	03/07/11	6.73	5 over bkgrd	SSWC
		SW-GS1	03/08/11	10.2	5 over bkgrd	SSWC
		SW-GS1	10/11/11	927	bnmrk 25 NTU	SSWC, FA, FC
		SW-GS1	10/27/11	40.8	bnmrk 25 NTU	SSWC, FA, FC
		SW-GS1	11/17/11	619	bnmrk 25 NTU	SSWC, FA, FC
		SW-GS1	12/19/11	64.7	bnmrk 25 NTU	SSWC, FA, FC
		SW-SL3	01/25/11	24.3	5 over bkgrd	SSWC
		SW-SL3	01/25/11	15.1	5 over bkgrd	SSWC
		SW-SL3	02/16/11	10.8	5 over bkgrd	SSWC
		SW-SL3	02/16/11	14.7	5 over bkgrd	SSWC
		SW-SL3	03/03/11	9.26	5 over bkgrd	SSWC
		SW-SL3	03/07/11	11.2	5 over bkgrd	SSWC
		SW-SL3	03/08/11	18.6	5 over bkgrd	SSWC
		SW-SL3	4/11/11	6.23	5 over bkgrd	SSWC
		SW-SL3	5/11/11	13.60	5 over bkgrd	SSWC
		SW-SL3	10/11/11	25.9	bnmrk 25 NTU	SSWC, FA, FC
		SW-SL3	11/17/11	39.8	bnmrk 25 NTU	SSWC, FA, FC
		SW-SL3	11/17/11	29.8	bnmrk 25 NTU	SSWC, FA, FC
Dissolved Oxygen	(mg/L)	SW-SL3	5/10/11	7.98	min 8 mg/L	SSWC
		SW-SL3	7/14/11	4.63	min 8 mg/L	SSWC, FC
		SW-SL3	8/23/11	6.36	min 8 mg/L	SSWC, FC
Ammonia	(mg/L)	SW-N4	01/24/11	0.025	0.0028	SSWC, FC
		SW-N4	02/14/11	0.0265	0.0028	SSWC, FC
		SW-N4	03/02/11	0.0292	0.0047	SSWC, FC
		SW-N4	03/08/11	0.0215	0.0103	SSWC, FC
		SW-SL3	01/25/11	0.012 T	0.0024	SSWA, SSWC, FA, FC
		SW-SL3	02/16/11	0.01 T	0.0015	SSWA, SSWC, FA, FC
Copper	(mg/L)	SW-GS1	11/17/11	0.0308	0.0081	SSWA, SSWC, FA, FC
		SW-N4	01/24/11	0.014	0.00471	SSWA, SSWC, FA, FC
		SW-N4	02/14/11	0.00794	0.00579	SSWC, FC
		SW-N4	03/02/11	0.00876	0.00530	SSWA, SSWC, FA, FC
		SW-N4	5/2/11	0.00785	0.00535	SSWA, SSWC, FA, FC
		SW-N4	5/17/11	0.0129	0.00565	SSWA, SSWC, FA, FC

Parameter	Units	Sampling Location	Sample Date	Sample Value	Regulatory Limit	Regulation
Copper	(mg/L)	SW-N4	10/25/11	0.00808	0.00682	SSWC, FC
		SW-N4	11/16/11	0.00798	0.00701	SSWC, FC
		SW-N4	12/15/11	0.00913	0.00657	SSWC, FC
		SW-SL3	01/25/11	0.0077	0.00470	SSWA, SSWC, FA, FC
		SW-SL3	02/16/11	0.00747	0.00495	SSWA, SSWC, FA, FC
		SW-SL3	03/07/11	0.00661	0.00531	SSWC, FC
		SW-SL3	9/19/11	0.013	0.0052	SSWA, SSWC, FA, FC
		SW-SL3	11/17/11	0.00694	0.00393	SSWA, SSWC, FA, FC
Iron	(mg/L)	SW-GS1	02/16/11	1.25	1.00	FC
Lead	(mg/L)	SW-GS1	11/17/11	0.0143	0.0015	SSWC, FC
		SW-GS1	12/19/11	0.0023	0.0018	SSWC, FC
		SW-SL3	01/25/11	0.00135	0.0007	SSWC, FC
		SW-SL3	02/16/11	0.00174	0.0007	SSWC, FC
		SW-SL3	03/07/11	0.0019 D	0.0008	SSWA, SSWC, FA, FC
		SW-SL3	11/17/11	0.00247	0.00052	SSWC, FC
		SW-GS1	11/17/11	0.0143	0.0015	SSWC, FC
Zinc	(mg/L)	SW-N4	01/24/11	0.0479	0.0437	SSWA, SSWC, FC
		SW-N4	11/16/11	0.144	0.065	SSWA, SSWC, FA, FC
		SW-SL3	03/07/11	0.0151 D	0.0492	SSWA, SSWC, FA, FC
FC = Federal Chronic Surface Water Criteria						
FA = Federal Acute Surface Water Criteria						
SSWC = State Chronic Surface Water Criteria						
SSWA = State Acute Surface Water Criteria						
ISWGP = Industrial Stormwater General Permit Benchmark						
T = Estimated Value						

8.2.2 - Groundwater Monitoring Data

Groundwater at the Cedar Hills Regional Landfill occurs both in a regional aquifer and in perched zones. Aquifer recharge is entirely by precipitation. There are no seasonal variations in horizontal groundwater flow paths. Vertical hydraulic gradients are found in areas of high recharge and transmissive aquifer materials. 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 field and chemical parameters are analyzed for and the results evaluated by a variety of graphical and statistical methods. The groundwater data evaluation presented in Attachment D describes onsite groundwater flow (elevations, direction and velocity); and groundwater quality. Variations in chemical concentrations over time, and possible impacts to groundwater quality by surface activities are also presented.

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 as flow converges and mixes from upgradient sources and concentrations of many analytes are 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) 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. Exceedances 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 some of the impacts to water quality. Trends for most contaminants in these perched zone wells have stabilized with the exception of parameters associated with landfill gas migration in monitoring well MW-47.

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.

KCSWD has historically monitored landfill gas on a monthly or quarterly basis for compliance with WAC 173-351. In addition to this compliance monitoring, additional monitoring has occurred at the perimeter and interior probes to provide information to the LFG extraction system operators. In the first two quarterly reports of 2011, the compliance monitoring data for each quarter was included. For the last two quarters of 2011, the monthly operational monitoring was also reported, as was the addition LFG migration monitoring. All the monitoring data for the year is included in Attachment E, including data previously reported and the addition monitoring data not previously reported. All results are grouped by monitoring probe.

LFG was detected above 5% methane by volume at gas probes GP-33C in June, August and September monthly monitoring. After the June measurement, the LFG extraction system was adjusted and the exceedance did not recur. However with the two consecutive exceedances in August and September, KCSWD began the response described previously in Section 8.1. In the course of daily monitoring of the west side perimeter probes, exceedances were detected at GP-30B also. Other exceedances detected throughout the year included two exceedances at GP-18C and one exceedance at GP-34A. These detections were not repeated in the year and no further action was taken after the initial adjustments to the LFG extraction system apparently addressed the issues.

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 2010 and 2011

Month	2011 Monthly Flow (million gallons)	2011 Number of Exceedances	2010 Monthly Flow (million gallons)	2010 Number of Exceedances
January	33.3	0	26.38	0
February	14.84	0	12.36	0
March	27.56	0	17.33	0
April	21.75	0	15.22	0
May	14.96	0	14.17	0
June	5.83	0	21.04	0
July	4.92	0	4.14	0
August	2.89	0	5.25	0
September	3.49	0	10.22	0
October	13.53	0	13.96	0
November	23.81	0	25.27	0
December	13.29	0	34.09	0
Total Discharged	180.17	0	199.42	0
Average. Monthly Discharge	15.01	0	16.62	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 2011.

8.4.2 - Leachate Monitoring Data

A statistical summary of the leachate monitoring data is included as Appendix F of Attachment D. A violation of the nickel loading limit for the Industrial Wastewater Discharge Permit with King County Wastewater Treatment Division occurred in November 2011. The corrective action taken is described in Section 8.1.

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 five 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 were suspended on August 27, 2010. Area 6 is permitted as a 14 lift landfill cell. Lifts 9 and 10 were filled as a single thirty foot lift. Work to complete the interim cover for Area 6 was partially completed in 2011. Interim cover will be completed in 2012 and settlement monitoring points established.

8.5.3 - Area 7

Filling operations in Area 7 began on June 17, 2010. It is permitted as a seven lift cell with each lift being thirty feet.

Table 8 – LANDFILL AIRSPACE UTILIZATION FACTORS

Year	Tonnage	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)
2006	998,871	1,564,508	1,277	486	0.178	0.113
2007	1,010,377	1,454,689	1,389	449	0.162	0.113
2008	930,617	1,270,613	1,465	481	0.189	0.138
2009	867,482	957,538	1,812	506	0.213	0.193
2010	830,909	1,183,488	1,404	507	0.223	0.156
2011 ¹	619,583	888,869	1,394	402	0.175	0.122

Footnote:

1 – Tonnage and Airspace consumed through October 2011. Unusually wet conditions prevented the end of year survey.

The average airspace utilization short term density (AUSTD) over the last six years was 1457 lb/cy. Variations to this average occurred in 2006 was variable due primarily to the impact of materials added from the Shoreline Transfer Station construction project, from 2007 through 2009 is due to sustained use of alternative daily cover, rock recovery, improved compaction practices, utilizing 30 foot lifts and settlement and 2010 through 2011 due to reduced compaction effort on the first lift during the transition to Area 7.

8.5.4 - Settlement

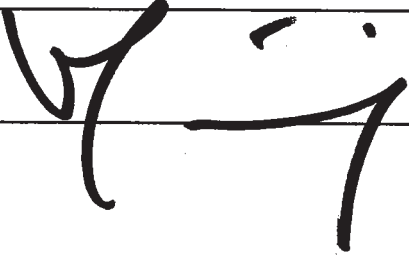
Settlement monitoring at CHRLF was started in 1992 and by 2005 seven monitoring locations had been established. More stations were added in 2007 while others were abandoned as a result of operational impacts. The effective total number of stations is currently nine. The monitoring locations, elevations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

Annual settlement, which is dependent on refuse thickness and time, has varied from 0.22% to 3.79% of the refuse thickness. Total settlement at all stations was variable. The average settlement rate for 2011 was 1.08 ft/yr. 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: April 2, 2012
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: 		

SECTION 10 - ATTACHMENTS

Attachment A - Remaining Capacity Analysis

Attachment B - Financial Assurance Estimates

Attachment C – Annual Permit Renewal Application
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