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April 1, 2021

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FM: Laura Belt, P.E., Interim Section Manager, Facility Engineering and Science Section (FESS), Solid Waste Division (SWD), Department of Natural Resources & Parks (DNRP)

DS LB

RE: Transmittal of 2020 Annual Report for Cedar Hills Regional Landfill

The purpose of this memorandum is to transmit the 2020 Annual Report for Cedar Hills Regional Landfill in compliance with WAC 173-351-200.

If you have any questions, please contact me at 206-477-5215 or via email at laura.belt@kingcounty.gov.

Enclosure

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CEDAR HILLS REGIONAL LANDFILL
2020 ANNUAL REPORT

King County
Department of
Natural Resources and Parks
Solid Waste Division

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

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April 2021

2020 ANNUAL REPORT
CEDAR HILLS REGIONAL LANDFILL

APRIL 2021

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CONTENTS

1.	Overview		1
2.	Facility Information		2
3.	Landfill Capacity and Development Status		3
4.	Financial Assurance Analysis		5
5.	Waste Disposal Quantities		7
6.	Summary of Groundwater, Stormwater, Leachate, and Landfill Gas Monitoring Results and 2021 Proposed Environmental Monitoring Program		8
	6.1	Summary of the Groundwater Monitoring Program	8
	6.2	Summary of the Stormwater Monitoring Program	8
	6.3	Summary of the Leachate Monitoring Program	9
	6.4	Summary of the Landfill Gas Monitoring Program	10
	6.5	Environmental Monitoring Program for 2021	11
7.	Summary of Landfill Personnel Training Program		12
8	Evaluation Reports		13
	8.1	Summary of Emergency or Corrective Actions Taken in 2020	13
	8.2	Evaluation of Stormwater Monitoring Data	17
	8.3	Evaluation of Groundwater Monitoring Data	19
	8.4	Evaluation of Landfill Gas Monitoring Data	22
	8.5	Evaluation of Wastewater Monitoring Data and Volume Generated	23
	8.6	Landfill Settlement	24
9.	Attachments		25

Attachment A – Operating Permits
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 Monitoring Results
Attachment H – Stormwater Reports
Attachment I – Wastewater Discharge Self-Monitoring Reports

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 (MSW) generated in the county, exclusive of the cities of Seattle and Milton. It is a 920-acre site located at 16645 228th Avenue Southeast, off Cedar Grove Road, approximately three miles north of Maple Valley, six miles east of the City of Renton and 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); and rights-of-way for a natural gas pipeline and numerous power transmission lines.

In 2020, waste disposal continued in refuse Area 8 after having commenced in 2019. Authorization to begin accepting waste in Area 8 was granted on July 5, 2019 by Public Health of Seattle and King County (PHSKC); a copy of their authorization letter is included in Attachment A. In addition, an Order of Approval was issued by the Puget Sound Clean Air Agency (PSCAA), dated July 02, 2019 under Notice of Construction Number 11307 authorizing KCSWD to begin operating Area 8.

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 maintenance;
- Changes to landfill operations; and
- Environmental monitoring program, including a summary of groundwater, stormwater, 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 - Washington Administrative Code (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. Municipal Solid Waste Permit PR0015736 was reissued to KCSWD for operation of CHRLF by PHSKC on May 7, 2019 and authorizes activity through May 7, 2029. The permit was renewed via an addendum to the original permit, per WAC 173-351-750(3), on January 10, 2020 and authorized landfill operation from January 1, 2020 to December 31, 2020. Copies of the permit and addendum are included in Attachment A.

SECTION 2 - FACILITY INFORMATION

The Washington Department of Ecology (WDOE) form, titled "Annual Report Municipal Solid Waste Landfill" that is required for submittal of this report is included in Attachment B.

Significant facility activities that occurred in 2020 include the following:

- Waste disposal continued in Area 8 after having begun in the summer of 2019.
- Construction of the Area 7 Contaminated Stormwater flap was completed.
- Aerators for the leachate lagoons received additional maintenance/electrical repairs during the fall of 2020.
- CHRLF leachate forcemain/pipeline repairs were completed to clear a partial blockage experienced in September/October of 2020.

SECTION 3 - LANDFILL CAPACITY AND DEVELOPMENT STATUS

CHRLF has capacity remaining in three Refuse Areas: 3,030,000 cubic yards in the combined Areas 5 and 6 and 6,632,616 cubic yards in Area 8 (as of a November 2, 2020 aerial flyover). Area 8 has a permitted capacity of 7,840,000 cubic yards. Capacities are calculated by comparing the difference between existing landfill contours and a design surface at completion. Attachment D contains documentation for calculating capacity.

Efforts are underway to optimize the use of this remaining built capacity. This includes decreasing the amount of airspace consumed by disposal, recovering returned airspace due to settlement, and recycling efforts. The capacity available for disposal is also impacted by airspace consumed by daily soil cover over refuse and road construction in the active areas. Airspace available for disposal is increased through the use of tarps for alternative daily cover, recovery of rock used for roads, and mechanical compaction.

As the landfill ages, it settles and airspace from settlement can be recovered for disposal. Settlement occurs due to consolidation and loss of mass from leachate and landfill gas (LFG) collection--as leachate and LFG is collected and removed from the landfill additional airspace is gained. Soil surcharge (i.e. stockpiling clean soils on top of covered waste) is used to accelerate settlement. Areas 5 and 6 both currently have soils partially stockpiled over them. This soil is intended for later uses, such as daily cover, road construction, or other on-site earthwork projects.

The table below presents current and planned capacity in cubic yards and tons by Refuse Area, as of November 2, 2020. It is based upon an airspace utilization of 1,600 pounds (lbs.) of refuse disposed per cubic yard (CY) of air space consumed, and an average yearly tonnage of 920,000 tons (averaged between 2018 and 2028 actual tonnage and forecasted amounts). 1,600 lbs./CY is the historical airspace utilization that is expected to be reached in Area 8 using current operational practices (compaction, daily cover usage, and rock recovery). See Attachment D for details.

Area	Capacity (cubic yards)	Capacity (tons)	Remaining Capacity (years)
8	6,632,616	5,306,093	~5.5
5 & 6	3,030,000	2,424,000	~2.5
Total	***9,662,616***	***7,730,093***	***~8.0***

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 Deck surfaces have interim covers that will be maintained until the completion of the last remaining lifts.

STATUS OF LANDFILL AREAS

Landfill Area	Area Specific Information	
Main Hill	Status	Closed
	Exposed Surface Area	84.4 acres
South Solid Waste Area	Waste was removed from this area and relocated to Area 7.	
Southeast Pit	Status	Closed
	Exposed Surface Area	9.6 acres
Central Pit	Status	Closed
	Exposed Surface Area	9.6 acres
Area 2/3	Status	Closed
	Exposed Surface Area	22.2 acres
Area 4	Status	Closed
	Exposed Surface Area	22.2 acres
Area 5	Status	Interim closure
	Final Cover Surface Area	9.2 acres
	Top Deck Interim Cover Area	31.4 acres
Area 6	Status	Interim closure
	Final Cover Surface Area	25.2 acres
	Top Deck Interim Cover Area	30.1 acres
	Volume in Place	6,800,000 cubic yards
Area 7	Status	Interim Closure
	Final Cover Surface Area	9.1 acres
	Top Deck Area	17.4 acres
	Volume in Place	8,070,000 cubic yards
Area 8	Status	Active
	Liner Footprint Area	31.4 acres
	Volume in Place (as of Nov. 2, 2020)	1,207,384 cubic yards

Note: Areas are net final cover plan view surfaces or as otherwise noted.

SECTION 4 - FINANCIAL ASSURANCE ANALYSIS

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 percent 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. New rates were adopted in 2018. The 2020 LRF contribution was $19.55 per ton versus the 2019 contribution of $19.02. In addition to WAC 173-351-600 requiring the LRF to provide financial assurance for closure and post-closure care, King County Code (4A.200.390) requires the LRF to include funding for new area development costs.

The current LRF rate is based on projected expenditures forecast when the current rate was adopted in 2018. Each year KCSWD reassesses the following items and calculates a new LRF contribution, based on the following items:

[a] Updated tonnage forecast;

[b] The current interest rate set by the King County Office of Economic and Financial Analysis (OEFA);

[c] Updated projected costs in each future year for closure, new area development, and facility improvements;

[d] Updated assumptions for future capacity development of the site and updated post-closure maintenance estimates.

[e] Updated post- closure maintenance estimate.

The details upon which the LRF contribution were based in the rate are included in Attachment E.

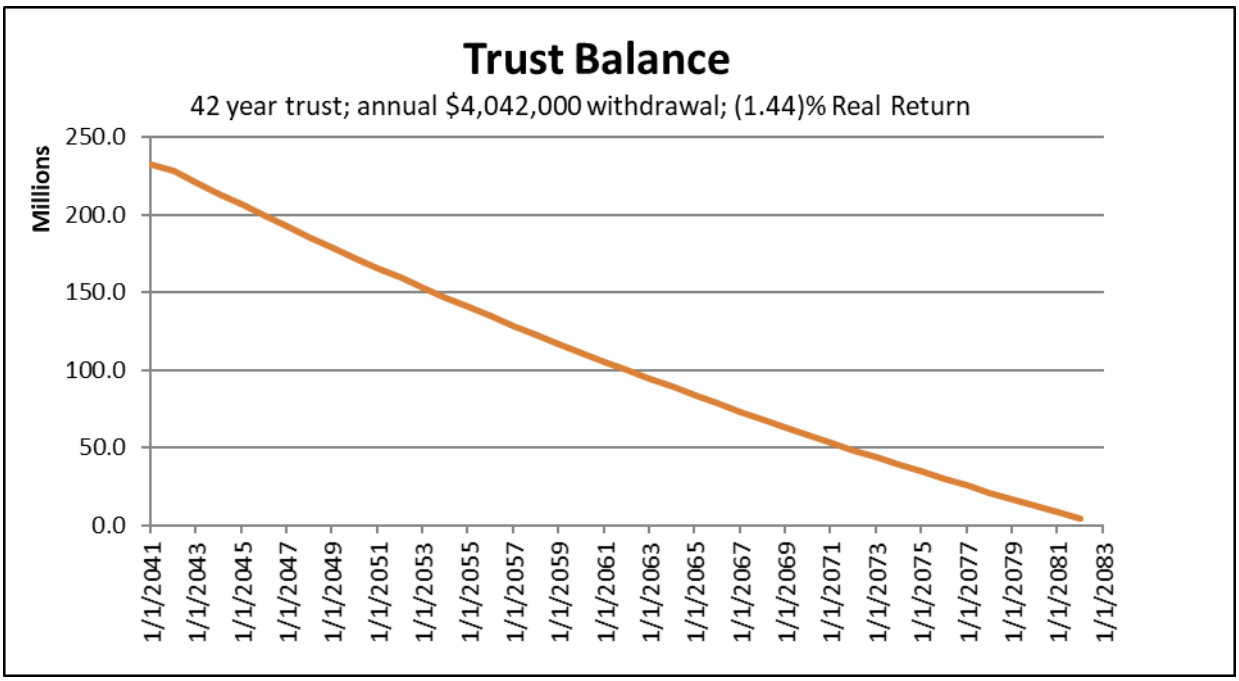
The post-closure maintenance estimate is updated annually. The updated estimate is based on current costs for maintenance of the systems and considers whether there have been changes to the environmental control systems that would lead to changes in maintenance costs as well as any changes to current costs of maintenance.

Based on a recommendation from the King County Auditor's Office, KCSWD uses the OEFA forecast for the both inflationary assumptions and likely future investment return interest rates. The current direction is to use a real (after inflation) long-term rate of return of -1.44 percent. [1]

[1] March 2020 forecast

The 2021 estimate is that $4,042,000 (2020 dollars) per year will be required to maintain the landfill for 42 years for a total of $169.7 million in expenses over the closure period.[2]The background for this year's estimate is included in Attachment E. The $169.7 million in total spending can be sustained over a 42-year period with a trust fund of about $232.2 million invested in government-backed securities paying a real (after inflation) rate of return of -1.44 percent.

This updated estimate was used in calculating the LFR fund contribution for 2020.



[2] It is anticipated that in 42 years the landfill will reach functional stability, a status attained after closure whereby there is little or no settlement, leachate production, or landfill gas production and only custodial care is required.

SECTION 5 - WASTE DISPOSAL QUANTITIES

The CHRLF received 869,150 tons of municipal solid waste in 2020. Detailed information can be found in Attachment B.

SECTION 6 - SUMMARY OF 2020 GROUNDWATER, STORMWATER, LEACHATE AND LANDFILL GAS MONITORING PROGRAM AND 2021 PROPOSED ENVIRONMENTAL MONITORING PROGRAM

6.1 Summary of 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 detail in the *Environmental Monitoring Sampling and Analysis Plan for Cedar Hills Regional Landfill (2013)* (SAP), and in Attachment F of this annual report. Thirty-one groundwater monitoring wells are monitored for groundwater elevations and geochemical sampling in the regional aquifer, and 14 for monitoring the perched saturated zones. Thirteen additional wells in the regional aquifer and 14 additional wells in the perched zones are monitored only for groundwater elevations. Detection monitoring wells are located downgradient of, or lateral to, waste placement areas. Background characterization wells are located up-gradient of waste placement areas.

6.2 Summary of Stormwater Monitoring Program

The Stormwater Monitoring Program is described in the SAP. The goals of this program include these elements:

- Monitor the effectiveness of Best Management Practices (BMPs) per the Stormwater Pollution Prevention Plan (SWPPP) for CHRLF;
- Evaluate compliance with the Industrial Stormwater General Permit (ISGP); and
- Evaluate compliance with the Construction Stormwater General Permit (CSGP).

Stormwater discharges associated with industrial activities at CHRLF are covered by the ISGP, which establishes monitoring requirements and benchmark values for several parameters. Three discharge locations are monitored quarterly for compliance with the ISGP. Routine inspections also are conducted on a monthly basis and more frequently during storm events. Permit compliance monitoring locations are at N4 (north end of the landfill); GS1 (south end of the landfill); and SL3 (discharges to a bioswale along 228th Avenue Southeast near the entrance to the landfill).

Besides routine monitoring conducted in accordance with the ISGP, KCSWD maintains several contingency surface water monitoring stations. The purpose of the contingency monitoring stations is to allow additional surface water monitoring if ISGP monitoring results exceed applicable benchmarks and broader surface water monitoring is warranted.

In 2020, KCSWD also had continued coverage under the CSGP - permit number WAR305034 with WDOE for the remaining Area 8 construction activities. A separate SWPPP was created for this CSGP permit. Permit coverage took effect in 2017 and remains active for 2021 construction.

Construction site BMPs and four CSGP monitoring locations are monitored weekly during construction activities (or within 24 hours of construction stormwater flows), or monthly during inactive periods, as allowed by the permit. The four monitoring locations are designated as follows: C-1 (northwest end of the site downstream of the northwest siltation pond); C-2 (northeast end of the site, downstream of the north stormwater pond); C-3 (southeast part of the site, downstream of the south stormwater lagoon and upstream of the bioswale); and, C-4 (southwest part of the site, downstream from the southwest siltation pond).

Copies of required stormwater reports submitted to WDOE are included in Attachment H.

6.3 Summary of Leachate Monitoring Program

KCSWD primarily collects two types of leachate samples at CHRLF: characterization and compliance. Leachate characterization is a critical component of the on-going groundwater contamination detection monitoring performed at the landfill. Leachate characterization also serves to assess pretreatment needs prior to discharge, and to evaluate the effectiveness of pretreatment. Characterization includes all analytes for which groundwater is analyzed, plus several analytes specifically related to wastewater characterization and treatment. Monthly characterization samples are collected at four monitoring locations: Leachate Effluent Pumping Station (LEPS), Vault 1A (V1A), which replaced Leachate Aeration Pond Influent (LAPI), which was decommissioned and removed in 2018 with Area 8 construction), Pump Station 2A, and MH-46N.
Compliance samples refer to those collected to support compliance with Wastewater Discharge Permit No. 7842-03, issued by King County Industrial Waste (KCIW). Weekly compliance samples collected from LEPS are analyzed for all permit-specified parameters. Sample analyte concentrations and leachate discharge flow data are used to calculate permit analyte loadings. Compliance is determined by comparing results to allowable limits specified in the permit.

KCSWD calculates and reports metals mass loading values alongside their respective concentration and flow values on the KCIW Self-Monitoring Report (SMR) form. SMRs are generated monthly and submitted to KCIW. SMRs for 2020 can be found in Attachment I.

KCSWD also submits an *Annual Facility and Sampling and Monitoring Report* to KCIW detailing sampling and analytical results for all non-permit required sampling and analysis, such as the characterization sampling described above.

In addition to compliance sampling and reporting, KCSWD has been conducting an investigation of characterization locations within the landfill leachate conveyance system since 2018, including leachate flows from Pump Station 1A, Pump Station 4, Area 5-6-7, and the seasonal flow from the contaminated stormwater lagoon. In 2019, additional sampling locations and analytes were added to the investigation, including flows from Area 8 and BEW. Continuing investigation efforts in 2020 also included additional BEW sampling (both treatment media and wastewater effluent), and condensate sampling from the landfill gas collection system. Collaboration with the University of

Washington Civil and Environmental Engineering Department that began in 2018 also continues to support these investigative efforts.

Field and analytical leachate data are included in Part 7 of Attachment F.

6.4 Summary of 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 monitor the potential presence of LFG in the subsurface vadose zone outside of the footprint of the landfill refuse (see Attachment G).

According to WAC 173-351-200 (4)(a), the concentration of methane gas generated by the facility shall meet the following limits:

- The concentration of methane gas generated by the facility does not exceed twenty-five percent of the lower explosive limit (LEL) for methane in facility structures (excluding gas control or recovery system components);
- The concentration of methane gas does not exceed the LEL for methane at the facility property boundary or beyond;
- The concentration of methane gases does not exceed one hundred parts per million (ppm) by volume of methane in offsite structures.

There are two categories (defined by function) of LFG probes at the CHRLF:

- Migration Monitoring (Compliance) Probes
- Interior Monitoring Probes

Migration Monitoring Probes are primarily intended to verify that methane concentrations at the property boundary do not exceed 50,000 ppm in the subsurface vadose zone. There are 36 Migration Monitoring (Compliance) Probes at CHRLF. The installation history of the LFG monitoring probes at the CHRLF was described in the 2005 CHRLF Annual Report. These probes are either single or multiple completion probes installed at different depths depending on subsurface geological formation. A description of each probe and information on its location, elevation, and installation date is provided in the Monitoring Plan figure in Attachment G.

Interior Monitoring Probes are used to evaluate and manage the performance of the LFG collection system with respect to LFG composition (methane, oxygen, and carbon dioxide) and vacuum radius of influence. This information is used to adjust the LFG collection and conveyance system to minimize the potential for LFG migration outside of the refuse footprint. There are 27 interior monitoring probes at CHRLF. The installation history of the LFG interior monitoring probes at the CHRLF was described in the 2005 CHRLF Annual Report. The probes are either single or multiple

completion probes installed at different depths depending on subsurface geological formation. A description of each probe and information on its location, elevation, and installation date is provided in the Monitoring Plan figure in Attachment G.

Migration and interior probe monitoring are performed quarterly for compliance with WAC 173-351, and monthly for operational indicators. Monitoring results are included in Attachment G. Results from LFG migration monitoring for 2020 are discussed in Section 8.4 of this report.

6.5 Environmental Monitoring Program for 2021

Effective January 1, 2016, KCSWD implemented the SAP, as approved by PHSKC and WDOE in 2015. The SAP outlines current monitoring programs designed to comply with the requirements of Chapter 173-351 WAC and other applicable environmental regulations and permits, including wastewater discharge permits and stormwater permits. Modifications to the SAP will occur only with prior approval of PHSKC and WDOE.

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 valid Solid Waste Association of North America Landfill Certification as Manager of Landfill Operations (MOLO) are listed below in the table below.

MOLO Certifications

NAME	TITLE	DATE OF CERTIFICATION
Rusty Bogart	Landfill Gas Operator	Certified through October 2021
Nigel White	Special Projects Manager	Certified through October 2022
Scott Barden	Landfill Operations Manager	Certified through October 2020
Bill Berni	Operations Manager	Certified through July 2020
Kris Burgin	Operations Supervisor	Certified through May 2022
Anthony Slaughter	Operations Supervisor	Certified through May 2022

SECTION 8 - EVALUATION REPORTS

8.1 Summary of Emergency or Corrective Actions Taken in 2020

The following is a listing of emergency situations and/or corrective actions taken by KCSWD in 2020 to maintain compliant operation of the landfill.

8.1.1 Stormwater Corrective Action

In 2020, CHRLF did not exceed any ISGP established stormwater monitoring benchmark limits. One effluent limitation exceedance occurred during 2020: total suspended solids exceeded the effluent limit for that parameter in a sample collected from monitoring location N4 on October 12, 2020. The stormwater discharge occurring on October 12, 2020 contained elevated levels of turbidity and total suspended solids. As demonstrated in the Discharge Monitoring Report for the fourth quarter of 2020 (see Attachment H), subsequent monitoring suggested that the discharge was anomalous and the exceedance was brief in duration. No corrective actions were required to restore compliance. The exceedance was documented in a 5-Day Report submitted to WDOE, as required by the permit.

During 2020, the Area 8 CSGP had exceedances of the turbidity benchmark limit in January at station C-3. In response to turbid stormwater discharges associated with the Area 8 construction project, KCSWD implemented additional temporary erosion and sediment control improvements and repairs to maintain the water quality of construction discharges and meet discharge limits. Additional details regarding exceedances and corrective actions are contained in the Discharge Monitoring Reports and Annual Report included in Attachment H.

8.1.2 Wastewater Discharge Permit Corrective Action

In 2020, KCSWD continued to investigate and develop a remedy for the Notice of Violation received from KCIW in July of 2018 for arsenic and chromium loading exceedances in wastewater discharged from CHRLF. Actions taken followed the outline provided in the Assessment of Penalty and Compliance Order issued by KCIW on December 21, 2018. KCIW issued a Revised Compliance Order dated October 29, 2019 which superseded and replaced the December 2018 Compliance Order. The Revised Compliance Order primarily modified the due dates and reporting requirements. KCSWD's continuing response includes research and development of realistic engineered alternatives to reduce metals loading below permit limits using source control and/or treatment technologies.

Sampling results indicate that 2020 discharges frequently exceeded the permit limit for arsenic loading and the screening level for soluble sulfide. In accordance with permit requirements, these exceedances were reported to KCIW using their 14-day report protocol, which explained the cause(s) of the exceedances, corrective actions taken to respond to the exceedances, and ensure ongoing compliance and resampling, as applicable.

No other corrective actions occurred in 2020 with regard to the wastewater discharge permit.

8.1.3 PHSKC Inspection Reports and Corrective Actions

In 2020, PHSKC inspected CHRLF four times. Corrective actions taken in response to inspection reports included routine maintenance activities such as litter collection, traffic safety measures, bird control, safety issues, recordkeeping, and soils coverage management.

The October 14, 2020 PHSKC inspection resulted in a nuisance odor violation. This was the result of the Odor Boss not functioning correctly during the inspection. This was a repeat violation, previously noted on November 19, 2019. Odor Boss functionality was restored, and normal operation resumed immediately after the inspection, resulting in resolution of the odor issue.

8.1.4 Title V Air Operating Permit Deviation Reports

Failures to comply with requirements of Title V Air Operating Permit #10138 must be self-reported to PSCAA in the form of deviation reports. Title V deviation reports in 2020 included the following:

- March 23, 2020: Two methane surface emission exceedances: 1) a cover penetration point emission exceedance of 8,374 ppm in the Main Hill Area on March 23, 2020; and 2) a small area emission exceedance of 1,300 ppm located in the south side of Area 6 stockpile on March 21, 2020. CHRLF Title V Operating Permit 10138 requires that methane surface emission limit should be less than 500 ppm or corrective action is required.

  The corrective actions taken were: 1) excavating a shallow trench to investigate the source of the 8,374 ppm methane exceedance. That source proved to be a loose connection on LFG line C-33 and was immediately repaired. Subsequent 10-day and 30-day surface emission checks on April 1 and April 22 indicated no methane detections at the same cover penetration location. 2) While the cause of the 1,300 ppm methane exceedance at south corner of Area 6 on March 21 was not fully specified, a localized adjustment to the vacuum field proved to be effective in reducing emission monitoring results. A methane concentration of 59 ppm was detected during the 10-day surface emission check on March 31 and 77 ppm during the 30-day surface emission check on April 20. These concentrations were significantly below the 500 ppm regulatory criteria. Routine monitoring of the area continued to ensure no additional methane exceedances occurred.

- June 23 and 24, 2020: Two methane surface emission exceedances: 1) cover penetration point E-54 had a methane exceedance of 4,000 ppm on June 23, 2020; and, 2) cover penetration point C-38 had a methane exceedance of 10,000 ppm on June 24, 2020. CHRLF Title V Operating Permit 10138 requires that methane surface emission limit should be less than 500 ppm or corrective action is required.

  The corrective actions taken were: 1) excavating a shallow trench to investigate the source of the E-54 methane exceedance. The source of methane exceedance was a gap created in deteriorated Polyvinyl Chloride seal that connected a riser pipe to its saddle tee-fitting just

below the ground. After replacing sealant at the failed tee-fitting, the subsequent 10-day and 30-day surface emission checks on July 3 and July 24 detected no methane at the cover penetration location E-54. 2) Similarly, at C-38 the source of methane exceedance was a deteriorated flexible hose connecting to a riser pipe just below the ground surface. After replacing the entire section of the flexible hose, the site was restored and the subsequent 10-day and 30-day surface emission checks on July 4 and July 24 detected no methane at C-38. Localized adjustments to the vacuum field proved to be effective in reducing emission monitoring results., as indicated by no methane detections during the subsequent 10-day and 30-day surface emission checks.

- September 7, 2020: Flare No. 1 was operating at lower temperature than permitted, due to a faulty temperature controller display. The operating temperature was recorded at 1,362 degrees Fahrenheit (ºF) for approximately 6.5 hours, which is lower than the permitted 1,411 ºF for the Flare No. 1 (using a 3-hour average). This permitted temperature is based on the most recent stack test results published on August 28, 2015 (submitted to PSCAA on October 29, 2015).

  Corrective action: A faulty temperature controller display located on a panel outside and near Flare No. 1, was identified by the operator in the field while the flare was running. When a discrepancy between the faulty temperature controller and the Supervisory Control and Data Acquisition (SCADA) system was noted, Flare No. 1 was placed on standby until a new temperature controller was installed on the Flare No. 1 panel on October 6, 2020.

- October 25, 2020: Flare No. 4 operated on average at 1,180 ºF for 12 hours, which is lower than the permitted 1,409 ºF for Flare No. 4 (using a 3-hour average). This permitted temperature is based on the most recent stack test results published on August 28, 2015 and submitted to PSCAA on October 29, 2015. The low temperature event began in the overnight hours and the technician on duty at the time failed to check the operating temperature of Flare No. 4 to ensure compliance. A shift change occurred during the low temperature event and the technician that came on duty failed to confirm acceptable operating temperatures in Flare No. 4. Based on these findings, KCSWD attributes this deviation to insufficient training.

  Corrective action: KCSWD reviewed operating protocols and expectations with appropriate personnel in the days following the low temperature event. The importance of operating flares at acceptable temperatures was underscored.

Formal enforcement documents received in 2020 from PSCAA included:

- Notice of Violation (NOV)3-A000090
  - This enforcement document replaced NOV 3-009650. It reflected four prior events (10/23/2017, 02/17/2018, 01/06/2019, and 01/21/2019) when landfill gas was flared at the North Flare Station at temperatures lower than permitted. Each of the events cited in this NOV was self-reported to PSCAA in the form of deviation reports.

- NOV 3-010402
    - This enforcement document pertained to an 08/19/2019 event when landfill gas combusted by Flare No. 4 at the North Flare Station did not achieve 98 percent destruction of non-methane organic compounds, which was lower than permitted. Action was taken by KCSWD to rectify this issue and no further action is required by PSCAA.
- Warning No. 2-A000002
    - This enforcement document notified KCSWD that PSCAA questioned the compliance of an odor control system (Odor Boss) in use at the landfill. The issue identified in the warning was whether the odor control system violated the prohibition on masking odors. As directed by the warning, KCSWD provided information to assist in the compliance evaluation of that system. The warning did not indicate that KCSWD must cease use of the odor control system pending a determination by PSCAA. That determination has not yet been communicated to KCSWD.

8.1.5 Independent Remedial Action

KCSWD is proceeding with an Independent Remedial Action in the East Perched Zone (EPZ) under the Model Toxics Control Act (MTCA) in accordance with WAC 173-340-510 and 173-340-515. KCSWD issued a Remedial Investigation/Feasibility Study (RI/FS) in December of 2016. EPZ Phase 1 Interim Actions were completed in June of 2020. Work completed included on-going monitoring of the six new groundwater monitoring wells, as well as the additional landfill gas wells that were installed in 2018 in the EPZ. Preparation for Phase 2 of the EPZ RI/FS project is currently in the planning stages.

8.1.6 2020 Leachate Forcemain/Pipeline Repair

In September of 2020, CHRLF personnel identified a flow restriction in the forcemain/gravity pipeline that conveys leachate effluent from CHRLF to the King County Wastewater Treatment Division South Treatment Plant in Renton, WA. The flow restriction impaired CHRLF's ability to discharge leachate normally. KCSWD investigated the cause and location of the flow restriction over a 3-week period and completed repairs in mid-October 2020. During the course of repair, three separate leachate releases occurred from the pipeline outside the property boundary of the landfill. Immediate action was taken by KCSWD to halt and remedy these releases. Further evaluation and restoration work are continuing under the direction and jurisdiction of WDOE (WAC 173-303-145). The leachate forcemain/gravity pipeline returned to full operational status when the blockage was removed and has functioned as designed since repairs were completed.

8.2 Evaluation of Stormwater Monitoring Data

Under the ISGP, quarterly sampling is required for the following 12 parameters: biological oxygen demand, 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. Field and analytical stormwater data are 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 Avenue 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 contain key aquatic life uses.

The CHRLF also has a CSGP for the Area 8 construction activities. Four discharge points are monitored in compliance with the CSGP. The four monitoring locations are: C-1 at the northwest end of the site downstream of the northwest siltation pond; C-2 at the northeast end of the site, downstream of the north stormwater pond; C-3 at the southeast part of the site, downstream of the south stormwater lagoon and upstream of the bioswale; and C-4 at the southwest part of the site, downstream from the southwest siltation pond. All CSGP monitoring points discharge into the ISGP monitoring locations.

Under the CSGP, inspections are performed of any areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site, during active construction. In accordance with the permit, monitoring and sampling was reduced to a monthly schedule due to construction inactivity in the summer of 2019. Construction activity resumed from August through November 2020, with weekly and/or daily monitoring occurring as per the permit. Monitoring is required for turbidity and for pH if more than 1,000 cubic yards of concrete is poured (no monitoring for pH occurred in 2020).

Exceedances of the CSGP for 2020 are summarized in the table below.

SUMMARY OF 2020 STORMWATER MONITORING DATA THAT EXCEEDED CSGP CRITERIA (Turbidity)

Date	Turbidity Measurement by Monitoring Location (NTUs)			
	C1	C2	C3	C4
1/22	<25 or NS	<25 or NS	53.7	<25 or NS
2/24	<25 or NS	<25 or NS	33.5	<25 or NS
3/23	<25 or NS	<25 or NS	<25 or NS	<25 or NS
4/15	<25 or NS	<25 or NS	<25 or NS	<25 or NS
5/12	<25 or NS	<25 or NS	<25 or NS	<25 or NS
6/12	<25 or NS	<25 or NS	<25 or NS	<25 or NS
7/20	<25 or NS	<25 or NS	<25 or NS	<25 or NS
8/17	<25 or NS	<25 or NS	<25 or NS	<25 or NS
8/24	<25 or NS	<25 or NS	<25 or NS	<25 or NS
8/31	<25 or NS	<25 or NS	<25 or NS	<25 or NS
9/2	<25 or NS	<25 or NS	<25 or NS	<25 or NS
9/8	<25 or NS	<25 or NS	<25 or NS	<25 or NS
9/14	<25 or NS	<25 or NS	<25 or NS	<25 or NS
9/24	<25 or NS	<25 or NS	<25 or NS	<25 or NS
9/28	<25 or NS	<25 or NS	<25 or NS	<25 or NS
10/2	<25 or NS	<25 or NS	<25 or NS	<25 or NS
10/10	<25 or NS	<25 or NS	<25 or NS	<25 or NS
10/14	<25 or NS	<25 or NS	<25 or NS	<25 or NS
10/19	<25 or NS	<25 or NS	<25 or NS	<25 or NS
10/26	<25 or NS	<25 or NS	<25 or NS	<25 or NS
11/7	<25 or NS	<25 or NS	<25 or NS	<25 or NS
11/13	<25 or NS	<25 or NS	<25 or NS	<25 or NS
11/20	<25 or NS	<25 or NS	<25 or NS	<25 or NS
12/18	<25 or NS	<25 or NS	<25 or NS	<25 or NS

NTU = Nephelometric turbidity unit

NS = Not Sampled

= criteria exceeded

Field and analytical stormwater data are included in Part 7 of Attachment F.

When turbidity exceedances occurred, the effectiveness of the existing stormwater BMPs were evaluated and modifications were made to improve erosion and sediment controls.

8.3 Evaluation of Groundwater Monitoring Data

Groundwater at the 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 over 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 recharged entirely 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. Site hydrogeological reports and supporting documentation show that the regional aquifer is the first continuously saturated zone beneath the landfill and serves as the earliest path for detection monitoring.

A monitoring network is in place consisting of 31 regional monitoring wells 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 whether 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 is variable and subject to surface activities occurring near the recharge zone. Coincidental with major clearing and grading activities on the QCF property, increasing trends for several key water quality indicator parameters began in 2011 and have continued through 2020.

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 landfill footprint and immediately downgradient of waste cells are influenced by the presence of LFG in the unsaturated strata. Flow paths in the north landfill area are also notably higher in chloride concentrations, along with several other ionic species. The data are consistent with an input from onsite, overlying infrastructure in the north end. Concentrations have declined and stabilized since maximum levels were reached in 2008-2010. Dispersion along the flow path is apparent in other wells.

Downgradient groundwater quality is also highly variable and displays 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 in the regional aquifer leaving the site has no exceedances of primary drinking water standards, with the exception of MW-67 for total arsenic in the fourth quarter of 2020.

MW-67 was investigated in December of 2020 by KCSWD and a licensed consultant hydrogeologist, with the intention of redeveloping the well. During the course of investigation, MW-67 was determined to be inadequate for groundwater monitoring due to damage to the well screen (as evidenced by filter pack sand present in the borehole), and inappropriate sizing of the well casing (diameter of the well is too small to allow redevelopment). This well will be decommissioned, and a replacement well drilled adjacent to the existing wellhead in a future project.

The data also indicate that CHRLF acts as an attenuation zone for upgradient impacts, allowing a reduction in the concentration of chlorinated volatile organic compounds to occur as groundwater flows from the south property line to the north-northeast. Recent water quality evaluations of QCF groundwater are available in *Fifth Five-Year Review Report for Queen City Farms* (2018).

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 zones. 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.

The East Main Hill perched zone is undergoing an independent clean-up action led by KCSWD. Recent investigation findings for this zone are presented in the *East Perched Zones Remedial Investigation and Feasibility Study (December 2016*). A discussion of conditions in the perched zone near the former South Solid Waste Area are available in the Technical Memoranda *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment* (*April 2010*).

8.3.3 Prediction Limit Exceedances

During 2020, no CHRLF groundwater monitoring wells had any 3-of-3 prediction limit exceedances.

For the fourth quarter of 2019, 3-of-3 prediction limit exceedance at MW-67 for total arsenic and barium, per the direction of PHSKC and WDOE, the following response was taken as an alternative to assessment monitoring per the SAP:

1. MW-67 redevelopment was attempted, but unsuccessful due to deficiencies in well construction.
2. Arsenic speciation is currently being considered to evaluate species of arsenic present in the regional aquifer, specifically with regards to MW-67.
3. A regional (i.e. five to10-mile radius from CHRLF) arsenic background study is being conducted by KCSWD using currently available public data to qualify and compare total arsenic levels in downgradient regional wells for CHRLF with other monitored wells in the vicinity of the landfill.

Action item 1 (redevelopment of MW-67) has been completed and resulted in finding that MW-67 is currently unsuitable for redevelopment and needs to be replaced in kind. Action item 2 (speciation) has been put on hold pending further direction from PHSKC and WDOE. Action item 3 (localized regional background study for total arsenic concentrations) is currently underway and will be submitted to PHSKC and WDOE in 2021. WDOE is in the process of issuing a localized background total arsenic study that will be used by KCSWD to further assess and evaluate total arsenic concentration results in regional wells at CHRLF.

At this time, no additional actions are underway to address the 3-of-3 prediction limit exceedances for total arsenic and barium at MW-67. Further information can be referenced in Attachment F of this annual report.

8.4 Evaluation of Landfill Gas Monitoring Data

During 2020, one exceedance of the methane regulatory limit occurred at compliance migration monitoring probe GP-44A during the third quarter of 2020. The methane concentration was 9.7 percent by volume. Per KCSWD standard practices, the LFG tech team returned to probe the

following morning and measured 8.6 percent methane by volume. After purging the probe for 10 minutes, methane levels dropped to 2.4 percent. The probe was purged again using the GEM5000 pump for nearly 15 minutes, after which the methane level was down to 0.5 percent. (The GEM5000 is an instrument used to measure the landfill gas in percentage volume for methane, oxygen, and carbon dioxide). The probe was monitored daily for two weeks to confirm that methane levels remained below the LEL. This supplemental gas probe monitoring data for GP-44A can be viewed in Attachment G.

Other low-level methane detections occurred in multiple probes below the exceedance criteria, including in GP-30A, GP-33A, and GP-36A along the west property line of the landfill. All detections were significantly below the LEL. Those low-level detection events are likely the result of calibration errors in the monitoring equipment used.

Methane was detected in a few interior monitoring probes, ranging from 1 to 6 interior probes in each month of 2020 by more than five percent volume. Using interior probe readings, adjustments were made on an on-going basis in more than 300 LFG wells inside the footprint of the landfill refuse to optimize collection of LFG. These extraction wells are upgradient from the above-referenced interior monitoring probes. Adjustments were made twice a month to ensure the containment of LFG within the footprint of landfill refuse. These adjustments were successful in preventing potential migration of LFG outside of the landfill refuse footprint, as demonstrated by the methane readings in the migration monitoring probes.

Methane was also detected outside the CHRLF generator 16 (GB16) building in December 2020 at a concentration of 170 ppm. This detection was substantially below the regulatory limit for ambient air concentrations. Also, methane was detected twice at MGPW1710D, located in the west perimeter landfill migration probes during the second quarter of 2020; once at 0.5 percent by volume, and also a second time at 2.9percent by volume. However, no methane detections occurred inside any CHRLF facilities, or in offsite facilities (Passage Point) at concentrations above 100 ppm.

All LFG monitoring data for 2020 for the perimeter compliance probes, interior probes, and building monitoring are included in Attachment G.

8.5 Evaluation of Wastewater Monitoring Data and Volumes Generated

Leachate collected throughout the landfill is routed to the onsite leachate lagoons where it mixes with other sources of wastewater at CHRLF (e.g., contaminated stormwater, gray water, sewage, and BEW process water). Following aeration, the combined wastewater discharges to the King County sewerage system pursuant to a Waste Discharge Permit 7842-03 issued to KCSWD by KCIW.

8.5.1 Wastewater Volumes

The volume of wastewater discharged from the leachate aeration basins by way of the Leachate Effluent Pumping Station (LEPS) are recorded daily by KCSWD Operations staff. The actual leachate volume generated within the landfill is not measured directly.

The maximum allowed daily discharge volume for wastewater from CHRLF per permit 7842-03 in 2020 was 2.7 million gallons per day. There were no exceedances of this permitted discharge volume in 2020.

8.5.2 Wastewater Monitoring Analytical Data

Per the KCIW permit, the total loading limit for total arsenic is 0.27 pounds per day. There were multiple exceedances of the arsenic loading limit throughout the year. There were no exceedances of any of the other analytical permit parameters in 2020. All wastewater monitoring analytical data is included in Attachment F. Self-monitoring reports submitted to KCIW in 2020 are included in Attachment I.

8.6 Landfill Settlement

Settlement monitoring at CHRLF began in 1992, and by 2005 seven monitoring locations had been established. More stations were added in 2007, while others have been abandoned as a result of operational impacts, including one station that was covered with Area 8 excavation soils in the summer of 2017. There are currently eight total settlement monitoring stations. Annual settlement, which is in part dependent on refuse thickness as well as time, has historically varied in a range of 0 percent to nearly four percent of total refuse thickness for different settlement monitoring locations over time. Settlement at all stations monitored in 2020 was minimal, with the highest rate being 0.357 percent of the underlying refuse thickness. It is anticipated that landfill settlement will continue, with older landfill areas settling at a comparatively lower rate to newer areas of disposed refuse.

SECTION 9 - ATTACHMENTS

Attachment A – Municipal Solid Waste Permit

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

Attachment H – Stormwater Reports

Attachment I – Wastewater Discharge Self-Monitoring Reports