Chapter 5: Surface Water

Production of surface water is a natural process of the hydrologic cycle on which anthropogenic (human-caused) influences can have positive or negative effects. Everyday precipitation produces surface water, and many of its physical properties are a function of the environment in which the precipitation falls. The Cedar Hills Regional Landfill (CHRLF) has an extensive system for managing precipitation that falls within its property limits. This chapter describes the systems for surface waste management and the potential for affecting surface water quality by implementing any of the alternatives.

The environmental review determined there would be no significant unavoidable adverse impacts to surface water or surface water quality during construction or operation of any of the alternatives.

5.1 Affected Environment

The affected environment includes the regional drainage basins in the vicinity of the CHRLF and the on-site drainage system discharges.

5.1.1 On-site Stormwater Management

In general, precipitation falls onto the landfill and becomes surface water. Surface water at the landfill is managed via several systems depending on its path and its required treatment before release from the site, based on its potential level of contamination through contact with garbage. Within the landfill area, much of the site is developed with impervious or low-permeability surfaces, thus there is minimal infiltration into site soils. As such, the majority of the rainfall at the site becomes stormwater runoff.

The surface water runoff volume from the site is not expected to increase significantly under any of the alternatives because the proposed development occurs on already impervious surface. The current surface water control systems adequately manage the anticipated runoff through three different systems, which are described below.

Leachate Collection

Water that falls on the surface and infiltrates through refuse is considered contaminated and is managed as leachate. The leachate collection system consists of pipes placed over an impermeable liner. A network of pumps and pipes conveys the leachate to the aerated leachate lagoons in the southwest corner of the landfill before discharging to the King County Wastewater Treatment Division (KCWTD) system.

Contaminated Stormwater Management

Surface water that encounters refuse can pick up pollutants, creating contaminated stormwater (CSW). The majority of CSW generated at the landfill originates in the area of active refuse placement. At the CHRLF, CSW is collected separately from leachate and uncontaminated (clean) stormwater runoff. The CSW conveyance system consists of berms, culverts, and asphalt-lined ditches that direct the CSW to the lined CSW lagoon in the southwest corner of the landfill. The CSW lagoon stores the CSW and facilitates pre-settling of solids before discharging to the leachate lagoons. In the leachate lagoons, CSW mixes with leachate and is aerated before discharging to the KCWTD system for treatment.

The existing CSW lagoon was constructed in 1997 during the Stage 1 Closure of Area 4 and is lined with a 60-mil thick high-density polyethylene (HDPE) geomembrane. The CSW lagoon occupies approximately 4 acres in the southwest area of the landfill with a design capacity of 12.8 acre-feet. The lagoon was initially sized to contain flows from about 46.4 acres of the landfill resulting from the 100-year, 24-hour storm. In 2009, the CSW lagoon was expanded to increase the lagoon's capacity to approximately 28.4 acre-feet and to contain flows from about 120 acres of the landfill. This increased size allows flexibility in landfill operations.

Under all of the action alternatives, the CSW lagoon function would be relocated to the South Solid Waste Area (SSWA) once waste is removed from this area. A similar-sized lagoon is anticipated for Alternatives 1 and 2. A larger CSW lagoon is anticipated for Alternatives 3 and 5. Under all the action alternatives, there would be sufficient space in the SSWA (approximately 31.5 acres) for the relocated CSW lagoon functions.

In addition to the landfill areas, additional CSW at the site is collected from the maintenance shop areas where equipment that operates on the active landfill area is serviced and from the loaded trailer parking area. The CSW collected from the maintenance areas is currently piped directly to the leachate lagoons for aeration, without going through the CSW lagoon.

Stormwater Runoff

The remainder of stormwater that leaves the landfill is uncontaminated runoff. Stormwater runoff from the inactive (closed) areas of the landfill, including, but not limited to, the buffer and closed refuse areas, is kept away from contamination sources through ditches, culverts, and berms. Stormwater ponds provide detention and sediment removal prior to discharge to wetlands and streams on the perimeter of the property.

Under all of the action alternatives, the existing southwest siltation pond, which receives flow from the southeast portion of the landfill, would be relocated to the SSWA after waste is removed from the area. The existing southwest siltation pond occupies an approximately 3-acre area in the southwest portion of the landfill and was designed to accept clean stormwater flow from about 114 acres of the site.

For Alternatives 1 and 2, the southwest siltation pond would be replaced with a similar-sized facility in the SSWA. Under Alternatives 3 and 5, the southwest siltation pond may be replaced with a larger facility. For all the alternatives, there would be sufficient space in the SSWA (approximately 31.5-acres) for the relocated southwest siltation pond.

5.1.2 Regional Drainage Basins

The CHRLF lies within the Issaquah Creek and Cedar River drainage basins (see Figure 5-1). McDonald Creek flows in an east–west direction approximately 0.5 mile north of the landfill, and is a tributary to Issaquah Creek. Stormwater runoff from the northern portion of the landfill drains to McDonald Creek. Issaquah Creek flows approximately one-quarter mile northeast of the landfill. Stormwater runoff from the eastern portion of the landfill buffer drains to Issaquah Creek. The Cedar River flows approximately 1 mile southwest of the landfill. Stormwater runoff from the southeastern corner of the landfill drains to the Cedar River. The

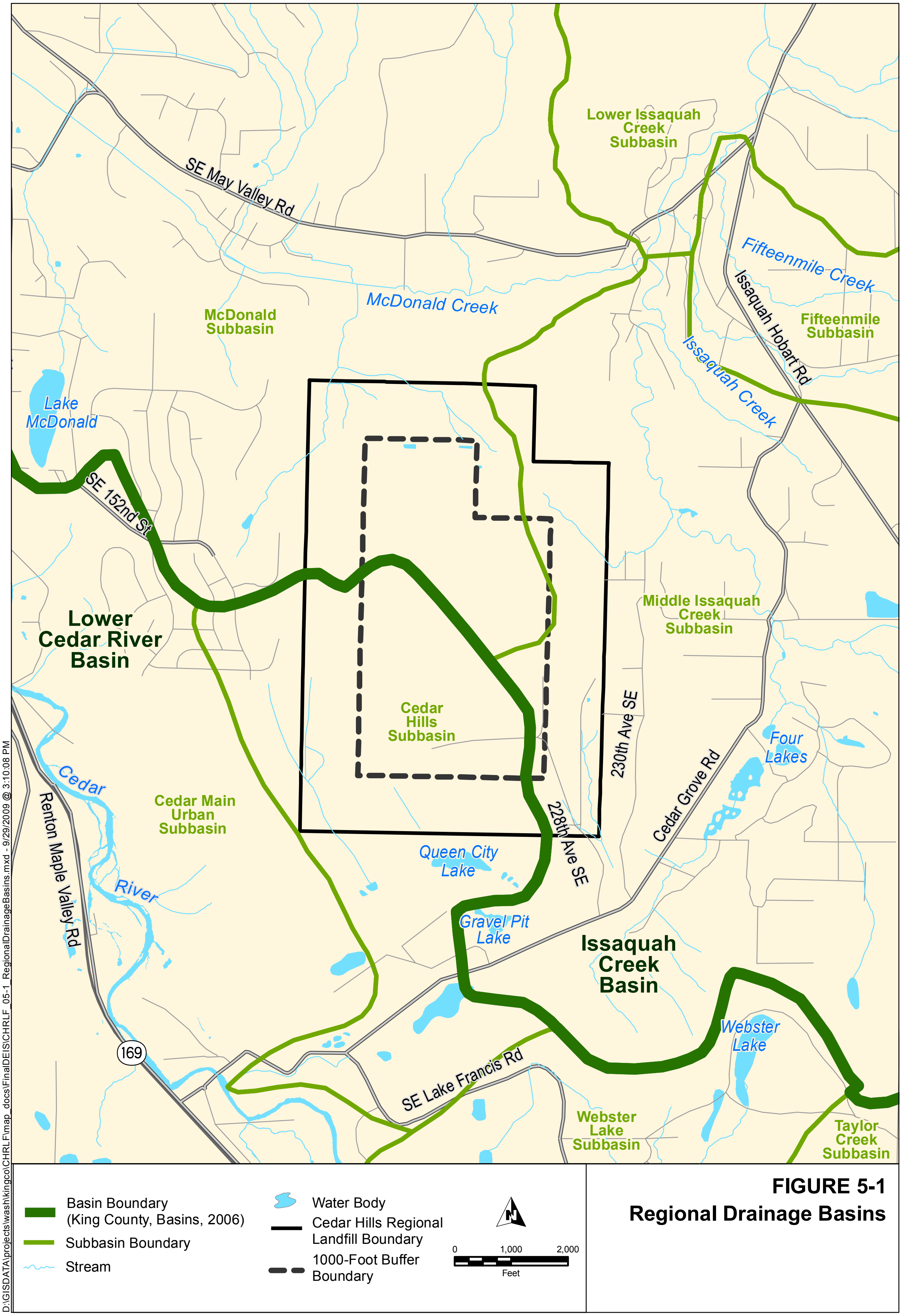

FIGURE 5-1
Regional Drainage Basins

majority of stormwater runoff from the south–central half of the landfill drains through Queen City Lake and into a gravel pit lake. No observable surface outlet exists at the gravel pit lake, which is located several hundred feet south of the landfill.

5.1.3 On-site Drainage Subbasins

As shown in Figure 5-2, stormwater runoff from the landfill flows to one of five on-site drainage subbasins: northeast, southwest, north, south, and southeast.

The northeast subbasin primarily drains forested land within the northeastern buffer area. Stormwater runoff in this basin is not exposed to industrial activity and discharges from the property toward the Issaquah Creek in the regional Middle Issaquah Creek Subbasin (Figure 5-1).

Stormwater runoff from the southwest subbasin originates almost entirely in the undisturbed forested buffer areas in the southwestern corner of the landfill and discharges south toward the Cedar River. Stormwater runoff in this basin is not exposed to industrial activity.

The north subbasin, which drains to McDonald Creek in the McDonald Subbasin (Figure 5-1), contains the northwestern corner and north portions of the forested buffer area and the northern half of the landfill. This drainage subbasin includes Refuse Areas 2, 3, and 4, the northern half of the East Main Hill Refuse Area, the Central Pit Refuse Area, and the northern half of the main asphalt access road on the west side of the landfill. The northern portion of CHRLF is no longer active, and an impermeable membrane, soil cap, and grass cover the refuse in this area. Stormwater runoff from the covered refuse areas of the north subbasin drains through the north siltation pond or the north stormwater pond. A series of culverts and open ditch channels conveys the flow into a wetland at surface water monitoring point SW-N4. Flows discharge from the wetland at monitoring point SW-N1, then flow to McDonald Creek, and ultimately to Issaquah Creek.

The south subbasin is the largest drainage area in the landfill, encompassing a majority of the southern half of the landfill site. Area 5, Area 7, the main soil stockpile, the SSWA, the south forested buffer area, the southwest siltation pond, and the south central detention pond all contribute stormwater runoff in the subbasin. The active Area 6, leachate lagoons, and the CSW lagoon are also located in the south subbasin, but they do not discharge to the stormwater system. Perimeter berms around Area 6 separate stormwater runoff from the CSW. When Refuse Area 7 becomes active, stormwater will discharge to the CSW and leachate lagoons, similar to Area 6.

The southeast subbasin conveys drainage from ditches along the eastern main access road, the southern main hill, and the SE Pit Refuse Area into the south stormwater pond. The maintenance and administrative facilities cover a paved area of approximately 3.5 acres within the subbasin. A sewer system routes runoff that is potentially contaminated into the leachate lagoons for pretreatment before conveyance to the KCWTD system for treatment. Ditches and berms route the uncontaminated runoff from the maintenance and administrative facilities to the south stormwater pond. The south stormwater pond discharges to a bioswale and then enters an infiltration ditch along 228th Avenue SE and Cedar Grove Road, which provides a path to the Cedar River. The water infiltrates beneath the ditch before reaching the Cedar River.

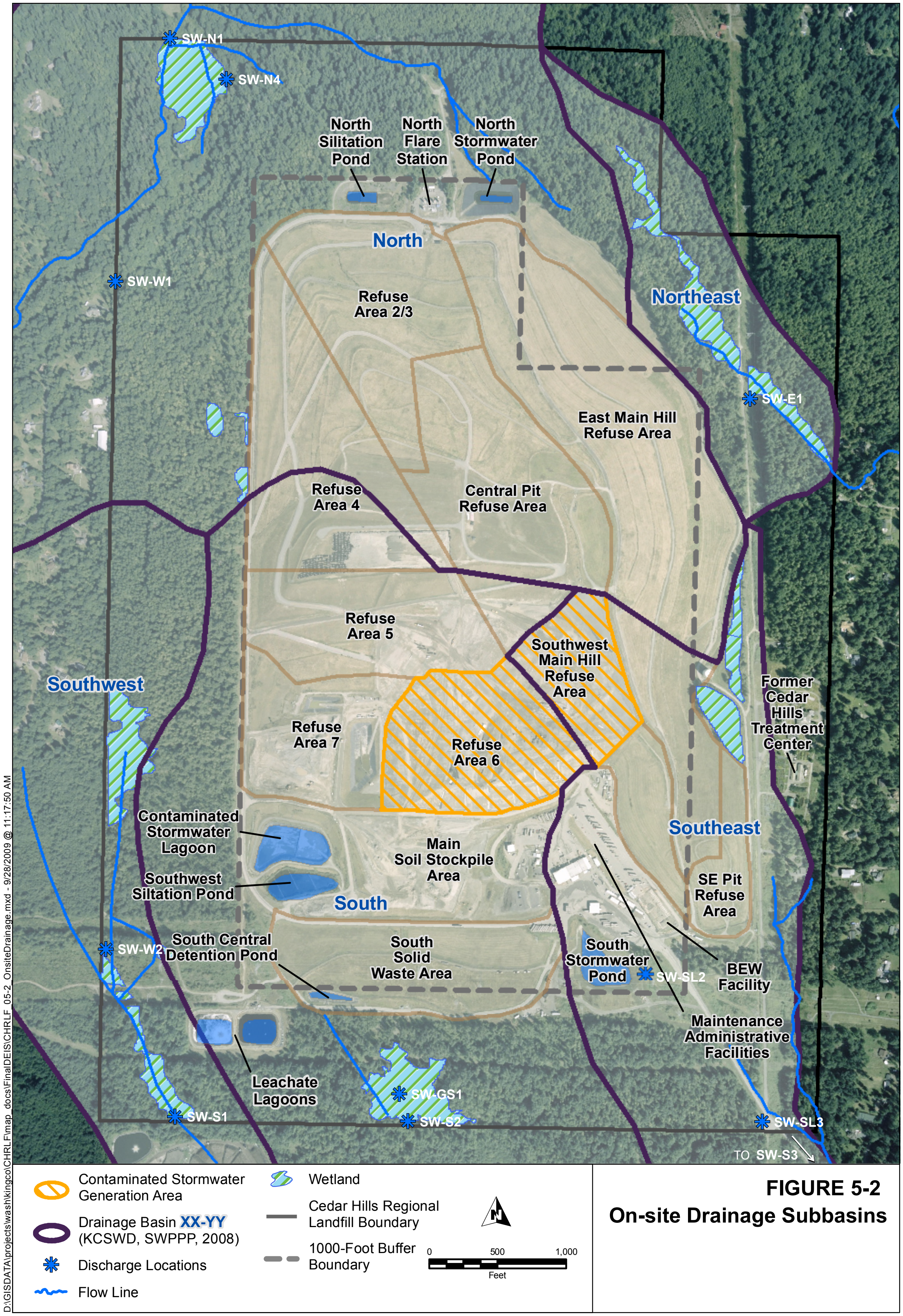

FIGURE 5-2
On-site Drainage Subbasins

Refuse Area 7 and the soil stockpile divert stormwater runoff to the southwest siltation pond. A series of baffles in the pond slows the flow and settles solids in the process. The pond outlet is an orifice that controls the discharge rate to pre-development levels. As stormwater leaves the pond, it enters a series of channels that flow to monitoring point SW-GS1. From this point, stormwater enters a wetland and leaves the site as sheet flow at monitoring point SW-S2, where it enters Queen City Lake and a gravel pit lake.

The majority of stormwater runoff generated in the SSWA drains to the south central detention pond. The pond releases at a controlled rate into the channels downstream of the south stormwater pond outlet that flow to monitoring point SW-GS1. A small portion of runoff from the SSWA and the south gravel access road drains to an unlined channel that converges with the stormwater from the south central detention and southwest siltation ponds.

5.1.4 Stormwater Runoff Quality

KCSWD routinely monitors the quality of stormwater runoff from the landfill in accordance with its Municipal Solid Waste Handling Permit (see Appendix B) and the Washington State Department of Ecology (Ecology) Industrial Stormwater General Permit (ISWGP) for the landfill.

KCSWD staff members collect stormwater grab samples for analysis at quarterly intervals from the following key locations around the landfill to meet ISWGP requirements (Figure 5-2):

- SW-N4, which drains the north subbasin on its northern property boundary
- SW-GS1, which drains the south subbasin on its southern property
- SW-SL3, at the exit of the bioswale from the south stormwater pond

All surface water is monitored and managed in accordance with the applicable permits. KCSWD transmits data to Ecology in quarterly discharge monitoring reports. The monitoring reports for 2007 and 2008 indicate that parameter concentrations in stormwater samples from the landfill typically fall well below their respective benchmark values, or effluent limits (see Tables 5-1 through 5-6). On occasion, storm events have led to erosion, resulting in elevated turbidity in the runoff. When a benchmark value is exceeded, KCSWD investigates to determine the cause and takes actions to improve the best management practices (BMPs) in the area of the cause or to address the cause in another manner, in compliance with the ISWGP. None of the exceedances of benchmark values has regularly recurred. Based on these data, stormwater runoff from the landfill is not adversely affecting the quality of water in creeks and rivers in the area.

KCSWD followed up on the turbidity benchmark exceedance for a sample collected at SW-GS1 in the first quarter of 2007 (see Table 5-3). The monitoring report noted that the sample (64.5 nephelometric turbidity units [NTU]) was collected in January following several months of unusually high precipitation and several severe winter storm events. It is likely that these events caused erosion of soil stockpiles (despite hydroseeding) and damaged silt fences in some areas. KCSWD repaired the damaged erosion control and stormwater systems. However, as noted in the 2008 Stormwater Pollution Prevention Plan (SWPPP) for the landfill, erosion and subsequent sedimentation is still a point of emphasis for the landfill operations staff. KCSWD continues to implement BMPs identified in the SWPPP to trap sediments and minimize erosion from the landfill.

In addition to quarterly monitoring at compliance points required by the ISWGP, KCSWD performs monthly monitoring at 11 locations around the site (shown in Figure 5-2). The results of this monitoring are reported to the Public Health – Seattle & King County (Public Health) and Ecology in compliance with WAC 173-351 and Section VIII of the Municipal Solid Waste Handling Permit.

Table 5-1. Quarterly Discharge Monitoring Reports SW-N4

Parameter	Units	Sample Type	Events Sampled	2007 1st Qtr	2007 2nd Qtr	2007 3rd Qtr	2007 4th Qtr	2008 1st Qtr	2008 2nd Qtr	ISWG Permit Limit
Turbidity	NTU	Grab	1	2.31	0.71	14.7	-	1.71	1.37	25
Oil & Grease	mg/L	Grab	1	ND	ND	ND	-	ND	ND	15

ISWG = Industrial Stormwater General (permit); mg/L = milligrams per liter; NTU = nephelometric turbidity unit.
ND = Not detected at the detection limit.

Table 5-2. Quarterly Discharge Monitoring Reports SW-N4

Parameter	Units	Sample Type	Events Sampled	2007 1st Qtr	2007 2nd Qtr	2007 3rd Qtr	2007 4th Qtr	2008 1st Qtr	2008 2nd Qtr	ISWG Permit 2008 Effluent Limitation Average Monthly*	ISWG Permit 2008 Effluent Limitation Maximum Daily**
pH	Standard Units	Grab	1	6.79	7.4	5.92	-	7.33	7.44	6–9	6–9
BOD5	mg/L	Grab	1	ND	ND	18	-	ND	8	37	140
TSS	mg/L	Grab	1	3	ND	8	-	3	3	27	88
Ammonia	mg/L	Grab	1	ND	ND	0.47	-	ND	ND	4.9	10
Alpha Terpinol	mg/L	Grab	1	ND	ND	ND	-	ND	ND	0.016	0.033
Benzoic Acid	mg/L	Grab	1	ND	ND	ND	-	ND	ND	0.071	0.12
p-Cresol	mg/L	Grab	1	ND	ND	ND	-	ND	ND	0.014	0.025
Phenol	mg/L	Grab	1	ND	ND	ND	-	ND	ND	0.015	0.026
Zinc (total)	µg/L	Grab	1	22	120	120	-	21	23	110	200

ISWG = Industrial Stormwater General (permit); mg/L = milligrams per liter; µg/L = micrograms per liter.
ND = Not detected at the detection limit.
- No sample collected since no qualifying storm event occurred during the quarter.
* If only one sample is taken during the monitoring quarter, the average monthly effluent limitation applies to that sample.
** The daily discharge is the average measurement of the pollutant over the day.

Table 5-3. Quarterly Discharge Monitoring Reports SW-GS1

Parameter	Units	Sample Type	Events Sampled	2007 1st Qtr	2007 2nd Qtr	2007 3rd Qtr	2007 4th Qtr	2008 1st Qtr	2008 2nd Qtr	ISWG Permit Limit
Turbidity	NTU	Grab	1	64.5*	-	-	-	5.4	3.28	25
Oil & Grease	mg/L	Grab	1	ND	-	-	-	ND	ND	15

ND = Not detected at the detection limit.
*The sample was collected in January following several months of unusually high precipitation and several severe winter storm events.
mg/L = milligrams per liter; NTU = nephelometric turbidity unit.

Table 5-4. Quarterly Discharge Monitoring Reports SW-GS1

Parameter	Units	Sample Type	Events Sampled	2007 1st Qtr	2007 2nd Qtr	2007 3rd Qtr	2007 4th Qtr	2008 1st Qtr	2008 2nd Qtr	ISWG Permit 2008 Effluent Limitation Average Monthly*	ISWG Permit 2008 Effluent Limitation Maximum Daily**
pH	Standard Units	Grab	1	6.73	-	-	-	6.76	6.88	6–9	6–9
BOD5	mg/L	Grab	1	ND	-	-	-	ND	ND	37	140
TSS	mg/L	Grab	1	2	-	-	-	9	4	27	88
Ammonia	mg/L	Grab	1	0.08	-	-	-	ND	ND	4.9	10
Alpha Terpinol	mg/L	Grab	1	ND	-	-	-	ND	ND	0.016	0.033
Benzoic Acid	mg/L	Grab	1	ND	-	-	-	ND	ND	0.071	0.12
p-Cresol	mg/L	Grab	1	ND	-	-	-	ND	ND	0.014	0.025
Phenol	mg/L	Grab	1	ND	-	-	-	ND	ND	0.015	0.026
Zinc (total)	µg/L	Grab	1	14	-	-	-	ND	ND	110	200

ISWG = Industrial Stormwater General (permit); mg/L = milligrams per liter; µg/L = micrograms per liter.
ND = Not detected at the detection limit.
- No sample collected since no qualifying storm event occurred during the quarter.
* If only one sample is taken during the monitoring quarter, the average monthly effluent limitation applies to that sample.
** The daily discharge is the average measurement of the pollutant over the day.

Table 5-5. Quarterly Discharge Monitoring Reports SW-SL3

Parameter	Units	Sample Type	2008 1st Qtr Events Sampled	2008 1st Qtr Average	2008 1st Qtr Max	2008 2nd Qtr Events Sampled	2008 2nd Qtr Average	2008 2nd Qtr Max	ISWG Permit Limit
Turbidity	NTU	Grab	2	23.25	30.4*	3	3.24	4.49	25
Oil & Grease	mg/L	Grab	2	ND	ND	3	ND	ND	15

ND = Not detected at the detection limit.
*The sample was collected in January following several months of unusually high precipitation and several severe winter storm events.
mg/L = milligrams per liter; NTU = nephelometric turbidity unit.

Table 5-6. Quarterly Discharge Monitoring Reports SW-SL3

Parameter	Units	Sample Type	2008 1st Qtr Events Sampled	2008 1st Qtr Average	2008 1st Qtr Max	2008 2nd Qtr Events Sampled	2008 2nd Qtr Average	2008 2nd Qtr Max	ISWG Permit 2008 Effluent Limitation Average Monthly*	ISWG Permit 2008 Effluent Limitation Maximum Daily**
pH	Standard Units	Grab	2	6.84	6.9	3	7.03	7.16	6–9	6–9
BOD5	mg/L	Grab	2	ND	ND	3	ND	ND	37	140
TSS	mg/L	Grab	2	44.5	48	3	4.3	6	27	88
Ammonia	mg/L	Grab	2	ND	ND	3	0.02	0.032	4.9	10
Alpha Terpinol	mg/L	Grab	2	ND	ND	3	ND	ND	0.016	0.033
Benzoic Acid	mg/L	Grab	2	ND	ND	3	ND	ND	0.071	0.12
p-Cresol	mg/L	Grab	2	ND	ND	3	ND	ND	0.014	0.025
Phenol	mg/L	Grab	2	ND	ND	3	ND	ND	0.015	0.026
Zinc (total)	µg/L	Grab	2	23	25	3	11.9	24	110	200

ISWGP Industrial Stormwater General (permit); mg/L = milligrams per liter; µg/L = micrograms per liter.
ND = Not detected at the detection limit.
* If only one sample is taken during the monitoring quarter, the average monthly effluent limitation applies to that sample.
** The daily discharge is the average measurement of the pollutant over the day.

5.2 Environmental Impacts

The evaluation of impacts to surface water assumes that well-proven engineering methods and techniques would be implemented to design and construct each of the action alternatives. It would be necessary to design a new surface water drainage system for each of the action alternatives in accordance with the 2009 King County *Surface Water Design Manual* (SWDM). In particular, the design and construction would need to consider the following:

- Construction scheduling
- Size of the relocated southwest siltation pond and the CSW pond (see Chapters 5 and 6 of the 2009 SWDM)
- Design of the new conveyance system to relocated ponds (see Chapter 4 of the 2009 SWDM)
- Separation and routing of stormwater, leachate, and CSW
- Maintenance of existing drainage patterns so that storm water would flow into the same drainage basin or subbasin
- Use of Low Impact Development (LID) techniques for new support facilities in the buffer

The evaluation of impacts to surface water quality assumes the implementation of BMPs in accordance with the SWPPP, including, but not limited to the following:

- Control erosion at the source, when possible, in accordance with the SWDM
- Intercept and convey surface water from disturbed areas to sediment ponds
- Properly identify clearing limits prior to clearing
- Provide perimeter protection (e.g., silt fence) downslope of areas to be disturbed prior to construction
- Provide stabilized construction entrances to limit the tracking of sediment off the construction area
- Implement additional measures for wet-season construction; these include covering stockpiled soil during winter, hydroseeding, and runoff management
- Inspect and maintain erosion and sedimentation control measures on a regular basis
- Use LID techniques that increase infiltration and minimize runoff in new support facility areas.

Current conditions at the site allow minimal infiltration in developed areas of the site.

5.2.1 Direct Impacts

Based on the design and construction considerations noted above, no significant impacts to surface water or surface water quality would be anticipated during construction or operation of any alternatives.

5.2.2 Indirect and Cumulative Impacts

Because there would be no direct impacts to stormwater or surface water quality as a result of implementing any of the alternatives, no indirect or cumulative impacts would be anticipated.

5.3 Mitigation Measures

Because no impacts to surface water or surface water quality would be anticipated as a result of implementing any of the alternatives, no mitigation measures would be necessary.

5.4 Significant Unavoidable Adverse Impacts

There would be no significant unavoidable adverse impacts to surface water or surface water quality as a result of implementing any of the alternatives.