CEDAR HILLS REGIONAL LANDFILL
2014 ANNUAL REPORT

King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste **Prevention** | *Resource* **Recovery** | *Waste* **Disposal**

www.kingcounty.gov/solidwaste

March 2015

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MARCH 2015

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March 30, 2015

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CONTENTS

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 (BEW); a right-of-way for a natural gas pipeline and numerous power transmission line rights-of-way.

Filling operations are continuing in Area 7. Area 7 is anticipated to have capacity through 2017. Area 8 is currently in the design phase.

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 2015 Permit Renewal Application is included as Attachment A.

SECTION 2 - FACILITY INFORMATION

Facility information can be found below in forms provided by Ecology included in Attachment B.

SECTION 3 - LANDFILL CAPACITY AND LANDFILL DEVELOPMENT STATUS

Currently, Cedar Hills has built capacity remaining in three areas (Area 5 - 870,000 cubic yards, Area 6 – 890,000 cubic yards, and Area 7 – 5,100,000 cubic yards) totaling 6,680,000 cubic yards. These capacities are based upon the difference between existing landfill contours (September 14, 2014 Aerial Survey) and the planned final surface of these areas at a maximum elevation of 788 feet above mean sea level. Attachment D provides the backup information for calculating capacity.

Efforts are underway to optimize the use of this remaining built capacity. These include decreasing the amount of airspace consumed by disposal and recovering airspace gained due to settlement.

The amount of airspace available for disposal is impacted by airspace consumed by daily cover and road construction. The use of tarps for alternative daily cover, and the recovery of rock used for roads increases the airspace available for disposal. Additionally, mechanical compaction increases the airspace available for disposal.

As the landfill ages, it settles. Airspace from settlement can be recovered for disposal. Settlement occurs due to consolidation and to loss of mass from leachate and more importantly gas production. As gas is collected, it is removed from the landfill. The airspace gas once occupied consolidates and the landfill settles. Also soil surcharge can be used to accelerate settlement. Areas 5 and 6 both have areas of soil stockpiled over them to accelerate settlement. This soil will be later recovered for other uses.

Cedar Hills has a planned capacity addition of 8,500,000 cubic yards for Area 8 (2010 FEIS Cedar Hills Site Development Plan). Area 8 is currently in the design phase.

The table below presents current and planned capacity in cubic yards and tons by area. It is based upon an airspace utilization of 1,600 pounds of refuse disposed per cubic yard of airspace in Area 7 and 8, and 1,500 pounds of refuse disposed per cubic yard of airspace in Areas 5 and 6. 1,600 pounds per cubic yard is the airspace utilization achieved in Area 7 using current operational practices (compaction, daily cover usage, and rock recovery).

Area	Capacity (cubic yards)	Capacity (tons)	Capacity (years)
5	870,000	650,000	0.7
6	890,000	670,000	0.8
7	5,100,000	4,080,000	4.6
Total 5, 6, and 7	6,060,000	5,400,000	6.1
8	8,500,000	6,800,000	7.7
Totals 5, 6, 7 and 8	15,360,000	12,200,000	13.8

Note 1: A lower airspace utilization (1,500 pounds per cubic yard) was used for Areas 5 and 6 because it is assumed that comparatively smaller consolidation will occur in their final lifts.

Note 2: 305,000 cubic yards of airspace has been recovered in Areas 5 and 6 between April 2011 and September 2014. This capacity is included in this estimate. Future settlement is not included in these estimates.

The development status of the landfill is summarized in the table below. Closed Areas are Refuse Areas closed in accordance with pertinent regulatory requirements and not currently scheduled to receive additional waste. The Area 5 and Area 6 top surfaces have interim covers that will be maintained until the completion of the last remaining lifts.

STATUS OF LANDFILL AREAS[1]

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	5.4[3]	50.1
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 during the disposal rate approval process and adjusted annually. In 2014, the LRF contribution was $12.35 per ton. The LRF includes funding for the revised new area development, closure and post closure maintenance cost estimates.

The LRF includes all currently identified projects and funds for unidentified projects further in the future. The post closure maintenance estimate is based on current costs for maintenance of the systems and is reviewed annually. The review considers whether there have been changes to the environmental control systems that would lead to changes in maintenance costs and any changes to current costs of maintenance. The review for this report did not identify any maintenance cost changes. The total project cost of post closure maintenance is then inflated to current year dollars and is used to forecast the future costs as described below. The detailed estimate from previous years is included in Attachment E.

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 was -1.31% for 2014. The interest rate will vary each year in accordance with the most recent forecast.

The current LRF rate is based on current status at the time the rate was adopted:

[a] The current tonnage forecast.
[b] The current interest rate set by OEFA, which is updated throughout the year. The interest rate is currently set at -0.2% 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 $2, 645,231 (2014 dollars) 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 $46,900,000 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 E. 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.

The Post Closure Maintenance estimate used in the 2012 Rate Request was reviewed for 2014 and is included for this report. Detailed estimates of post closure maintenance costs are included in Attachment E. This estimate is reviewed annually for any significant changes and reviewed and updated in detail prior to any rate increase request.

KCSWD sent a letter to WDOE in 2012 regarding options for providing certification of the LRF funding. KCSWD has had no further discussions with WDOE or DPHSKC. When the correct mechanism has been identified, KCSWD will provide the certification required.

SECTION 5 - WASTE DISPOSAL QUANTITIES

The CHRLF received an average of 2,310 tons of municipal solid waste a day in 2014. Detailed information can be found in Attachment B.

SECTION 6 - SUMMARY OF 2014 GROUNDWATER, SURFACE WATER, LEACHATE AND LANDFILL GAS MONITORING PROGRAM AND 2015 PROPOSED ENVIRONMENTAL MONITORING PROGRAM

6.1 - Summary 2014 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 Part 7 of Attachment F.

The Groundwater Monitoring Program is described in Section 6.2 of the 2004 CHRLF Hydrogeologic Report and in Attachment F 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. Five (5) additional wells in the regional aquifer and fifteen (15) additional wells in the perched zones 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 is monitored at twelve (12) strategic locations around the landfill. Surface water samples are collected monthly for characterization. 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 Part 7 of Attachment F.

6.3 - Summary Leachate Monitoring Program

Leachate is analyzed for characterization and compliance with Wastewater Discharge Permit No. 7842-02. 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 2014 are included in Part 7 of Attachment F.

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 figure included in Attachment G.

Parameters typically measured at the LFG monitoring probes include methane, oxygen and carbon dioxide concentrations and static pressure. Monitoring is performed quarterly for compliance with WAC 173-351, and monthly for operational indicators. Monitoring data results are included in Attachment G. Results from LFG migration monitoring for 2014 are discussed in Sections 8.1 and 8.3 of this report.

6.5 - Proposed Environmental Monitoring Program for 2015

Proposed changes to the environmental monitoring program include an updated Sampling and Analysis Plan (SAP). Modifications to the network of wells and frequency of sampling, intended to streamline monitoring and optimize resources while maintaining program efficiency and regulatory compliance. The updated SAP and the Cedar Hills Hydrogeologic Report will be submitted to DPHSKC for approval in 2015. Pending approval, environmental monitoring is expected to continue as in 2014.

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 the table below.

MOLO Certifications

NAME	TITLE	DATE OF CERTIFICATION
John Hills	Lead Equipment Operator	Certified through April 2018
Lenny Kuzaro	Lead Equipment Operator	Certified through April 2018
Rusty Bogart	Landfill Gas Operator	Certified through 2015
Chris Gavigan	Assistant Operations Manager	Certified through 2015
Wally Grant	Landfill Gas Supervisor	Certified through 2016
Shawn Carter	Transportation Supervisor	Certified through October 2017
Scott Barden	Landfill Operations Manager	Certified through October 2017

SECTION 8 - EVALUATION REPORTS

8.1 - Summary of Emergency or Corrective Actions Taken in 2013

8.1.1 Leachate Discharge Permit Corrective Action

As discussed later in section 8.4, no leachate discharge corrective actions were necessary in 2014.

8.1.2 Inspection Reports Responses

In 2014, PHSKC inspected CHRLF 44 times; 39 of which were deemed satisfactory and five of which were deemed unsatisfactory. The issues identified in the unsatisfactory inspection reports and subsequent corrective measures undertaken by KCSWD are outlined below.

Inspection Date	Issue(s) Observed	Corrective Measures Taken
January 10, 2014	• Areas of insufficient cover within Area 7	• Additional cover material applied, where needed. Communicated to PHSKC in a memorandum dated May 16, 2014.
February 7, 2014	• Atypical amounts of windblown litter and debris observed away from the tipping area.	• Collected and removed litter. Communicated to PHKSC in a memorandum dated May 16, 2014.
February 20, 2014 and February 28, 2014	• Water ponding observed at north end of Area 5 • Gas release as evidenced by bubbling in ponded water.	• Improvements made to stormwater conveyance system to prevent ponding. Communicated to PHSKC in memorandums dated May 23 and May 24, 2014. • Subsequent surface monitoring showed methane concentrations within acceptable levels. • Existing plans to place soil surcharge stockpiles on the top of Areas 5 and 6 were accelerated to improve landfill gas control and drainage. PHSKC approved the design plans on June 16, 2014.
March 26, 2014	• Water ponding observed in areas 5 and 6. • Methane was measured in excess of 500 parts per million by KCSWD staff.	• Same as above.

8.1.3 Title V Air Operating Permit Deviation Reports

KCSWD reports deviations from the Title V Air Operating Permit in Deviation Reports that are submitted to PSCAA on a monthly basis. The Title V Operating Permit establishes standards for temperature and air intrusion for the landfill gas collection system. The standard for temperature is that recorded temperature should be less than 131 degrees Fahrenheit, and the standard for air intrusion is oxygen concentration should be less than 5 percent. The table below summarized deviations which occurred in 2014.

2014 Instances												
Location	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
4IFC0033			O							O		O
A5E00H9S		T	T		T							
A5E0L12N												
A5E0L13N				O						O		O
A5ESS002			O									
A5UC000E									O			
A5UC000W									O			
A6IS007E										O		
A6IW4004		O										
A6IW4005				O								O
A6L1201E				O								
A6L1203E				O								
A6L1204E				O								
A6L1204S									O	O		
A6L1207S									O			
A6L1208E										O		
A6L50H6S	O											
A7L0204W			O									
A7L0302W										O		
CHCSFC01									O			

Notes:

O = *Oxygen &/or nitrogen exceedance likely caused by air infiltration associated with high gas extraction rates. Corrective measures included adjusting flow rate and applied vacuum to control air intrusion.*

T = *Operating temperature >131 ºF likely due to localized reactive temperature from refuse decomposition. Authorized by PSCAA on March 9, 2011 – no corrective measures warranted.*

In addition, the Title V Air Operating Permit requires quarterly surface monitoring for fugitive landfill gas, and a program to monitor cover integrity on a monthly basis. The two incidents described below summarize corrective actions performed in response to these requirements.

In March of 2014 (March 26), methane concentrations in excess of 500 ppm were recorded in monitoring for fugitive emissions over the Area 6 top deck. In response, additional vacuum was applied to collection wells which reduced fugitive emissions to below the threshold.

On December 16th of 2014, there was a three hour loss of power to the blower system. During this interval of time pressure built up under an exposed geomembrane on Area 7. Damage to some pipe boots and liner material surrounding pipe boots occurred. Repairs to the pipe boots and damaged liner material were completed by December 18th.

8.2 - Evaluation of Surface Monitoring Data

The CHRLF operates under a National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater General Permit (ISGP), number WAR000756. Three discharge points are monitored in compliance with the ISGP. These points are N4 to the north, GS1 in the south, and SL3 along 228th Avenue SE.

Under the ISGP, quarterly sampling is required for the following 12 parameters: BOD_5, total suspended solids, ammonia (total as N), alpha terpineol, benzoic acid, p-Cresol (4-methylphenol), phenol, zinc (total), pH, turbidity, copper (total), and oil sheen. Actual monitoring includes quarterly monitoring for these analytes at these three locations, as well as monthly monitoring for additional analytes at all locations. Field and analytical surface water data is included in Part 7 of Attachment F.

Monitoring station N4 monitors discharges to an unnamed tributary to McDonald Creek, which ultimately flows into Issaquah Creek. Monitoring station SL3 monitors discharges to a series of roadside ditches along 228th Ave SE and Cedar Grove Road. While the ditches ultimately connect to the Cedar River, the underlying geology is highly infiltrative, resulting in the infiltration of stormwater discharging from CHRLF long before it reaches the Cedar River. Monitoring station 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.

Exceedances of the ISGP for 2014 are summarized in the table below.

SUMMARY OF 2014 STORMWATER MONITORING DATA THAT EXCEEDED ISGP CRITERIA

Sample Period	Sample Result	Unit	Criteria Exceeded		
			Benchmark	Effluent Limit	
			Quarterly Average	Monthly Average	Daily Maximum
Sample Location: N4					
Q1	No Exceedances				
Q2	No Exceedances				
Q3	**Zn = 125**	ug/L	117	110	200
Q4	No Exceedances				
Sample Location: GS1					
Q1	**Turbidity = 30**	NTU	25	--	--
Q2	None				
Q3	**TSS = 88.1**	mg/L	--	27	88
	TSS = 47.9	mg/L	--	27	88
	Turbidity = 184.533	NTU	25	--	--
Q4	**Turbidity = 110**	NTU	25	--	--
	TSS = 131	mg/L	--	27	88
	TSS = 69	mg/L	--	27	88
Sample Location: SL3					
Q1	No Exceedances				
Q2	**Zn = 175**	ug/L	117	110	200
	Cu = 17.996	ug/L	14	--	--
Q3	**TSS = 95.5**	mg/L	--	27	88
	TSS = 186	mg/L	--	27	88
	Turbidity = 361.165	NTU	25	--	--
	Cu = 25.1325	ug/L	14	--	--
Q4	No Exceedances				

Notes:

= exceedance

Zn = total zinc

TSS = total suspended solids

Cu = copper

ug/L = micrograms per liter

mg/L = milligrams per liter

NTU = Nephelometric turbidity unit

-- = not defined

8.3 Groundwater Monitoring Data

Groundwater at the Cedar Hills Regional Landfill (CHRLF) occurs both in a regional aquifer and in perched zones. The regional aquifer flows through advance outwash and deeper deposits and is separated from the base of waste placement areas by more than 200 feet of unsaturated sands and gravels. Perched groundwater occurs in onsite till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified; leaving the regional aquifer beneath the landfill as the earliest target hydraulic pathway for groundwater contaminant detection.

Attachment F contains a detailed analysis of groundwater monitoring results. Sections 8.3.1 and 8.3.2 give a summary of the conclusions of the Annual Groundwater Monitoring Report certified in Attachment F.

8.3.1 Regional Aquifer

The regional aquifer beneath CHRLF is entirely recharged by precipitation. A local recharge area is located immediately south of the landfill within the Queen City Farms (QCF) property, and is centered north of the Main Gravel Pit Lake. In general, groundwater flow in the regional aquifer is radial from the recharge area. Beneath the landfill, regional flow is to the north in the south and central portions of the landfill site. Flow direction in the northern part of the site turns northeasterly as recharge from the McDonald Creek drainage affects flow patterns. Regional Aquifer flow is physically separated from the Cedar River and likely discharges to Issaquah Creek. There is no significant seasonal variation in horizontal groundwater flow paths. Horizontal gradients are influenced by infiltrating precipitation in the recharge area. Vertical hydraulic gradients are demonstrated by head differences in adjacent wells screened at different depths and related to hydraulic conductivity of the aquifer materials. A flow path analysis has been completed for the site and indicates a complex flow regime in the landfill vicinity

A monitoring network is in place consisting of 45 monitoring and production wells. Monitoring network wells are located to characterize groundwater flow and to obtain representative samples for water quality characterization. Downgradient flow converges into a high transmissivity zone which provides excellent monitoring coverage for all flow paths within the potential source area.

An extensive list of chemical analytes and field parameters are analyzed and the results are evaluated by a variety of graphical and statistical methods. The groundwater data analyses presented in this report describe onsite groundwater elevations, flow direction and velocity; and summarizes the evaluation of groundwater quality to determine if chemical concentrations have changed over time or differ between well locations. This report determines if these findings are indicative of impacts to groundwater quality by surface activities.

Upgradient groundwater quality, especially in wells nearest the southern recharge zone, is profoundly affected by conditions and activities that have occurred on the adjoining QCF property. Upgradient groundwater quality manifests a high degree of spatial variation and temporal trends, which are expected given recharge area site history which has included a variety of land uses, investigations and remediation.

As flow continues into areas beneath the landfill footprint changes are discernible as groundwater encounters and equilibrates to different oxidation-reduction conditions, soil gas/groundwater interface conditions and solvent/solute interactions. Flow paths under the footprint and immediately downgradient of waste cells are influenced by landfill gas (LFG) in the unsaturated strata. Flow paths in the north landfill area (aligned along MW-66, MW-74, MW-75 and MW-85) are notably higher in chloride concentrations. The data are consistent with

an input from onsite, overlying infrastructure in the north end. Concentrations have declined since maximum levels reached in 2008-2010.

Downgradient groundwater quality also manifests a high degree of spatial variation and temporal trends. Much as recharge effects are dampened with distance from the source, the concentrations of many analytes are attenuated by processes such as dispersion dilution, sorption, and degradation as groundwater flows beneath the landfill. The highest concentrations of certain analytes occur in upgradient wells. Groundwater quality in the regional aquifer leaving the site remains consistent with historical data.

These data indicate that CHRLF acts as an attenuation zone for upgradient impacts, allowing a reduction in the concentration of chlorinated volatile organic compounds (CVOCs).

Site hydrogeological reports and supporting documentation identify the regional aquifer is the first continuously saturated zone beneath the landfill and serves as the earliest path for detection monitoring. Recent water quality evaluations of QCF groundwater are available in the *2010 Expanded Hydrogeology Assessment Queen City Farms King County, Washington,* (December 2010) and *Report Evaluation of Remedial Action 10-Year Review Queen City Farms King County, Washington* (2008).

8.3.2 Perched Zones

Perched groundwater occurs in onsite till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified. Recharge is by precipitation with possible hydraulic continuity to surface streams.

Impacts from past landfilling practices have previously been recognized in several perched zone wells. Site improvements and engineered facilities have been effective in reducing contaminant concentrations attributable to past practices. Declining or stable long term trends for many contaminants are apparent in these wells. Additional investigations are in planning to evaluate residual impacts and make recommendations. Recent findings are available in the Technical Memoranda *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment,* April 2010, and the *East Main Hill Perched Zones,* October 2010.

8.4 Evaluation of Gas Monitoring Data

See Attachment G 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 G. 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. All the monitoring data for the year for the perimeter compliance probes is included in Attachment G.

8.5 Evaluation of Leachate Monitoring Data and Volumes Generated

Leachate collected throughout the landfill is routed to the Leachate Effluent Pump Station (LEPS). Following aeration, leachate discharges to the King County sewerage system pursuant to a Waste Discharge Permit issued to SWD by the King County Industrial Waste Program (permit no. 7842-02).

8.5.1 – Leachate Volumes

The recorded volumes of leachate discharged from the leachate aeration basins via the LEPS are indicated in the table below. The actual leachate volume generated within the landfill is not measured directly.

LEACHATE DISCHARGE DATA AND EXCEEDANCES FOR 2014

Month	**Flow** (million gallons)	**Daily Max Discharge Volume Exceedances**
January	19.9085	None
February	25.3584	None
March	33.509	None
April	15.2564	None
May	13.7587	None
June	4.5678	None
July	4.8222	None
August	4.4012	None
September	8.9872	None
October	17.924	None
November	19.7542	None
December	20.8396	None
Total	**189.0872**	**None**
Average/ Month	**15.7573**	**0**

Pursuant to the Waste Discharge Permit (no. 7842-02), the daily maximum discharge volume for CHRLF is 2.7 million gallons per day. There were no exceedances of the permit daily limits in 2014.

8.5.2 – Leachate Monitoring Data

A compilation of leachate monitoring data is included in Part 7 of Attachment 7. All of 2014 monitoring results were in compliance with effluent limitations established in Waste Discharge Permit Number 7842-02.

8.6 – Landfill 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 total number of stations is currently nine. Annual Settlement, which is in part dependent on refuse thickness as well as time, has varied from 0.18% to 3.79% of the refuse thickness. Total settlement at all stations was variable. The average settlement rate for 2014 was 0.18%.

It is anticipated that landfill settlement will continue, with older landfill areas settling as a comparatively slower rate.

SECTION 9 - ATTACHMENTS

Attachment A – Permit Renewal Application

Attachment B – Tonnage Report

Attachment C – Disposal Fees

Attachment D – Landfill Capacity Documentation

Attachment E – Financial Assurance Documentation

Attachment F – Annual Summary of Groundwater Monitoring Results

Attachment G – Landfill Gas Probe Monitoring Results