South Park Landfill

Final Cleanup Action Plan

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Washington State Department of Ecology
Toxics Cleanup Program
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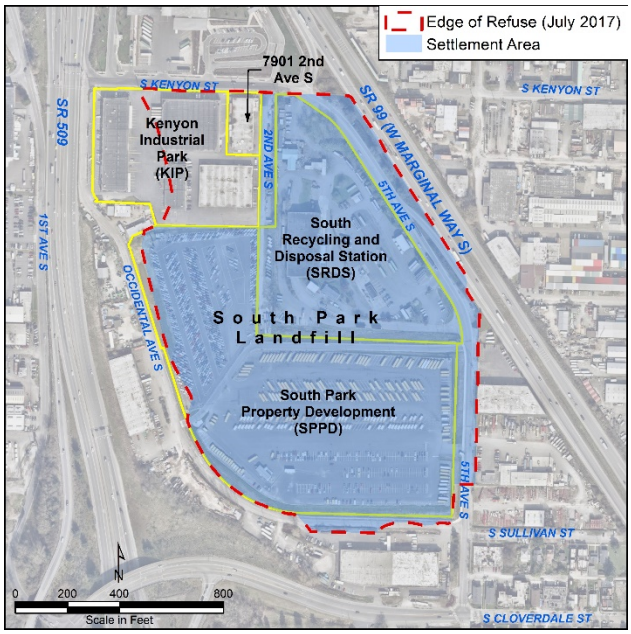
Executive Summary



The South Park Landfill Site (Site) includes property that is a closed solid waste landfill in the South Park neighborhood of Seattle, Washington. It is located in the Lower Duwamish Valley near the western valley wall between State Routes 509 and 99.

The landfill operated from the 1930s until 1966 when it was closed. By 1970, the South Recycling and Disposal Station, Kenyon Industrial Park, and several other facilities had been built on top of the landfill portion of the Site and were operating industrial facilities.

In February 2007, the Site was added to Washington State's Hazardous Sites List. Soil, groundwater, surface water, and landfill gas monitoring began in the late 1980s and have continued periodically to the present day. Today, landfill gas (methane) is still being produced at low levels and will require remedial controls, but no methane was detected in buildings on or near the landfill based on investigations conducted over four quarters in 2011. Vinyl chloride is still present at low levels in groundwater greater than Washington State's groundwater cleanup level. Vinyl chloride data will continue to be collected during groundwater monitoring to confirm that concentrations remain low and continue to decrease over time. Drinking water for the South Park community is provided by the Seattle Municipal Water Supply system, and the source of the water is protected watersheds in the Cascade Mountains.

A preliminary draft Cleanup Action Plan (CAP) for the Site was prepared by the potentially liable persons, as required by Washington State Model Toxics Control Act (MTCA) Agreed Order No. 6706. The Washington State Department of Ecology (Ecology) reviewed the preliminary and public review draft CAPs and used them to develop this Final CAP.

This CAP describes the proposed remedial alternative and specifies cleanup standards and other requirements for the cleanup of the "Settlement Area," which is a portion of the Site. The Settlement Area consists of the two largest parcels within the "Edge of Refuse" (defined below) and certain adjacent City of Seattle and Washington State right-of-ways. The Edge of Refuse is the portion of the Site where wastes were placed as part of South Park Landfill operations. The proposed cleanup action is based on information and technical analyses documented in the 2017 Remedial Investigation/Feasibility Study (RI/FS) for the Site and consideration of public comments and community concerns.

Ecology will hold a public comment period on this CAP. During the comment period, the public will be provided an opportunity to review the CAP and submit comments to Ecology. Once the comment period closes, Ecology will consider all comments received before finalizing the CAP. The final CAP will be implemented under a Consent Decree.

PROPOSED CLEANUP ACTION

Under MTCA, closed solid waste landfills are expected to prevent the spread of (or contain) hazardous substances. To meet the requirements of MTCA, the selected containment remedy must protect human health and the environment, and provisions must be made for long-term monitoring and maintenance.

The environmental investigation and analyses conducted as part of the RI/FS have guided the selection of a cleanup action that protects human health and the environment into the future. This proposed cleanup action for a portion of the Site consists of the following elements:

- A **landfill cap/cover** to protect people and animals from direct contact with the landfill contents.
- **Landfill gas controls** to prevent or mitigate subsurface migration of landfill gas into on-site and nearby buildings and structures.
- **Stormwater controls** to (1) prevent stormwater from coming into contact with solid waste, (2) maintain the landfill cap/cover, and (3) meet regulatory requirements.
- **Long-term monitoring of groundwater** to confirm that the residual vinyl chloride in the groundwater system remains at low concentrations and continues to degrade over time. Iron, manganese, and arsenic will also be monitored to demonstrate reduction in concentrations over time to background or pre-impairment levels.
- **Long-term monitoring of the cap/cover, the landfill gas controls, and groundwater** to ensure that the cleanup remedy is effective and provides long-term protection of human health and the environment.
- **Environmental Covenants** to ensure long-term compliance with regulations and maintenance of the cleanup remedy.

Completing the cleanup action detailed in this CAP will ensure that the Settlement Area meets the regulatory requirements for the protection of human health and the environment.

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
7901	7901 2nd Avenue S., LLC
ARAR	Applicable or relevant and appropriate requirement
CAP	Cleanup Action Plan
City	City of Seattle
COC	Chemical of concern
CPOC	Conditional point of compliance
County	King County
CUL	Cleanup level
DCE	Dichloroethene (three isomers: 1,1-DCE, *cis*-1,2-DCE, and *trans*-1,2-DCE)
Ecology	Washington State Department of Ecology
IA	Interim Action
IAWP	Interim Action Work Plan
IB	Industrial Buffer, a City zoning designation
IG2	General Industrial 2, a City zoning designation
KIP	Kenyon Industrial Park
L3	Lowrise 3, a City zoning designation
LEL	Lower explosive limit
Lenci	Lenci Frank Corporation
LFG	Landfill gas
µg/L	Micrograms per liter
µS/cm	Microsiemens per centimeter
MFS	Minimal Functional Standards
mg/L	Milligrams per liter
MTCA	Model Toxics Control Act
NAVD 88	North American Vertical Datum of 1988
OMM	Operations, maintenance, and monitoring
OMMP	Operations, Maintenance, and Monitoring Plan
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PLP	Potentially liable person
POC	Point of compliance

Acronym/ Abbreviation	Definition
ppmv	Parts per million by volume
redox	Oxidation-reduction (potential)
RI/FS	Remedial Investigation/Feasibility Study
ROW	Right-of-way
SF 5000	Single Family 5000
SPPD	South Park Property Development, LLC
SR	State Route
SRDS	South Recycling and Disposal Station
STS	South Transfer Station
STSII	South Transfer Station Phase II
TCE	Trichloroethene
VOC	Volatile organic compound
WAC	Washington Administrative Code

1.0 Introduction

This Final Cleanup Action Plan (CAP) describes the cleanup action selected by the Washington State Department of Ecology (Ecology) for the "Settlement Area," a portion of the Site, which is comprised of the two largest parcels within the "Edge of Refuse" (defined below) and certain adjacent City of Seattle (City) and Washington State right-of-ways (ROWs). This cleanup action plan for a portion of the Site will result in an expeditious cleanup of a large portion of the landfill by consolidating the two interim cleanup actions on the largest properties and integrating them into a coordinated and comprehensive cleanup under state regulations. Per Model Toxics Control Act (MTCA), the Site is defined by where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located. Based on factors currently known to Ecology, the Site is generally located at 8100 and 8200 2nd Avenue South, Seattle, Washington, and includes a former municipal solid waste landfill located in the South Park neighborhood of Seattle, Washington. For purposes of this CAP, certain areas of the Site have been separately identified (e.g., the Settlement Area). Ecology considers those areas to be part of the Site. The Edge of Refuse defines that area of the Site where wastes were placed as part of South Park Landfill operations. The landfill received solid waste from the 1930s until 1966, when it was closed under the existing landfill closure laws. In February 2007, the Site was added to Ecology's Hazardous Sites List, based on concerns related to groundwater contamination and the presence of potentially flammable or explosive landfill gas (LFG). Investigations of groundwater, surface water, soil, and LFG began in the late 1980s and have continued to the present day. The selected cleanup action described in this CAP fulfills the requirements of the MTCA, Chapter 70.105D of the Revised Code of Washington, administered by Ecology under the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC), for a portion of the Site. In 2009, the City and South Park Property Development, LLC (SPPD) entered into Agreed Order No. 6706 to conduct a Remedial Investigation/Feasibility Study (RI/FS) and to complete a preliminary draft CAP. Agreed Order No. 6706 was amended in 2013 to include an Interim Action (IA) to be conducted primarily on the portion of the Site owned by SPPD and was amended again in 2015 to include an IA to be conducted primarily on the portion of the Site owned by the City.

This CAP was developed using information presented in the RI/FS (Floyd|Snider et al. 2017) for the Site, which was prepared by the Floyd|Snider Team (Floyd|Snider, Aspect Consulting, Herrera Environmental Consultants, and BHC Consultants) on behalf of the City, King County (County), and SPPD, and reviewed and approved for public comment by Ecology. Ecology will hold a single unified public comment period on the RI/FS, CAP, and Consent Decree. During the comment period, the public will be provided an opportunity to review the RI/FS, CAP, and Consent Decree, and submit comments to Ecology. Once the comment period closes, Ecology will consider all comments received before the documents are finalized and the final Consent Decree is implemented.

The objective of this CAP is to satisfy the MTCA requirements for cleanup action plans set forth in WAC 173-340-380(1). Consistent with the requirement of that section, this CAP provides the following information:

- Site description, background, and characterization
- Cleanup standards and remediation levels for each hazardous substance in each medium of concern
- Description of the selected remedial action, including justification for the selection
- Brief summary of the remedial action alternatives considered in the RI/FS
- Implementation schedule and restoration timeframe
- Institutional controls
- Applicable state and federal laws

2.0 Site Description and History

2.1 SITE, EDGE OF REFUSE, AND SETTLEMENT AREA DESCRIPTIONS

The Site is situated in the South Park neighborhood, located in Section 32 of Township 24 North, Range 4 East (Figure 2.1). The Site includes the Edge of Refuse, which refers to that section of the Site where landfill operations occurred historically and solid waste was placed, and the Settlement Area. Remedial actions required by this CAP address the Settlement Area, which is composed of the largest two parcels within the Edge of Refuse and certain adjacent City of Seattle and Washington State ROWs. The Edge of Refuse and Settlement Area are shown in Figure 2.2.

Several parcels that were initially added to the County tax rolls via foreclosure in the 1920s and were later purchased by the City and the County in the 1950s are located within the Edge of Refuse. Until it was closed in 1966, the landfill was operated by the City, and operation included disposal and burning of municipal, commercial, and industrial refuse (SPU 1997; Ecology and Environment, Inc. 1988). Since that time, the parcels within the Edge of Refuse have undergone filling and grading activities and has been redeveloped. Nearly half of the land located within the Edge of Refuse is currently covered with structures and the rest is paved with limited areas of landscaping. A detailed description of the history of the parcels within the Edge of Refuse and its owners is provided in Section 2.0 of the RI/FS.

The land within the Edge of Refuse covers approximately 39 acres and is roughly bounded to the north by South Kenyon Street, to the east by State Route (SR) 99 and 5th Avenue South, to the south by South Sullivan Street, and to the west by Occidental Avenue South (Figure 2.2). The Edge of Refuse, shown in Figure 2.2, was established by review of aerial photographs from 1936 to 1970, logs from dozens of soil borings, and other information. Details are presented in Section 4.0 of the RI.

The following sections describe the Settlement Area.

2.1.1 South Park Property Development Parcel

The SPPD property includes 21.0 acres of land purchased from the County in 2006. The County had purchased the parcel out of tax title in 1957 prior to leasing it to the City from 1958 through 1978. After disposal operations at the landfill ended in 1966, additional unclassified fill was added, and the parcel was graded. The County later leased portions of the property to a variety of tenants from the mid-1980s through the late 1990s, primarily for truck and equipment storage. In 2008, the property was largely cleared of vegetation and, in some areas, a layer of crushed concrete was added as ballast and the parcel was regraded.

In 2014 and 2015, SPPD performed an IA for cleanup at the parcel per the 2013 Ecology-approved Interim Action Work Plan (IAWP) under Amendment No. 1 of Agreed Order No. DE 6706 for the Site (Farallon 2013). The IA was performed simultaneously with the redevelopment of the property. The property redevelopment includes a modular building for employees and paved parking for employees and visitors. The IA work included regrading and capping the landfill surface, installing and operating a LFG control system, implementing institutional controls, and

conducting monitoring. Ecology has reviewed the IA and associated design reports, and determined that the IA at this portion of the Site is consistent with requirements for the final cleanup detailed this CAP. Under the terms of this CAP, there will be ongoing obligations performed at this property as detailed in the Landfill Post-Closure Operations, Maintenance, and Monitoring Plan (OMMP; Appendix A).

2.1.2 South Recycling and Disposal Station Parcel

The South Recycling and Disposal Station (SRDS) property[1] is defined by County tax parcel 7328400005, encompassing 10.55 acres, and was purchased out of tax title by the City in 1951. Two additional strips of land, 60 feet on the west of the SRDS parcel and 30 feet on the south, were incorporated into the property in 2003 by City Ordinance 121306. This additional land is in the process of being recorded by the County and brings the site area to approximately 11 acres.

The SRDS parcel operated from 1966-2013 as a transfer station for municipal solid waste and other recyclable materials. In spring 2013, the City opened a new solid waste transfer station across the street on South Kenyon Street. The City will redevelop the SRDS as a support arm of the new South Transfer Station (STS). Under Amendment No. 2 of Agreed Order No. DE 6706, an IA will take place on this property as detailed in the 2015 Ecology-approved IAWP (Herrera and Aspect 2015). The IA includes installation of asphalt, concrete, or membrane caps, and LFG and surface water controls; implementation of institutional controls; and compliance monitoring. The LFG collection system will include horizontal (trench) collectors, conveyance piping, and vents to address areas covered by cap materials as well as new buildings planned for construction. Both LFG and groundwater will be monitored to assess the effectiveness of the IA on the SRDS portion of the Landfill. Under the terms of this CAP, there will be ongoing obligations performed at this property as detailed in the OMMP (Appendix A).

Ecology has reviewed the IAWP and determined that the IA will meet the final cleanup action elements of this CAP.

2.1.3 Transportation Corridors

The landfill is surrounded by City streets and State highways, as shown in Figure 2.2. The Edge of Refuse extends beneath sections of the following roads and/or ROWs, as shown in Figure 2.2:

- 5th Avenue South where the landfill is present has complex ownership as shown on Figure 2.2.
    - The section adjacent to the City's SRDS parcel is deeded by quitclaim deed (King County Record No. 9012260159 dated 12/14/90, Blocks 6, 7, 17 & 18 of plat – 1st Add to River Park, Vol. 8, p. 65) to the City from the State, as turn back ROW of SR 99. The quitclaim deed conveys all right, title, and interest for road purposes only.

[1] The City's landfill parcel is known as the SRDS in this CAP, to be consistent with other landfill-related documents. It is called the South Transfer Station Phase II (STSII) in other City documents, as it is being redeveloped to provide services that complement the new STS across the street.

  - On the section adjacent to the SPPD parcel, the western 20-foot-wide strip is held by the City through accepted deeds from the County, for street and general corporate purposes under Ordinance 96099; while the western 30-foot-wide strip is held as easement by the City (through the original platting).
- South Sullivan Street where the landfill is present was accepted under ord. 96099, for street and general corporate purposes by the City.
- Southbound lanes of SR 99 (West Marginal Way S.) were originally part of US Route 99 (1926-1972) and part of Primary State Highway 1 (1937-1964), then became SR 99 in 1972. The landfill extends to the near edge of pavement of the southbound lanes (i.e., under the right shoulder of the southbound lanes).

Information on Seattle Department of Transportation ownership was supplied by Mr. Larry Huggins, Real Property and Environmental Manager, City of Seattle Department of Transportation. Information on Washington State Department of Transportation ownership of SR 99 was inferred from a City of Seattle City Engineer's Department drawing created in 1934 and revised through 1989; a copy of the drawing is contained in Appendix A of the RI.

2.2 ZONING AND LAND USE

The majority of the portion of the Site within the Edge of Refuse, with the exception of the southeastern corner in the vicinity of the intersection of 5th Avenue South and South Sullivan Street, is zoned by the City as General Industrial 2 (IG2; Figure 2.3). This zoning designation includes general and heavy manufacturing, commercial uses subject to certain limitations, transportation and utility services, and salvage and recycling uses. The areas west, north, and northeast of the Site are also designated as IG2. The southeastern corner of the Site is designated as Industrial Buffer (IB), which is intended to provide buffering between industrial areas and adjacent residential areas. Farther east, southeast, and south of the Site, the South Park area is designated as either Lowrise 3 (L3) or Residential Single Family 5000 (SF 5000). The residential property closest to the Landfill is an L3 apartment building located at the southeastern corner of 5th Avenue South and South Sullivan Street, which is approximately 100 feet southeast of the Site. The nearest single-family home is located approximately 200 feet southeast of the Site (Figure 2.3).

Major roadways surrounding the Site (Figure 2.2) include the following:

- SR 99, adjacent to the northeastern portion of the Site
- SR 509, approximately 200 feet west of the Site

Based on the zoning characteristics and a review of the available aerial photographs, both the IG2- and IB-zoned areas of the Site can be reasonably designated as industrial properties.

2.3 SITE HISTORY

Historical operations at the landfill are based primarily on information available in the City and County files, as well as aerial photographs taken from 1936 to 2004. A detailed description of the historical operations and accompanying aerial photographs are provided in Section 2.0 the RI/FS.

The original disposal location documented in the records became active sometime before 1936, when most of the surrounding area was still farmland. Materials disposed of in the landfill primarily consisted of municipal, commercial, and industrial waste (SPU 1997; Ecology and Environment, Inc. 1988) from south and west Seattle. Waste from some parts of nearby unincorporated King County may also have been disposed of, as allowed under the County's 1958 lease with the City. By 1946, active disposal in the northwestern corner of the landfill had expanded to the southeast into the parcel occupied by the present-day SRDS. At that time, solid waste was burned at the landfill prior to final disposal, and that practice would continue until 1961.

After the landfill was closed in 1966, South Sullivan Street was moved approximately 150 feet north to its present location. Between 1967 and 1974 (more than 40 years ago), the Kenyon Industrial Park (KIP), 7901 2nd Avenue S., LLC (7901), and SRDS parcels were established facilities, closely resembling their current configuration and use today. After the landfill was closed, the SPPD property was used for truck storage and other purposes from the early 1970s until the mid-1990s. In 2008, the SPPD parcel was cleared of vegetation and partially regraded using crushed concrete as fill. The parcel then continued as a leased equipment and truck storage yard.

3.0 Conceptual Site Model

3.1 PHYSICAL CONCEPTUAL SITE MODEL

The Site is located within the Lower Duwamish Valley, near the western valley wall, as shown in Figure 2.1. The Duwamish Valley consists of a relatively thick sequence of alluvial deposits overlain by a relatively extensive layer of imported fill. The alluvial deposits range from 30 to 50 feet thick near the edge of the valley to more than 100 feet thick in the center of the valley (Hart Crowser 1998). Groundwater first occurs in the upper deposits within the alluvial Duwamish Valley Aquifer. More details on the hydrogeology can be found in Figures 3.1 and 3.2 of the RI/FS.

The Duwamish Valley Aquifer is a relatively young hydrogeological feature. Approximately 7,000 years ago, an arm of Elliott Bay extended up the valley for several miles past where the Site is today, to the city of Auburn. At that time, marine waters from Puget Sound filled the valley. A series of volcanic events and mudflows, and subsequent erosion of the mudflows, slowly filled the marine embayment and led to the formation of the valley and its aquifer. Today, the Duwamish Valley has an average elevation of 21 feet above mean sea level (based on the North American Vertical Datum of 1988 [NAVD 88]), and the former marine embayment contains sediment/soils comprising the subsurface alluvial aquifer. The sides of the valley are bounded by glacial materials (mostly glacial till) with isolated areas of bedrock.

Deeper groundwater below the B-Zone (greater than -40 feet NAVD 88) within the Duwamish Valley Aquifer is saline in most locations and often old, with little opportunity for recharge and/or discharge. Shallow groundwater is fresh due to recharge from the uplands near the edge of the valley walls and precipitation falling in the valley. At the Site, the Duwamish Valley Aquifer is subdivided into three zones (Perched Zone, A-Zone, and B-Zone) to assist in the classification and investigation of the aquifer conditions and chemical contamination.

Shallow groundwater flow (fresh water) flows from the Duwamish Valley walls, joins with precipitation that infiltrates the Duwamish Valley Aquifer, and discharges into the Lower Duwamish Waterway, which flows north to discharge into Elliott Bay (refer to Figure 2.1). Because groundwater flows from the higher topographic elevations of the uplands toward the lower topographic elevations of the Duwamish Waterway, the groundwater typically has a slight upward vertical gradient from the B-Zone to the A-Zone of the Duwamish Valley Aquifer. Within the A-Zone of the Duwamish Valley Aquifer, there is a Silt Overbank Deposit, which, due to its fairly consistent thickness and extent, acts as a low-permeability leaky aquitard across much of the valley. The Silt Overbank Deposit is generally located at an elevation between 0 and +10 feet, based on the NAVD 88, and represents an alluvial flood deposit surface likely from the 1800s. The Silt Overbank Deposit creates perched groundwater conditions because it limits downward groundwater migration.

The Duwamish Waterway is a channelized tidal waterway directly connected to Elliott Bay. As the groundwater in the Duwamish Valley Aquifer approaches the Duwamish Waterway, it enters a zone that is influenced by tidal action in Puget Sound, which can cause temporary groundwater

flow reversals near the waterway. These flow reversals introduce oxygen-rich, saline water into the Duwamish Valley Aquifer adjacent to the Duwamish Waterway.

As mentioned above, groundwater at the landfill has been investigated in three zones:

- **The Perched Zone:** A shallow zone of groundwater and infiltrating stormwater, typically less than 1 foot in thickness perched on top of the Silt Overbank Deposit where it is present. This zone reflects very localized conditions.
- **A-Zone groundwater:** The groundwater in the Duwamish Valley Aquifer beneath the Silt Overbank Deposit is generally the upper 15 feet of the aquifer, extending down to approximately -15 feet NAVD 88.
- **B-Zone groundwater:** Groundwater deeper in the Duwamish Valley Aquifer is generally located below -15 feet NAVD 88 but above the estuarine/marine deposits. This zone does not exist along the upgradient edge of the landfill near the valley wall because the Duwamish Valley Aquifer becomes thinner and only the A-Zone is present. Along the downgradient edge of the landfill, estuarine deposits are generally encountered around -40 feet NAVD 88.

Groundwater migration through the Duwamish Valley Aquifer is through both the A-Zone and the B-Zone.

3.2 LANDFILL "STAGE" CONCEPTUAL SITE MODEL

Solid waste landfills have been extensively studied across the country and are well understood by today's solid waste engineers. As part of engineers' modern training, they are taught the concept that municipal solid waste landfills undergo well-defined stages as they age and that understanding these stages allows the engineer to predict the characteristics of LFG and leachate production. This section describes the five stages of solid waste landfills and discusses where the landfill portion of the Site is within this scheme and what that means for future LFG and leachate production.

3.2.1 The Five Stage Model

Municipal solid waste landfills contain a large proportion of organic material that can be degraded by the range of microorganisms found in landfills, including food and garden waste, paper and board, and wood and some textiles (Williams 2005). The processes of degradation of organic bioreactive wastes in landfills involve not only biological processes but also interrelated physical and chemical processes. Five main stages of degradation of biodegradable wastes have been identified and are routinely used by landfill engineers to understand performance and improve designs. These five stages are addressed in detail in the RI/FS (Floyd|Snider et al. 2017).

As shown in Figure 3.1, the stage of a landfill controls the composition of the LFG, the rate of LFG production, and the composition of the leachate coming from the landfill. The South Park Landfill is in late Stage 4 and early Stage 5 (refer to Section 3.2.2). Stage 4 conditions typically last the longest and involve the most pronounced changes. During Stage 4, LFG is dominated by methane

and carbon dioxide, with little to no oxygen present. The leachate becomes anaerobic. Initially it is acidic due to the formation of organic acids from food decomposition, but later the pH returns to neutral, and the carbon dioxide acts to buffer the pH. The anaerobic conditions within the landfill favor the reductive dechlorination of the solvents, such as trichloroethene (TCE) to vinyl chloride, and then further reduction to the nontoxic ethene occurs. If the anaerobic leachate enters groundwater, the groundwater will also become anaerobic, and this will cause the dissolution of iron and manganese from the native soils. It is during this time that many unlined solid waste landfills develop groundwater contamination from iron, manganese, and vinyl chloride.

During late Stage 4, methane concentrations decline to less than 20 percent by volume and, most importantly, the rate of methane production decreases sufficiently enough that there is little or no buildup of pressure. Without a buildup of pressure, there is no mechanism to "push" LFG migration; instead, the gas is emitted slowly from the landfill by a combination of diffusion and barometric pumping.[2] At Stage 5, methane production is so low that the gas within the landfill begins to resemble atmospheric conditions, and both oxygen and nitrogen concentrations rise. The leachate has a neutral pH and only a slightly elevated concentration of salts. The underlying groundwater system also starts to recover during this period. As the groundwater starts to become aerobic, iron and manganese are redeposited on the native soils (from which they came). Vinyl chloride, if still present, will continue to degrade but will use different biological pathways, as discussed in Section 5.8 of the RI/FS.

3.2.2 South Park Landfill Current Stage

The landfill was opened in the 1930s and closed in 1966. It primarily accepted solid waste, and much of the waste was burned to reduce volume. Today, the landfill is in late Stage 4 (where methane is still present but with no pressure accumulation) to early Stage 5 (where oxygen is present), depending on the location within the landfill. LFG data since 1997 indicate that the concentrations in many of the probes are stable and range from 0 to 40 percent methane by volume. The production of methane is too low to produce a measureable increase in pressure. In areas where the methane production is now less than 20 percent, the landfill is transitioning to Stage 5; when it is less than 5 percent methane, it is in Stage 5.

Specific conductivity in wells in and downgradient of the landfill, at concentrations between 170 and 1,500 microsiemens per centimeter (µS/cm), is now consistent with upgradient concentrations of 400 to 1,300 µS/cm. The pH at the landfill has also returned to neutral conditions, with most wells between 6.6 and 6.9.

Another aspect of the anaerobic conditions that develop at a landfill during Stage 4 is the development of an iron and manganese zone downgradient. The anaerobic conditions that develop in groundwater beneath a landfill leach naturally occurring iron and manganese from the soils in the aquifer. As soon as the conditions become less anaerobic, the iron and manganese

[2] Barometric pumping refers to the natural airflow in the unsaturated zone included in landfills without active gas control systems, in response to natural variations in atmospheric pressure.

concentrations return to background conditions in the aquifer. At the Landfill, iron and manganese concentrations are approaching background conditions as defined by the conditions at upgradient wells. The iron and manganese concentrations in many of the wells are already equal to their respective background concentrations; MW-18 has the greatest concentrations, with manganese at the background concentration and iron at less than 2 times the background concentration. These concentrations are consistent with the landfill transitioning to Stage 5.

Chemicals of concern (COCs) are discussed in Section 4.0, along with their nature and extent and cleanup levels (CULs). As discussed there, their extent and concentrations are also consistent with an aged municipal landfill transitioning into Stage 5. Section 6.0 presents remedial action components to bring the COCs and LFG into compliance with CULs.

3.3 EXPOSURE PATHWAYS AND RECEPTORS

3.3.1 Human Health Exposure Pathways and Receptors

The Settlement Area is primarily composed of a closed solid waste landfill that has been redeveloped as industrial-zoned properties and public streets. The Settlement Area encompasses buildings, hard-packed surfaces, and paved areas. Streets within and adjacent to the Settlement Area are asphalt-covered and contain utility ROWs. Other utilities also run through the Settlement Area.

The areas around the landfill where vinyl chloride is present in groundwater and LFG is present in unsaturated soil, and those areas of the Site beyond the landfill are also industrial areas.

Table 3.1 lists potential exposure pathways and human receptors that are being considered at the Settlement Area and for downgradient groundwater.

Table 3.1
Potential Exposure Pathways and Human Receptors

Medium	Location	Exposure Route	Receptor
Ambient air	Buildings throughout the Settlement Area	Inhalation of VOCs	Industrial worker
Ambient air	Buildings throughout the Settlement Area	Explosive hazard from methane	
Confined air	Utility vaults at or adjacent to the Settlement Area	Inhalation of VOCs	Industrial maintenance worker
Confined air	Utility vaults at or adjacent to the Settlement Area	Explosive hazard from methane	
Surface soil	Soils that are not covered by the existing pavement/ buildings or future landfill cap at the Settlement Area	Direct contact, including dermal	Industrial worker
Subsurface soil	Soils beneath existing pavement/buildings or future landfill cap at the Settlement Area if pavement/buildings or cap is disturbed	Direct contact, including dermal	Industrial worker
Groundwater	Groundwater downgradient of the edge-of-refuse	Potential drinking water use	No current or potential future receptors
	Groundwater that discharges into the Lower Duwamish Waterway	Use of surface water by aquatic species	Aquatic species (because the Lower Duwamish Waterway is saline; there is no drinking water use)

Abbreviation:
VOC Volatile organic compound

3.3.2 Ecological Receptors

The Settlement Area is exempt from the requirement for a terrestrial ecological evaluation consistent with WAC 173-340-7491(1)(b) because all contaminated soil "will be below existing buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed to soil contamination." To qualify for this exemption, an institutional control is required under WAC 173-340-440. This institutional control is also required as part of the landfill closure. Filing an environmental (restrictive) covenant on each property within the Settlement Area is a remedial action required by this CAP and is also a requirement in the Consent Decree (refer to Section 16.0 of the RI/FS). The CAP and Consent Decree also require use of an alternative system to meet the requirements of institutional controls for certain ROWs (refer to

WAC 173-340-440(8)(b)). As detailed in the schedule, the alternative environmental (restrictive) covenant will be drafted for Ecology's review within 180 days after the effective date of the Consent Decree.

3.4 REMEDIAL INVESTIGATION CONCLUSIONS

Based on the findings of the RI and the conceptual site model discussed in Section 3.1, the following historical information, findings, and determinations were considered during development of the FS to identify effective remedial actions for the Settlement Area:

3.4.1 Age, Extent, and Condition of the Landfill

- Solid waste was disposed of in the landfill portion of the Site from the 1930s through the mid-1960s; much of the waste was burned to reduce the volume. The landfill was closed in 1966. The extent of the Edge of Refuse is shown in Figure 2.2 and is based on review of aerial photographs, available records from the City and County, and soil test pit and boring logs.
- The landfill is unlined, and the bottom of the waste is in direct contact with groundwater, either a thin layer of Perched Zone groundwater resting on the Silt Overbank Deposit, or the upper few feet of the A-Zone of the Duwamish Valley Aquifer when the silt layer is not present.
- Between landfill closure in 1966 and 2015, the SPPD parcel and sections of the SRDS parcel, as well as the shoulders of the ROWs, were unpaved and allowed rainwater falling on the site to infiltrate. During this time, infiltration occurred on over 60 percent of the landfill.
- The contents of the landfill include municipal solid waste, burned waste and ash, and interbedded soil and general-purpose fill used as cover during operations and as fill during closure and post-closure activities. Because of the heterogeneous nature of the waste/fill and its presence within a closed landfill, limited characterization was performed during the RI. Based on 30 years of state and national experience with similar landfills, the waste/fill is presumed to contain one or more hazardous substances, some of which may be at concentrations greater than MTCA CULs. Some of these hazardous substances have been released to groundwater and soil vapor as discussed above.
- The former West Ditch is considered within the Edge of Refuse due to historical operations, but the ditch is not part of the "contained landfill;" rather, it historically served as part of the stormwater system for the SPPD parcel. Soil in the ditch was investigated as part of the RI. It was found to contain polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), metals, petroleum hydrocarbons, and very low concentrations of two common pesticides. All concentrations are less than MTCA CULs for soil at industrial sites.

3.4.2 Landfill Gas Findings

- Ongoing LFG (methane) monitoring confirms that the landfill is in late Stage 4 or early Stage 5, depending on the location. Specifically, the landfill is still producing methane in some areas but with no measureable pressure buildup on either the paved or unpaved parcels.[3] Methane concentrations measured in the subsurface within the landfill range from non-detect to approximately 20 percent. Typical concentrations are below 10 percent and many areas are below 1 percent. Similar conditions have been observed at the landfill since the 1990s.
- Perimeter LFG probes were not in compliance for LFG during the RI in the following locations:
  - The historical KIP swale.
  - The area along 5th Avenue South adjacent to the SPPD parcel. An SPPD IA was performed that included installation of a LFG control system on the SPPD parcel. The LFG control system brought this area into compliance (as discussed in the RI/FS); however, the system will need to maintain control sufficient to keep the area in compliance.
- Methane intrusion into buildings at or adjacent to the Landfill is not occurring:
  - Buildings at the SRDS parcel were either built with methane mitigation or undergo routine monitoring by Seattle Public Utility (SPU) staff with no detected methane.
  - Screening of buildings at the KIP parcel and the 7901 parcel for methane and explosive gases occurred quarterly for four quarters in 2011. No methane was detected.
  - Screening of buildings along 5th Avenue South across from the Landfill occurred quarterly for four quarters in 2011. No methane was detected.
  - No buildings existed on the SPPD parcel at the time of the RI. The new building on the parcel is equipped with methane mitigation and an alarm.
- Concentrations of volatile organic compounds (VOCs) in subsurface soil vapor at the Landfill are less than Ecology's screening levels except for benzene and vinyl chloride:
- Benzene was detected in soil vapor in the historical KIP swale outside the Edge of Refuse at concentrations greater than the screening level, but is less than the screening level at all other locations.
- Vinyl chloride was detected at low concentrations in soil vapor at the Landfill. Only one sample exceeds its screening level: the vinyl chloride concentration in GP-27 located along 5th Avenue South is approximately 1.5 times its screening level. The nearest building is more than 50 feet away and that area is now under control of the SPPD LFG system.

[3] Although no pressure has been detected at the landfill in years, under the terms of this CAP, for any change in site conditions, such as changes in pavement, the Subject potentially liable persons (PLPs; defined in Section 6.2) must demonstrate to Ecology that either the change will not cause LFG to build up beneath the surface or that the LFG will be controlled by an active or passive LFG system with monitoring to prevent the buildup of LFG pressure.

3.4.3 Groundwater Findings

- Vinyl chloride, iron, and manganese are groundwater COCs that exceed CULs at the conditional point of compliance (CPOC) for the Settlement Area.
- Vinyl chloride exceeds its CUL at the northeast corner of the Site. Its CUL is 0.29 micrograms per liter (µg/L) and is based on consumption of drinking water. Concentrations at the Landfill near the downgradient edge-of-refuse (the CPOC) range from non-detect at 0.02 µg/L to detections ranging from 0.051 µg/L to 1.4 µg/L. The source of vinyl chloride at the Landfill is believed to have been small amounts of the degreasing solvent TCE that were likely disposed of at the landfill and have since degraded to vinyl chloride. Vinyl chloride is still present today because residual contamination is likely trapped in the fine-grained Silt Overbank Deposit; this residual contamination would slowly diffuse into the A-Zone of the Duwamish Valley Aquifer. Concentrations in groundwater downgradient of the landfill at monitoring wells across SR 99 are between non-detect at 0.02 and 0.31 µg/L (MW-08, MW-24, MW-26, and MW-27), except at MW-31 where a second non-landfill source is also contributing contamination.
- Iron and manganese concentrations are naturally high in the Alluvial Aquifer; therefore, a CUL based on background was calculated using the procedures in MTCA 173-340-709. Details are presented in Section 5.6.4 of the RI/FS. Iron is periodically (but not consistently) elevated at concentrations greater than background in MW-10, MW-18, MW-25, and MW-32; the other wells are in compliance. Manganese is periodically (but not consistently) elevated at concentrations greater than background in MW-08, MW-10, MW-18, MW-24, MW-25, and MW-32; the remaining wells are in compliance. Based on the trend plots presented in Appendix J of the RI/FS, all wells are expected to be in compliance for iron and manganese within the next 10 years.
- Three other COCs are present in groundwater although their concentrations are less than their respective CULs at the CPOC:
    - Benzene concentrations are greater than its CUL in upgradient well KMW-05 and it is detected in MW-25; it will be monitored in KMW-05, KMW-03A, and CPOC well MW-25.
    - Arsenic concentrations are greater than its CUL in upgradient well KMW-05 and interior well KMW-03A, and it will be monitored in wells MW-12, MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27, MW-32, and MW-33. Note that MW-27 is not a CPOC well for arsenic.
    - *cis*-1,2-Dichloroethene (DCE) is in compliance in all wells, but is the precursor of vinyl chloride and will be monitored in all wells in which vinyl chloride is monitored.
- Groundwater has been monitored at the landfill since the late 1980s, with additional wells added along the downgradient edge during the RI. Today, the leachate/perched groundwater has neutral pH (6 to 8) and salinities that are typically between

background concentration and 3 times the background concentration, but less than the natural salinity of deeper groundwater in the Duwamish Valley Aquifer. Wells screened within refuse show moderately anaerobic groundwater with concentrations of dissolved oxygen at 0.37 to 0.56 milligrams per liter (mg/L; versus 9.0 mg/L for fully aerobic groundwater) and corresponding oxidation-reduction (redox) potential at -20.8 to -145.9 millivolts (mV). By the edge-of-refuse, the groundwater is already becoming less anaerobic than that beneath the landfill, with slightly greater concentrations of dissolved oxygen between 0.45 and 0.78 mg/L and redox potential at -6 to -123.6. These dissolved oxygen, specific conductivity, and pH conditions are consistent with the transition from late Stage 4 to Stage 5. Comparing upgradient and downgradient A-Zone groundwater concentrations for conventional indicators of leachate such as pH (average 6.6 to 6.7), specific conductance (average 703 to 733 µS/cm), alkalinity (average 240 versus 292 mg/L as calcium carbonate [$CaCO_3$]), and dissolved iron (average 11 versus 14 mg/L) showed very little difference consistent with minimal impact for leachate today. This is discussed in Section 5.6.6 of the RI/FS.

- The historical KIP swale outside the Edge of Refuse also had a unique groundwater signature due to the presence of the cement kiln dust fill. Groundwater from KMW-05 is highly alkaline, with a pH of approximately 13 between January 2011 and March 2014 and high concentrations of arsenic. Groundwater monitoring wells completed downgradient of this area have pH values between 7.4 and 7.8. The landfill compliance wells farther downgradient have returned to neutral pH, indicating that the alkalinity has been neutralized before the groundwater leaves the downgradient Edge of Refuse. Likewise, arsenic concentrations have decreased to less than natural background (5 µg/L as discussed in Section 5.6.2 and Table 5.9 of the RI/FS) by the downgradient Edge of Refuse.

These findings were used to develop the final CULs for a portion of the Site and to identify the preferred remedy for the Settlement Area (discussed in Sections 8.0 through 16.0 of the RI/FS).

4.0 Contaminated Media, Chemicals of Concern, and Cleanup Standards

The landfill has been investigated since the late 1990s because of the ongoing presence of low concentrations of LFG and groundwater contamination. For the 2014 Draft Final RI/FS, data from the various investigations at the Site were compiled to develop the list of contaminated media and COCs. This section provides a summary of these data.

4.1 SOIL CLEANUP LEVELS, POINT OF COMPLIANCE, AND COMPLIANCE REQUIREMENTS

4.1.1 Waste and Soil within the Landfill

The waste/fill at the site is presumed to be contaminated with one or more hazardous substances. Due to the heterogeneous nature of waste at municipal landfills and its planned containment within a closed landfill, the landfill contents were not fully characterized for specific hazardous substances during the RI, although leachate and groundwater were. Soil used as daily cover during operations and as fill during closure and post-closure activities is also considered part of the landfill contents and was not fully characterized. As with the refuse, the soil fill is presumed to contain one or more hazardous substances. The presence of the Landfill requires the placement of an environmental (restrictive) covenant on each parcel within the Settlement Area stating that the Landfill is present and incurring other obligations discussed in the FS.

In some areas within the Settlement Area, landscaping soils exist above the capped landfill contents; these areas include landscaped areas and ROWs. Landscaping soil within the Settlement Area above the landfill cap was tested and identified hazardous substances at concentrations typical for urban soils, below the MTCA Method C Industrial CULs.[4] The Environmental (Restrictive) Covenants will also state that the site is limited to Industrial uses.

Per MTCA requirements, a plan that relies on containment of landfill wastes and use of industrial soil CULs also requires that an Environmental Covenant (discussed in Section 6.2.7) be recorded against each of the Settlement Area's parcels.

4.1.2 Soil in the Former West Ditch

As discussed in Section 3.4, soils in the former West Ditch are part of the Settlement Area but are not contained within the landfill itself. Soils in the former West Ditch were sampled and characterized and were found to contain PAHs, PCBs, metals, petroleum hydrocarbons, and very low concentrations of two common pesticides. All concentrations were less than the MTCA Method C CULs for soil at industrial sites. Because none of the concentrations in soils currently exceed the MTCA Method C CULs for industrial sites, no remedial action is required for those soils under this CAP; however, the soils were solidified as part of the SPPD IA.

[4] MTCA Method A industrial CULs are being used for lead, total petroleum hydrocarbons, and PCBs, according to customary practice in Washington State.

4.2 GROUNDWATER CLEANUP LEVELS AND POINT OF COMPLIANCE

For groundwater, the point of compliance (POC) is the point or points where the groundwater CULs must be attained for the Site to be in compliance with the cleanup standards. The standard POC for groundwater under MTCA is throughout the Site from the uppermost level of the saturated zone extending vertically to the lowest most depth, which could potentially be affected by the Site. Where it is not practicable to meet the CUL throughout the Site within a reasonable restoration timeframe, Ecology may approve a CPOC. The CPOC will be as close as practicable to the source of hazardous substances, not to exceed the property boundary. Ecology has approved a CPOC for the Settlement Area at the downgradient edge of refuse.

Also, for landfills closed prior to modern landfill standards, MTCA (WAC 173-340-710(7)(c)) considers Minimal Functional Standards (MFS) to be relevant and appropriate requirements, and MFS (at WAC 173-304-100(58)) defines the groundwater POC as "that part of ground water that lies beneath the perimeter of a solid waste facilities' active area as that active area would exist at closure of the facility." This is commonly referred to as "edge-of-refuse." Groundwater beyond the MFS POC at the edge-of-refuse would also need to meet the CULs with respect to releases (current or historical) from the landfill. A MTCA CPOC for groundwater for the land within the Edge of Refuse is in the same location as a MFS POC. For this CAP, it will be referred to as a groundwater CPOC.

For the Settlement Area, the groundwater CPOC is the downgradient edge-of-refuse shown as the red dashed line in Figure 2.2. Compliance is monitored by a series of monitoring wells located as close as practical to this boundary. Unfortunately, SR 99 (West Marginal Way S.) was constructed in the 1960s over the downgradient edge of the landfill. This has limited the location of CPOC monitoring wells. In consultation with Ecology over the last decade, a series of compliance wells have been installed on the far and near sides of SR 99. These locations were deemed to be practical monitoring locations from which compliance at the CPOC (beneath the southbound lanes of SR 99) can be inferred.

Ecology has determined that maximum beneficial use of groundwater beneath and immediately downgradient of the Site is drinking water; therefore, the groundwater CULs are based on CULs for potable groundwater. MTCA Method A, B, or C, or maximum contaminant level (MCL) CULs were developed for all contaminants detected in groundwater; CULs for iron, manganese, and arsenic are based on background consistent with procedures in Section 709 of MTCA regulations.

Currently only vinyl chloride, iron, and manganese exceed their CULs at the CPOC. The chemical precursor of vinyl chloride, *cis*-1,2-DCE, will be monitored in all CPOC wells to aid in understanding future vinyl chloride concentrations, but has been in compliance for years and is not a COC.

Arsenic and benzene are elevated at the Site, upgradient of the Settlement Area and the Edge of Refuse on the KIP parcel, decrease as they move across the KIP parcel, and are currently in compliance at the CPOC wells for the Settlement Area. Benzene will be monitored in MW-25 (CPOC well), which is downgradient of where benzene is elevated. Arsenic will be monitored in

wells MW-12, MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27, MW-32, and MW-33. Note that MW-27 is not a CPOC well for arsenic.

Iron and manganese exceed the A-Zone background concentrations determined for the Settlement Area (27 mg/L and 2.1 mg/L, respectively). Manganese also exceeds the B-Zone background concentration determined for the Settlement Area (1.1 mg/L). Therefore, iron and manganese are also groundwater COCs that will be monitored at the CPOC. For the A-Zone background concentrations, site-specific data from upgradient wells were used. For the B-Zone background concentrations, data from other MTCA sites within the valley were used to estimate a background concentration. If more and/or better data become available in the future, the B-Zone background estimate may be updated.

Table 4.1 presents the site COCs, the CULs set for the Settlement Area, and their concentration range in the CPOC monitoring wells during the most recent monitoring event in March 2014.

Table 4.1
Chemicals and Their Groundwater Cleanup Levels

Chemical	Cleanup Level	Compliance Status in CPOC Monitoring Wells	Range in CPOC Monitoring Wells (March 2014)
Vinyl chloride	0.29 µg/L	Out of compliance	<0.02 to 0.99 µg/L
Iron (Total)	27 mg/L (A-Zone) 31 mg/L (B-Zone)	Out of compliance	A-Zone: 4 to 29 mg/L B-Zone: 21 to 33 mg/L
Manganese (Total)	2.2 mg/L (A-Zone) 2.2 mg/L (B-Zone)	Out of compliance	A-Zone: 0.15 to 2.9 mg/L B-Zone: 1.1 to 1.5 mg/L
cis-1,2-DCE	16 µg/L	No exceedances	<0.2 to 1.9 µg/L
Benzene	5.0 µg/L	No exceedances	<0.2 µg/L
Arsenic	5.0 µg/L (background)	No exceedances[1]	Dissolved: 0.2 to 0.9 µg/L Total: 0.3 to 0.7 µg/L

Note:

1 MW-27, a downgradient A-Zone well across SR 99 consistently has arsenic at concentrations greater than the CUL due to a cement kiln dust deposit that is across the street from the Settlement Area; this well is not a CPOC for arsenic. Arsenic concentrations at the CPOC upgradient of MW-27 are in compliance, as shown in Figure 5.13 of the RI. All other CPOC wells are in compliance for arsenic.

Abbreviations:

µg/L Micrograms per liter
mg/L Milligrams per liter

Vinyl chloride concentrations in the compliance wells range from not detected (at a detection limit of 0.02 µg/L) to 0.99 µg/L. In some locations the concentrations are greater than the MTCA Modified Method C CUL of 0.29 µg/L.[5]

Figure 4.1 shows the vinyl chloride concentrations at the Settlement Area for the most recent round of sampling. Green symbols for the wells indicate concentrations less than the CUL. Yellow symbols indicate concentrations greater than the CUL but less than the drinking water standard, and red symbols indicate concentrations greater than both. For those wells that have exceedances, trend plots are showing the trends over time for the wells.[6]

4.3 AIR CLEANUP LEVELS AND POINT OF COMPLIANCE

The facilities located within the Settlement Area boundary are industrial facilities. The appropriate CULs for air at the Settlement Area are the MTCA Method C industrial standards. The standard POC is ambient air throughout the Settlement Area. Application of these standards is complicated because ambient air measurements cannot distinguish between chemicals released from the landfill (for example as vapor intrusion facilitated by LFG migration) and chemicals being actively used at the operational facilities within the Settlement Area boundary. Therefore, soil vapor samples were collected. Based on a vapor intrusion analysis performed in accordance with Ecology's *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action* (Ecology 2016; originally published as a draft in 2009 and updated in 2016 to include toxicity factors.), as discussed in Section 6.5.3 of the RI/FS, vapor intrusion is not a pathway of concern for this Site.

4.4 LANDFILL GAS REQUIREMENTS

Methane, the primary constituent of LFG, is regulated under MTCA. Methane is also regulated as LFG in the regulations pertaining to landfills, and these regulations are relevant and appropriate requirements. LFG mitigation criteria under the MFS are defined in WAC 173-304-460 and King County Board of Health Title 10 regulations. The principal criteria relevant to the Settlement Area are the following:

- Methane concentrations in soil at the Edge of Refuse within the Settlement Area must not exceed 5 percent by volume, the lower explosive limit (LEL) for methane. This is traditionally measured in a network of LFG perimeter probes along the edge-of-refuse. Currently, methane concentrations in all of the LFG perimeter probes on the Settlement Area comply with this criterion.
- Methane concentrations inside buildings and structures within the Settlement Area must not exceed 1.25 percent by volume, or 25 percent of the LEL. These measurements are collected within the buildings. During the RI, all buildings at the landfill were in compliance based on the extent of monitoring done for the various

[5] Because vinyl chloride has a state and federal drinking water number, the MTCA Method B value is modified per Ecology's guidance (Ecology 2005).

[6] Trend plots begin when data for a well were first available; wells were installed at different times.

properties; however, ongoing monitoring of buildings that overlie the Landfill is included as part of long-term compliance monitoring for LFG (refer to Section 6.0).

- Methane concentrations inside buildings and structures located beyond the Settlement Area must not exceed 100 parts per million by volume (ppmv). During the RI, all buildings within 100 feet of the landfill were inspected and found to be free of methane. However, ongoing monitoring of buildings not within the Edge of Refuse is still required as part of long-term compliance monitoring (refer to Section 6.0) for any building that is within 100 feet of a perimeter LFG probe that exceeds 5 percent methane (by volume).

Figure 4.2 shows the most recent data for each of the perimeter probes. Extensive monitoring of the buildings occurred during the RI, and no methane was detected.

4.5 FINAL CHEMICALS OF CONCERN AND CLEANUP LEVELS

The final COCs exceeding a CUL at their CPOC and their associated CULs are summarized in Table 4.2.

Table 4.2
Contaminated Media, Chemicals of Concern, and Their Cleanup Requirements

Medium	Chemical of Concern Exceeding Cleanup Level	Cleanup Level (or Equivalent)	Point of Compliance	Restoration Timeframe
Waste and soil within the Settlement Area	Multiple hazardous substances based on heterogeneity of landfill refuse	MTCA Method A and C Industrial cleanup levels	Wastes and soil that are contained within the Landfill	In compliance as long as containment remedy meets requirements of this CAP
Landscaping soil above the contained area	None remaining after SPPD IA	MTCA Method C Industrial Cleanup Level	Soil, to 15 feet below ground surface, that is above the contained Landfill	In compliance
Groundwater	Vinyl chloride (refer to Table 4.1 for other COCs that are in compliance at the CPOC)	0.29 µg/L	Groundwater throughout the aquifer at and beyond the CPOC (edge-of-refuse)	Approximately 10 years based on existing trend data
Groundwater	Iron	27 mg/L (A-Zone) 31 mg/L (B-Zone)	Groundwater throughout the aquifer at and beyond the CPOC (edge-of-refuse)	Approximately 10 years based on landfill stage model
Groundwater	Manganese	2.1 mg/L (A-Zone) 1.1 mg/L (B-Zone)	Groundwater throughout the aquifer at and beyond the CPOC (edge-of-refuse)	Approximately 10 years based on landfill stage model
Groundwater	Arsenic	5 µg/L	Groundwater throughout the aquifer at and beyond the CPOC (edge-of-refuse)	Approximately 10 years based on existing trend data
Soil vapor	LFG (methane)	5 percent by volume	Vadose zone at and beyond the CPOC (edge-of-refuse)	Within 1 year after the completion of construction of the individual LFG systems
Indoor air	LFG (methane)	1.25 percent by volume	Throughout the buildings located above refuse (landfill footprint)	In compliance

Abbreviations:
µg/L Micrograms per liter
mg/L Milligrams per liter

5.0 Applicable or Relevant and Appropriate Requirements

According to WAC 173-340-360(2) and WAC 173-340-710, all cleanup actions under MTCA must comply with applicable state and federal laws and Ecology-identified relevant and appropriate requirements. "Applicable state and federal laws" include legally applicable requirements including those cleanup standards, standards of control and other environmental protection requirements, criteria or limitations adopted under state or federal law that specifically address a hazardous substance, cleanup action, location, or other circumstance at the Site. "Relevant and appropriate requirements" include those cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location or other circumstance at the Site, are considered by Ecology to address problems or situations similar enough to those encountered at the Site that their use would make common sense. These two types are referred to collectively as "applicable or relevant and appropriate requirements" or "ARARs." The remedial action must meet all Ecology-approved ARARs.

Table 5.1 lists the known ARARs for this cleanup action separated into three categories that apply to establishing CULs or conducting cleanup actions:

- Chemical-specific requirements are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. These were used during the RI/FS to establish the CULs presented in Section 4.0.
- Location-specific requirements are restrictions placed on the concentration of hazardous substances or on activities solely because they occur in special locations.
- Action-specific requirements are usually technology-based requirements or limitations on actions taken with respect to hazardous substances.

5.1 MINIMUM FUNCTIONAL STANDARDS FOR SOLID WASTE HANDLING

Because of the size of this particular landfill, the development that has already occurred on areas where waste is in place, and the apparent effectiveness of the current containment system, it was concluded that treatment or removal of the landfill is not practicable, and this option was eliminated early in the feasibility process. Because that is the case, as a starting point MTCA uses the closure requirements in in the MFS for Solid Waste Handling (WAC 173-304) as an ARAR for the selected cleanup action and then modifies them as needed to meet the MTCA cleanup requirements (WAC 173-340-710(7)(c), solid waste landfill closure requirements):

> *"For solid waste landfills, the solid waste closure requirements in WAC 173-304 shall be minimum requirements for cleanup actions conducted under this chapter. In addition, when the department determines that the closure requirements in WAC 173-351 or WAC 173-303 are legally applicable or relevant and appropriate*

requirements, the more stringent closure requirements under those laws shall also apply to cleanup actions conducted under this chapter."[7]

The requirements described in the MFS are designed to ensure that a landfill is closed in a manner that accomplishes the following:

- Minimizes the need for further maintenance.
- Controls, minimizes, or eliminates threats to human health and the environment from post-closure escape of municipal solid waste constituents, leachate, LFGs, and contaminated rainfall or waste decomposition products to the ground, groundwater, surface water, and the atmosphere.
- Prepares the site for the post-closure period, which must allow for continued facility maintenance and monitoring of air, land, and water as long as necessary for the facility to stabilize and protect human health and the environment.
- Implements LFG collection and treatment.
- Establishes institutional controls to supplement engineering controls.

5.2 OTHER LOCATION- AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Additional ARARs for the Site are identified in Table 5.1.

[7] Solid waste landfills operating after October 1991 are required to meet landfill requirements in WAC 173-351. Because the landfill within the Site was closed in 1966, none of the closure requirements in WAC 173-301, 173-304, or 173-351 are applicable requirements. However, as allowed by WAC 173-340-710(7)(c), Ecology used the soil waste closure requirements in WAC 173-304 as minimum requirements for the cleanup action.

6.0 Implementation of the Cleanup Action

This section describes the cleanup action for the Settlement Area developed in accordance with WAC 173-340-360 through 173-340-390. The cleanup action is based on the presumptive remedy for solid waste landfills, which is containment, and monitoring with possible contingent action for contaminated groundwater. It also includes provisions for inspection and maintenance of the landfill cover (cap), long-term monitoring at the Settlement Area, and institutional controls, including Environmental Covenants, and meets the MTCA cleanup action requirements for the Settlement Area portion of the Site.

6.1 USE OF THE PRESUMPTIVE REMEDY FOR LANDFILLS

Under MTCA, closed landfills are considered to be sites that have used "containment of hazardous substances" as the preferred remedy for meeting soil cleanup standards. Under WAC 173-340-740(6)(f), MTCA defines the expectation for containment sites as follows:

> *"WAC 173-340-740(6)(f) The department recognizes that, for those cleanup actions selected under this chapter that involve containment of hazardous substances, the soil cleanup levels will typically not be met at the points of compliance specified in (b) through (e) of this subsection. In these cases, the cleanup action may be determined to comply with cleanup standards, provided:*
>
> > *(i) The selected remedy is permanent to the maximum extent practicable using the procedures in WAC 173-340-360;*
> >
> > *(ii) The cleanup action is protective of human health. The department may require a site-specific human health risk assessment conforming to the requirements of this chapter to demonstrate that the cleanup action is protective of human health;*
> >
> > *(iii) The cleanup action is demonstrated to be protective of terrestrial ecological receptors under WAC 173-340-7490 through 173-340-7494;*
> >
> > *(iv) Institutional controls are put in place under WAC 173-340-440 that prohibit or limit activities that could interfere with the long-term integrity of the containment system;*
> >
> > *(v) Compliance monitoring under WAC 173-340-410 and periodic reviews under WAC 173-340-430 are designed to ensure the long-term integrity of the containment system; and*
> >
> > *(vi) The types, levels, and amount of hazardous substances remaining on-site and the measures that will be used to prevent migration and contact with those substances are specified in the draft cleanup action plan."*

As noted above, it has been concluded that treatment or removal of the landfill are not practicable alternatives. However, the specific remedy selected for the Settlement Area must demonstrate that the other elements of containment are met as defined by sections (ii) through (iv) above. The RI/FS focuses on screening alternative approaches consistent with the landfill

closure ARAR that would meet the requirements of containment under MTCA as described above—for example, determining site-specific alternatives for LFG controls that would comply with WAC 173-340-740(6)(f).

The basic requirements for landfill closure under MFS are as follows:

- Installation of a landfill cap, with associated grading and stormwater controls to eliminate direct contact with refuse, decrease leachate formation, and avoid contamination of stormwater by refuse.
- Installation of LFG controls as needed to control migration of LFG at unacceptable levels from the area of refuse.
- Installation of leachate controls as needed to prevent groundwater contamination from the refuse.
- Institutional controls to supplement engineering controls.
- Long-term monitoring of remedial systems for as long as the system is needed to meet CULs and containment goals.

The preferred alternative was developed as part of the FS, with consideration of multiple technologies and/or alternatives for each of the components required as part of landfill closure.

6.2 REQUIRED CLEANUP ACTION

MTCA defines specific requirements that must be met for a selected remedy to be protective of human health and the environment and identifies criteria that must be met by each alternative. In addition, the selection of other requirements that must be met to protect human health and the environment is guided by the MFS. The regulations also ensure that a landfill must continue with operation and maintenance of the selected remedy and the appropriate long-term monitoring to ensure that the remedy is effective.

This section states the components of the cleanup action for the Settlement Area. Additional rationale can be found in Sections 10.0 through 16.0 of the RI/FS.

6.2.1 Landfill Cap

The cleanup action requires a landfill cap covering all areas at the Settlement Area that contain solid waste. The primary goal of the landfill cap is to block access or exposure to the solid waste and soil; secondary goals are to limit stormwater infiltration and to facilitate the performance of the LFG systems. Minimum standards for the landfill cap and requirements for continued monitoring and maintenance of the cap are discussed below.

6.2.1.1 Minimum Standards for Landfill Cap

All areas of the Settlement Area must be covered by a landfill cap, which meets the minimum standards set out below. These requirements do not apply in areas that are covered by a structure. However, if redevelopment results in removal of a structure, then a landfill cap

meeting these minimum standards must be installed unless another structure covers the same footprint.

The minimum standards for a landfill cap are as follows:

- A minimum thickness of 12 inches of fill material will be placed over the solid waste. This fill material does not need to meet a low-permeability standard. Existing fill that meets this depth requirement will be considered acceptable. Imported fill must not introduce new contaminants and must be naturally occurring soil or rock (i.e., virgin material) from an established quarry. This material will not require testing prior to use at the Landfill; however, the quarry must provide testing results for the fill material that are current (i.e., within 2 years). If an alternative to these fill specifications is requested by a Subject PLP or a property owner, a variance request and justification must be submitted to Ecology for approval.
- Additional fill or fill of specific geotechnical specification must be placed in order to meet the structural section requirements of road and foundation base as required by the geotechnical engineer responsible for the pavement design.
- A 3-inch minimum thickness for asphaltic concrete or a 4-inch minimum thickness for cement concrete will cover the fill.
- Pavement sections that fail to meet the primary and secondary goals of a landfill cap must be replaced. For example, a pavement section that fails and develops large cracks, potholes, or settlement issues due to insufficient or incorrect pavement design (as opposed to routine maintenance needed due to age), must be replaced with an appropriate pavement section.
- Areas, such as landscaped buffers and slopes, perimeter landscaping including trees, planter islands, or gravel road shoulders, that will not be paved or receive hardscape (i.e., concrete), will require a soil layer with a minimum thickness of 24 inches and a distinct visible barrier between the new improvements and the top of the solid waste. The soil used as fill must not introduce new contaminants or contain contaminant concentrations exceeding MTCA industrial CULs.
- Stormwater conveyance and treatment facilities located above solid waste such as swales, ditches, or ponds on the Settlement Area are required to have cover, as prescribed by WAC 173-304-460, consisting of a low-permeability layer with a minimum 24-inch thickness of soil and permeability of 10^{-6} centimeters per second or less, or an impermeable geomembrane that is at least 50 millimeters thick.
- There are also requirements for construction practices that will provide protection for the workers and ensure that construction at the Settlement Area is conducted in a manner that will minimize potential exposure or release of contaminants to the environment. These practices are described in Section 9.4 of the RI/FS.

On the SRDS parcel, there is an existing area with large, established trees. The landfill cap requirements specified above are not intended to require removal of the trees. The requirement

associated with the trees is to ensure that the landscaping at the base of the trees blocks direct contact with refuse.

If a variance to the minimum standard requirements for a landfill cap is requested by a Subject PLP, then a variance request and justification must be submitted to Ecology for approval. Each proposed variance will be reviewed by Ecology to determine if the proposal will meet the goals of the landfill cap and MTCA regulations. As an example, the following variances have been approved for the SPPD parcel within the Settlement Area:

- The Seattle Department of Transportation's standard sidewalk section of 2 inches instead of 3 inches is acceptable in areas where the sidewalk will not be driven over. The sidewalks must be maintained to prevent direct contact with refuse.
- In areas with steep slopes, the use of a multilayer cap with a geomembrane instead of asphalt must be used. The designed and built layer must be stable and resistant to erosion; if erosion occurs, the area affected must be repaired.

6.2.1.2 Relationship with Requirements in Minimum Functional Standards

Although the minimum landfill cap requirements discussed above are protective of human health and the environment and meet the MTCA requirements, they are a variance to the specific cap design listed in the MFS. The proposed landfill cap does not consist of either 2 feet of low-permeability soil or a geomembrane layer and does not include a 6-inch-thick vegetative layer. As part of this CAP, Ecology is approving the variance from the closure methods set forth in WAC 173-304-460. This is allowed by MTCA in WAC 173-340-710(5), which allows for variances, or waivers, of provisions that are included in other applicable regulations. Allowing the asphaltic concrete cap to vary from the provisions of the MFS is appropriate at this Settlement Area for the following reasons:

- A low-permeability cap is not needed because the landfill is already in late Stage 4/early Stage 5, and infiltration of stormwater has been occurring for decades.
- The landfill is unlined and in direct contact with groundwater; therefore, blocking stormwater infiltration has no measureable impact on groundwater quality.
- The proposed landfill cap, supported by the OMMP and institutional controls that limit the uses of the landfill, will effectively prevent direct contact with wastes, improve the effectiveness of the LFG system, and reduce the amount of stormwater infiltration.

A more detailed rationale for the variance, or waiver, of provisions in the MFS for the landfill cap was approved by Ecology in October 2012 and is available in Appendix B of the IAWP for the SPPD parcel (Farallon 2013).

6.2.1.3 Allowance for Reinterment during Cleanup

Regrading, including excavation and reinternment of the solid waste, is allowed during the implementation of the cleanup action, as long as the final configuration does not expand the

footprint of the Landfill and all solid waste and contaminated soil remains contained beneath the landfill cap.

6.2.1.4 Implementation Schedule

Landfill cap requirements by parcel are presented in Figure 6.1. At present, the SPPD parcel is in compliance with the landfill cap requirements described above following its IA conducted in 2015. The SRDS is undergoing an IA that will bring the landfill cap into compliance with these requirements in the next 3 to 5 years.

6.2.2 Landfill Gas Controls

LFG controls at the Settlement Area must be sufficient to eliminate explosion hazards due to methane buildup and to demonstrate that LFG is not migrating off the Settlement Area in unacceptable concentrations (refer to Section 4.4 for LFG criteria). Section 6.0 of the RI/FS presents the nature and extent of LFG, including methane and VOCs. Measurements were collected in soil vapor probes and in ambient air in buildings. Monitoring of perimeter gas probes has shown that LFG is still present in some locations at concentrations greater than 5 percent methane but with no measurable pressure. Buildings were measured for methane in four events as part of the RI, and no methane was detected with a detection limit of 0.5 ppmv and an action level of 100 ppmv. Although documented conditions are protective in aboveground buildings, the continued slow generation of LFG requires ongoing monitoring and controls.

Indoor air in buildings that are closest to the LFG probes that had the greatest methane concentrations was monitored several times during the course of the RI, and no LFG intrusion was found.

LFG mitigation criteria under the MFS are defined in WAC 173-304-460 and King County Board of Health Title 10 regulations. The principal criteria relevant to the Settlement Area are the following:

- Methane concentrations in soil within the Settlement Area boundary must not exceed 5 percent by volume, the LEL for methane.
- Methane concentrations inside buildings and structures within the Settlement Area boundary must not exceed 1.25 percent by volume, or 25 percent of the LEL.
- Methane concentrations inside buildings and structures beyond the Settlement Area boundary must not exceed 100 ppmv.

Routine perimeter probe monitoring and building monitoring will be conducted in accordance with the OMMP to ensure the above criteria are met Settlement Area (perimeter probe network is shown in Figure 6.2). All occupied buildings within the Settlement Area will be required to have continuous methane detectors with alarms (i.e., operate 24 hours per day, 7 days per week); meters will be set to alarm at the 1.25 percent level.

The cleanup action for the Settlement Area is presented in the following sections by parcel.

6.2.2.1 SPPD Parcel and Adjacent 5th Avenue South

As part of the redevelopment and IA, SPPD installed an active LFG control system in 2014 and 2015. The system was designed and installed in conjunction with the landfill cap and cover requirements described above, and new buildings and utilities on the parcel will be constructed to be compatible with the LFG system. LFG had been detected along 5th Avenue South adjacent to the SPPD parcel. The LFG system at the SPPD parcel was designed to control LFG along the section of 5th Avenue South adjacent to the parcel. Since the system became fully operational in late 2015, the probes along 5th Avenue South have been in compliance. The system at SPPD will continue to be responsible for compliance along the adjacent section of 5th Avenue South. This system also influences the ROW associated with South Sullivan Street adjacent to this parcel. Continued operation of the LFG system is required under this CAP.

6.2.2.2 SRDS Parcel

The buildings that are currently on the parcel are either naturally ventilated or are elevated and skirted with porous siding; both are appropriate methods of LFG mitigation. As part of the IAWP, SRDS will install a LFG control system, intended to be operated as passive with an option to convert to active if necessary. The final design for the SRDS system was described in the Ecology-approved IAWP, dated July 2015. The system has been designed in conjunction with the landfill cap and cover requirements described in Section 6.2.1, and new buildings and utilities on the parcel will be constructed to be compatible with the proposed system. This system also influences the ROW associated with 5th Avenue South adjacent to this parcel. Continued operation of the LFG system is required under this CAP.

6.2.2.3 Public Roads and Right-of-Ways

LFG has not been identified at concentrations of concern in public roads and ROWs anywhere except for along 5th Avenue South in LFG probes GP-27 and GP-29. The LFG system installed at the SPPD parcel during its IA was designed to control LFG leaving the SPPD parcel and migrating into 5th Avenue South. Post-construction results of the IA indicate that both probes are now in compliance. The probes will continue to be monitored as part of long-term monitoring of LFG under this CAP. If exceedances occur in the future at these probes, the operation of the LFG system at the SPPD parcel will be adjusted to bring the probes back into compliance. If they occur, the out-of-compliance results and the adjustment of the LFG system would be reported to Ecology as part of the long-term compliance monitoring program discussed in Section 6.2.5 and presented in Appendix A, Attachment A.2.

6.2.3 Stormwater Controls

The stormwater controls at the Settlement Area are designed to capture the bulk of the stormwater before it can make contact with solid waste. Because the landfill extends into the water table, stormwater controls for the Settlement Area are not intended to limit infiltration; rather, stormwater controls for the Settlement Area are intended to prevent solid waste constituents from contaminating stormwater runoff. The stormwater controls are also intended

to minimize the potential for disturbances, erosion, scouring, or otherwise disturbing the landfill cap. The parcels within the Settlement Area are paved and have stormwater infrastructures that are consistent with the goal stated above. As part of the cleanup action detailed in this CAP, the systems described below will be operated and maintained:

- **SRDS Parcel.** This parcel is undergoing redevelopment and plans are not yet final. Final plans will be approved by Ecology before implementation and will take into account the goal of stormwater controls for the Settlement Area and will be designed not to interfere with the cleanup action. Currently, the redevelopment plans indicate that stormwater drainage will be collected across the SRDS parcel and will require flow and quality mitigation using a subsurface stormwater vault, anticipated to be located on the northern portion of the SRDS parcel under a parking area where the site is more open (i.e., not under buildings). Discharge from the stormwater vault is anticipated to drain to the northwest to the 30-inch-diameter storm pipe located in 2nd Avenue South. This system ties in to the storm drain system on SR 509 that flows into the wetlands on the west side of SR 509.

- **SPPD Parcel.** Stormwater capture on the SPPD parcel is achieved with a system of paved surfaces and catch basins, and conveyance via overland flow on paved surfaces and piping to detention and treatment in one of two SPPD property bioswales. A small proportion of SPPD parcel stormwater runoff (e.g., from the access driveway off 5th Avenue South) is outside the capture area of the bioswales and flows to catch basins in ROWs.

  The North and West bioswales discharge to a new 36-inch-diameter concrete storm drain line installed in the Occidental Avenue South ROW. The new storm drain line bypasses the private KIP storm drain line formerly used to convey stormwater flows from the SPPD property to a City drain line in South Kenyon Street. The new Occidental Avenue South storm drain line connects to the same City drain line in South Kenyon Street downstream of the inflow from KIP. The City drain line discharges into the wetland system west of SR 509, ultimately discharging to the Lower Duwamish Waterway.

  Past surface water control included construction of two bioswales: one in the northern portion of the SPPD parcel (North Bioswale), and the other in the northern portion of the former West Ditch (West Bioswale). As part of the construction of the West Bioswale and preparation of the subgrade for the bioswale and other redevelopment purposes, former West Ditch sediments were solidified by mixing in a Portland cement mixture. The low-permeability membrane cap system was installed along the eastern slope of the former West Ditch and keyed into the solidified material, effectively capping exposed solid waste in this area. Soil on the western side of the former West Ditch was covered with a distinct visible barrier that was overlain with a minimum of 18 inches of clean fill material or top soil. To minimize the effects to shallow groundwater flow from the solidified material, notches were cut into the top of the solidified mass and filled with drain rock, providing drainage to convey shallow groundwater from west to east across the top of the solidified mass. The

design and the basis for the design of the former West Ditch sediment solidification aspect of the surface water control component of the IA are presented in the IAWP.

6.2.4 Downgradient Groundwater Controls

The remedial action for groundwater is long-term groundwater monitoring with contingent action if triggers are met related to concentrations rising at the Settlement Area boundary in the future. The groundwater cleanup action uses monitoring and statistical analysis of well-by-well trend plots, as further described in the Groundwater Monitoring and Contingency Plan (Appendix A, Attachment A.3). This plan also contains the triggers for the contingent action. Long-term monitoring will confirm whether concentration trends remain stable or decrease further once cleanup actions are implemented (landfill cap and LFG extraction). Finally, measured concentrations in MW-30, a shallow, perched well, are less than Ecology's screening levels for vapor intrusion concerns, and so will not be addressed as part of the remedial action.

The only COCs greater than CULs for groundwater at the CPOC are vinyl chloride, iron, and manganese. Monitoring wells have been installed along the downgradient perimeter of the Settlement Area to monitor compliance at the CPOC for groundwater. There is no drinking water or water supply well downgradient of the Settlement Area, and the nearest point of exposure is 1,600 feet downgradient, where groundwater discharges to the Lower Duwamish Waterway.

Based on data collected from the RI/FS, residual vinyl chloride appears to be releasing very slowly from a silt lens in the upper sections of the aquifer. Based on existing trend plots, these concentrations are expected to come into compliance within 10 years of the completion of construction of cleanup elements at the Settlement Area.

Long-term groundwater monitoring will include vinyl chloride, iron and manganese, *cis*-1,2-DCE (the precursor for vinyl chloride) in wells where vinyl chloride is measured. Benzene will be monitored in well MW-25 to track a localized plume that appears to originate upgradient of the Settlement Area, and arsenic in wells MW-12, MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27, MW-32, and MW-33. Note that MW-27 is not a CPOC well for arsenic. The perimeter groundwater monitoring well network is shown in Figure 6.2.

6.2.4.1 Contingent Triggers and Actions Based on Vinyl Chloride

Two conditions that will trigger contingent actions will be monitored in the existing compliance monitoring well network:

- **Condition 1.** Condition 1 (the concentration trigger) is based on groundwater concentrations. In about half of the downgradient wells, the vinyl chloride concentrations exceed the CUL of 0.29 µg/L, with concentrations in one well (MW-25) fairly consistently between 0.7 and 1.4 µg/L. If concentrations in any downgradient well exceed 1.45 µg/L (5 times the CUL) for two consecutive sampling events, this constitutes Condition 1, and a contingent response is triggered. This trigger is not applied to MW-30 and MW-31, whose concentrations are affected by a non-landfill source in addition to the landfill.

- **Condition 2.** Condition 2 (the trend trigger) is based on the trend of groundwater concentrations over time in the monitoring wells. Condition 2 is reported using trend plots supported with simple statistical tools in ProUCL.[8] Condition 2 is designed to capture statistically meaningful increases in groundwater concentrations. The trend identification will use a well-established, non-parametric statistical method for trend analysis available in ProUCL called the Mann-Kendall method and will be applied to downgradient wells where the concentration of vinyl chloride is greater than the CUL. The trend analysis will include MW-31 (which is screened in the alluvial aquifer), but not MW-30 (which is screened in the Silt Overbank Deposit). The trend test will be performed at a 95 percent confidence interval.

If either or both of the trigger conditions occur, the following actions will be implemented:

1. Ecology will be notified within 30 days of data validation to report that a trigger condition has occurred.
2. Within 90 days of the notification, the Subject PLPs will submit a written evaluation that considers the following:
    a. Is the cause of the trigger event (source of the contamination) known?
    b. Does it likely represent a transient condition or a new condition?
    c. Do the data indicate that the most likely source is the Landfill?
    d. Does a focused exposure assessment indicate an exposure threat to human health or the environment?
    e. If the source is likely a parcel within the Settlement Area, what actions are appropriate at this time? Actions may include, but are not limited to, one or more of the following:
        i. Continued monitoring to confirm that it is a transitory effect. For example, construction that disturbs the Silt Overbank Deposit may cause a short-term increase that may be acceptable to Ecology as part of the construction project.
        ii. Modified sampling to understand the cause or source.
        iii. Changes in operations of LFG systems.
        iv. Changes in some site-related activity, if practicable.
        v. Additional investigation at the Site.
        vi. Confirmation that natural attenuation conditions are stable and favorable and possible implementation of in situ modification (such as the addition of a reducing agent or microbial enhancement), if needed.
        vii. Pump and/or treat if determined to be appropriate and effective.
        viii. Other technologies that are appropriate to the situation.

[8] ProUCL is currently approved by Ecology for use for this test. Other software may be used in the future but will require approval by Ecology.

f. If additional remedial action beyond the above actions is considered, it will be evaluated in a manner consistent with a focused FS under MTCA, leading to a proposed corrective action.

Ecology will review the evaluation and determine what action(s) the Subject PLPs will take based on the written evaluation. Following implementation of the contingent actions, Ecology will determine if the actions have addressed the risks or hazards precipitated by the trigger. If Ecology determines that the action(s) do not address them, Ecology may decide if the conditions constitute remedy failure such that Ecology may use a reopener to require more remedial action.

If an increasing trend is observed for MW-31, the following actions would be appropriate:

1. Ecology will be notified within 30 days of data validation to report that a trigger condition has occurred.
2. Because monitoring wells MW-25, MW-32, and MW-33 are between the Edge of Refuse and MW-31, if an increasing trend is observed in MW-31, the concentrations at these wells will be evaluated to determine if the source could be the within the Edge of Refuse or if it is another location. If concentrations in the compliance monitoring well network indicate that the probable source is within the Edge of Refuse, the Subject PLPs will proceed with the action in 2e above. If Ecology determines the data at the compliance monitoring well network indicate that the Landfill is not the cause of the increasing trend, it is Ecology's expectation that no additional action is required under this Consent Decree.

6.2.4.2 Contingent Triggers and Actions for Iron and Manganese

Iron and manganese are elevated to concentrations greater than background in several downgradient CPOC wells, as discussed in Section 4.2. Trend plots shown in Appendix J of the RI/FS indicate that concentrations are slowly decreasing and are expected to come into compliance within 10 years. As long as the concentrations are stable or decreasing, no further action is required beyond monitoring. Once a dataset of eight quarterly events has been collected for iron and manganese during long-term monitoring (Section 2.4 of the Groundwater Monitoring and Contingency Plan, Appendix A, Attachment A.3), Ecology may approve a decreased frequency of monitoring for iron and manganese. If the concentrations are increasing, the Subject PLPs will meet with Ecology to discuss next actions. Ecology will determine if further active remediation is needed and if this will require reopening the consent decree due to remedy failure.

6.2.4.3 Contingent Triggers and Actions for Arsenic

There are known cement kiln dust deposits upgradient of the Edge of Refuse on the KIP parcel, and downgradient of the Edge of Refuse east of 5th Avenue S. As long as the arsenic concentrations are stable or decreasing in the downgradient wells MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-32, and MW-33, no further action is required beyond monitoring. If arsenic remains in compliance for 2 years (eight additional quarters), arsenic analysis for the

Settlement Area would be terminated. If the concentrations are increasing, the Subject PLPs will meet with Ecology to discuss next actions. Ecology will determine if further active remediation is needed and if this will require reopening the consent decree due to remedy failure.

6.2.5 Operations, Maintenance, and Monitoring

To ensure that the selected components of the cleanup action are implemented efficiently and are operating properly, long-term operations, maintenance, and monitoring (OMM) of the various components must be implemented. An OMMP that outlines these specific requirements for long-term monitoring is included in Appendix A. The following is a summary of the OMM requirements for the affected media at the Settlement Area:

- **Landfill cap.** The landfill cap, consisting of pavement, buildings, and geomembrane/soil layers, as described in Section 6.2.1, must be maintained in such a manner as to prevent contact with the solid waste/soil beneath the cap, prevent "short-circuiting" of the LFG controls, and support the stormwater controls that avoid solid waste contamination of runoff. The landfill cap is not required to entirely block the infiltration of stormwater. The cap must be inspected annually, and these records must be maintained for Ecology inspection. If the cap is damaged or becomes worn, it must be repaired and the repairs must be reported in accordance with the Landfill Cap Inspection and Maintenance Plan (Appendix A, Attachment A.1).
- **Landfill gas.** Monitoring LFG collection systems serves two purposes: (1) performance monitoring within the system guides its operation, and (2) post-construction compliance monitoring (confirmational monitoring under MTCA) confirms that the system is controlling LFG emissions as required by the cleanup action. The long-term LFG monitoring requirements are described in the Landfill Gas Monitoring and Contingency Plan (Appendix A, Attachment A.2). Additional monitoring will be performed on a parcel-by-parcel basis because the LFG controls are parcel-dependent. The specifics for each parcel will be described in a parcel-specific LFG OMMP.
- **Groundwater.** Long-term groundwater monitoring is a fundamental component of both landfill closure requirements and MTCA. The long-term groundwater monitoring requirements are site-wide (not parcel-specific) and are described in the Groundwater Monitoring and Contingency Plan (Appendix A, Attachment A.3).

The plans referenced above make up the OMMP attachments and were prepared as individual stand-alone plans. The OMMP will also specify requirements for record keeping of inspections and repairs, and reporting.

6.2.6 Site Coordinator Responsibilities

A Landfill Site Coordinator will be designated to perform the long-term monitoring and reporting required under this CAP. The Site Coordinator will conduct the following work:

- Ongoing monitoring of LFG in perimeter probes as specified in the OMMP (Appendix A), including monitoring of off-site buildings if triggered by the results of the perimeter probe monitoring.
- Ongoing groundwater monitoring as specified in the OMMP (Appendix A).
- Annual inspections of the integrity of the landfill caps as specified in the OMMP.
- Annual inspections of surface water drainage effectiveness as specified in the OMMP.
- Creation and submittal of an annual report to Ecology of data/information related to the bullets above.
- Coordination and submittal of data required for Ecology 5-year site reviews.
- Informing Ecology of major OMM activities and incidents at the various parcels, as required in the OMMP, and acting as a central point of contact for field questions from Ecology, routing them to the appropriate person, as needed.

6.2.7 Environmental (Restrictive) Covenants

WAC 173-340-440 establishes that when the final remedy does not remove all contaminants from the property, appropriate institutional controls shall be established in an Environmental (Restrictive) Covenant on the property. The restrictive covenants shall run with the land and be binding on each owner's successors and assigns.

The proposed Environmental (Restrictive) Covenants for each parcel within the Settlement Area are attached as Appendix B and apply to the SRDS parcel and the SPPD parcel. As required by WAC 173-340-440(9), “the restrictive covenants shall:

(a) Prohibit activities on the site that may interfere with the cleanup action, operation and maintenance, monitoring, or other measures necessary to assure the integrity of the cleanup action and continued protection of human health and the environment.

(b) Prohibit activities that may result in the release of a hazardous substance that was contained as a part of the cleanup action.

(c) Require notice to the department of the owner's intent to convey any interest in the site.

(d) No conveyance of title, easement, lease, or other interest in the property shall be consummated by the property owner without adequate and complete provision for the continued operation, maintenance and monitoring of the cleanup action, and for continued compliance with this subsection.

(e) Require the landowner to restrict leases to uses and activities consistent with the restrictive covenant and notify all lessees of the restrictions on the use of the property.

(f) Require the owner to include in any instrument conveying any interest in any portion of the property, notice of the restrictive covenant under this section.

(g) Require notice and approval by the department of any proposal to use the site in a manner that is inconsistent with the restrictive covenant.

(h) Grant the department and other property owners the right to enter the property at reasonable times for the purpose of evaluating compliance with the cleanup action plan and other required plans, including the right to take samples, inspect any remedial actions taken at the site, and to inspect records."

The landfill extends under three roads in the area (Figure 6.3). Typically, the refuse was shallow in these locations and often indistinguishable from other fill sources (cement kiln dust, concrete, etc.) historically used for roads throughout the valley. Ecology will work with the Seattle Department of Transportation and the Washington State Department of Transportation under WAC 173-340-440(8)(b) to define a notification process that transmits requirements applicable to the ROWs, as captured in the Environmental (Restrictive) Covenants, to ROWs that do not fall under the traditional environmental covenant process. The schedule for completion is shown in Section 7.0.

As discussed in Section 6.0, control of LFG migration to the ROWs will be performed by the adjacent parcel.

6.3 COMPLIANCE WITH MODEL TOXICS CONTROL ACT REQUIREMENTS

MTCA cleanup standards for the Settlement Area portion of the Site are described in Section 4.0. This section describes how the cleanup action meets cleanup standards.

6.3.1 Requirements for Cleanup Actions (WAC 173-340-360(2))

The threshold criteria identified in WAC 173-340-360(2)(a) that must be met by the selected remedy and the reasons why the preferred alternative meets them, are as follows:

(a)(i) Protect human health and the environment

Landfill cap. The landfill cap described in Section 6.2.1 will prevent direct contact with solid waste by humans, plants, and animals. It will also ensure that stormwater that leaves the Settlement Area through the stormwater conveyance systems has not come into contact with solid waste.

By limiting infiltration of stormwater, the cap will also decrease the amount of leachate produced. As discussed in Section 6.2.3, because the landfill is unlined and the contents are already in contact with groundwater, this decrease in infiltrating stormwater is viewed as a minor benefit that may or may not produce measurable changes in groundwater quality.

Landfill gas controls. The LFG control described in Section 6.2.2 meets system requirements for preventing worker and visitor exposure to methane and carbon dioxide concentrations that pose a risk to human health. The concentrations in buildings adjacent to the Settlement Area are already at acceptable levels; therefore, LFG systems will be limited to the footprint of the Settlement Area. The LFG system will also collect any VOCs entrained in the LFG system to avoid the accumulation of VOCs in buildings (control vapor intrusion).

Stormwater controls. The stormwater controls described in Section 6.2.3 meet the MTCA requirements by effectively separating the stormwater from the landfill solid waste and contaminated soil. The captured stormwater will be conveyed and discharged off-site in accordance with the stormwater regulations and ordinances.

Groundwater monitoring. Long-term groundwater monitoring with contingent actions is an appropriate remedial action for groundwater because groundwater sampling data for the compliance monitoring well network indicate that vinyl chloride, iron, and manganese are the only remaining COCs detected at concentrations greater than CULs for groundwater, is very close to being in compliance, and is continuing to decrease toward compliant concentrations less than CULs. The most recent concentrations of vinyl chloride data collected from CPOC wells range from not detected at 0.02 to 0.99 µg/L. Ecology has established a CUL for vinyl chloride in groundwater of 0.29 µg/L. This value was selected to protect potential drinking water uses, but it is also protective of surface water quality. There are no current or anticipated drinking water wells between the Settlement Area and the Lower Duwamish Waterway, located approximately 1,600 feet downgradient.

Operations, maintenance, and monitoring. OMM requirements combined with the Environmental (Restrictive) Covenants will ensure that the cleanup action is maintained over time, is protective of human health and the environment, and meets the expectations in WAC 173-340-7491 for protection of terrestrial receptors.

(a)(ii) Comply with cleanup standards (WAC 173-340-700 through 173-340-760)

The containment remedy is an effective MTCA remedy for soil that complies with cleanup standards and allows solid waste within the closed landfill to be left in place as long as the requirements for a containment remedy are met. Groundwater concentrations will comply with the MTCA Method B CULs at the conditional POC for landfills at the edge-of-refuse. The groundwater concentrations of all the historical contaminants except for vinyl chloride, iron, and manganese are already in compliance at the CPOC. As described in Section 6.2.4, the downgradient groundwater will meet the cleanup standards within a reasonable timeframe (10 years for vinyl chloride, iron, and manganese) and will be monitored routinely to ensure that the groundwater is achieving the desired conditions within a reasonable restoration time. The LFG controls comply with the standards developed to prevent LFG levels greater than the permissible percentages of methane and carbon dioxide and any applicable cleanup standards. The LFG controls will also control VOC emissions from the Landfill.

(a)(iii) Comply with applicable state and federal laws (WAC 173-340-710)

The landfill cover specifications meet the alternative cap requirements for the landfill cap and cover allowed by WAC 173-340-710. The landfill cap, in conjunction with the recommended

stormwater infrastructure, ensures compliance with these requirements. The LFG control requirements apply to the specific landfill regulations as outlined in Section 11.0 of the RI/FS. The other components of the remedy are consistent with the applicable regulations.

(a)(iv) Provide for compliance monitoring (WAC 173-340-410 and WAC 173-340-720 through 173-340-750)

Compliance monitoring will be conducted for both LFG and groundwater, as described in Appendix A, Attachments A.2 and A.3.

WAC 173-340-360(2)(b) specifies three other criteria that cleanup actions must achieve. The following list describes how these criteria are met by the preferred alternative:

(b)(i) Use permanent solutions to the maximum extent practicable

The preferred remedy is permanent to the maximum extent practicable for a closed solid waste landfill containing large volumes of hazardous substances at low concentrations. OMM requirements, along with Environmental (Restrictive) Covenants, ensure that the containment remedy for soil and solid waste will remain protective over time.

(b)(ii) Provide for a reasonable restoration time frame

Cleanup actions combined with OMM requirements in this CAP will ensure protection of human health and the environment. The IA cleanup actions were completed at the SPPD parcel in 2015 and are expected to be completed at the SRDS parcel in the next 3 to 5 years. A schedule for implementation of the remedial action is presented in Section 7.0. Groundwater contaminant concentrations are expected to come into compliance within 10 years as residual vinyl chloride degrades and iron and manganese attenuate; there are no current or anticipated uses of or exposures to the groundwater.

(b)(iii) Consider public concerns (WAC 173-340-600)

Ecology provides the CAP and associated Consent Decree for public review and comment and responds to comments raised by the public. Ecology finalizes the CAP and Consent Decree after consideration of public input.

6.3.2 Requirements for Containment Systems (WAC 173-340-740(6)(f))

WAC 173-340-740(6)(f) includes specific requirements of a containment cleanup action that allow soil and solid waste with concentrations greater than the soil CULs to remain in place. These requirements are met by the preferred alternative in the following ways:

(f)(iv) Institutional controls are put in place

An Environmental (Restrictive) Covenant will be established for each parcel that overlies the Settlement Area to ensure that the requirements of the remedy, including OMM of the landfill cap, LFG control systems, and groundwater monitoring, are met.

(f)(v) Compliance monitoring (WAC 173-340-410) and periodic reviews (WAC 173-340-430) are designed to ensure long-term integrity of the containment system

The OMMP (Appendix A) provides details for OMM requirements to ensure that the cleanup action components are implemented efficiently and are functioning as intended. In addition, each parcel with a LFG system will have a LFG OMMP designed to ensure the long-term integrity of the system. OMM information will be compiled and reported to Ecology in a Settlement Area Annual Monitoring Report. Periodic review of the remedial action in accordance with WAC 173-340-420 will occur as detailed in the Consent Decree.

(f)(vi) Types, levels, and amount of hazardous substances remaining on-site and the measures that will be used to prevent migration and contact with those substances are specified in the CAP

The material remaining within the landfill is municipal solid waste containing low levels of hazardous substances. Containment of hazardous substances will be accomplished through the installation and maintenance of a landfill cap, as described in Section 6.2.1.

7.0 Implementation Schedule

Implementation of the remedial actions included in this CAP will occur over the next 10 years according to a parcel-by-parcel approach, as shown in Figure 7.1. The restoration timeframe for groundwater compliance is 10 years. Table 7.1 lists the milestones that have been identified, along with the schedule deadlines.

Table 7.1
Implementation Schedule

Item/Milestone	Timeframe
Construction and Operations of Remedial Components	
Remedial action construction at SPPD	Completed as IA in 2015.
Operation of LFG system at SPPD	Operations began as IA in 2015 and will continue until no longer needed per OMMP (Appendix A, Attachment A.2).
Remedial action construction at new SRDS (STSII)	To be performed as IA under the schedule in Agreed Order No. 6706.
Operation of LFG system at new SRDS (STSII)	Operations to begin as part of IA (expected between 2020 and 2022) and will continue until no longer needed per OMMP (Appendix A, Attachment A.2).
Installation of methane alarms in buildings	Part of remedial action; 180 days after the effective date of the Consent Decree for all existing buildings in the Settlement Area; or at time of occupancy for any future new buildings.
Long-Term Monitoring and Environmental (Restrictive) Covenants	
Long-term monitoring of LFG, groundwater, and landfill cap integrity	Part of OMMP; monitoring would begin 180 days after the effective date of the Consent Decree and will continue until no longer needed per OMMP (Appendix A).
Environmental (Restrictive) Covenants for SPPD and SRDS parcels	Filed with the County Recorder within 180 days after the effective date of the Consent Decree.
Alternate Environmental (Restrictive) Covenant for Seattle Department of Transportation and the Washington State Department of Transportation ROWs	Final draft available for Ecology review within 180 days after the effective date of the Consent Decree.

8.0 References

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Tables

Table 5.1
Applicable or Relevant and Appropriate Requirements

Potential Chemical-Specific ARARs[1]	Source[2,3]	Description and Relevance
National Ambient Air Quality Standards	40 CFR 50	Specifies primary and secondary National Ambient Air Quality Standards, National Emission Standards for Hazardous Air Pollutants, and performance standards for new and existing stationary sources. National Ambient Air Quality Standards are applicable to those elements of the Interim Action pertaining to the collection and management of LFG.
Federal Regulations Implementing the Toxic Substances Control Act (TSCA)	40 CFR 700—799, as applicable	Specifies testing, handling, and disposal requirements for materials contaminated with polychlorinated biphenyls (PCBs), dioxins/furans, etc. These regulations would apply to material generated during conduct of the Interim Action that is found to be contaminated with toxic substances regulated under TSCA.
State Dangerous Waste Regulations	WAC 173-303	Establishes regulatory requirements for the generation, handling, storage, transport, treatment, and disposal of dangerous wastes in the State of Washington under the provisions of the Washington State Hazardous Waste Management Act. These regulations apply to waste deemed dangerous or extremely hazardous to public health or the environment. The regulations would apply to material generated during conduct of the Interim Action that is found to be contaminated with dangerous waste, and requires treatment and disposal off-site.
Washington State Minimal Functional Standards for Landfills	WAC 173-304-460	This regulation applies to facilities that dispose of solid waste in landfills, with the exception of inert, demolition, and wood waste landfills. It specifies limits on methane concentrations at the property boundary and in on-site and off-site structures, and requires compliance with ambient air quality standards and emission standards at the property boundary. This regulation applies only to solid waste landfills that operated after 1985, but it is a minimum requirement for solid waste landfill cleanups.
Puget Sound Clean Air Agency (PSCAA) Notice of Construction	Regulation I	Requires a Notice of Construction and Application for Approval before constructing or modifying an air contaminant source. This would apply to the Interim Action due to potential emissions of LFG.
PSCAA Emission Standards for Toxic Air Pollutants	Regulation III	Implements at a regional level the National Emission Standards for Hazardous Air Pollutants (NESHAPS). It requires best available control technology for sources of toxic air contaminants; and requires that toxic air contaminants be quantified and compared against acceptable source impact levels for each contaminant. PSCAA Emission Standard for Toxic Air Pollutants are applicable to air emissions from the LFG collection system.
King County Board of Health Regulations	Title 10	The requirements established in this regulation meet or exceed the requirements established by the Washington State Minimum Functional Standards for Solid Waste Handling. Applicable chemical-specific requirements are the same as those described for the Minimal Functional Standards (see WAC 173-304-460 above).
Potential Location-Specific ARARs[1]	**Source[2,3]**	**Description and Relevance**
Federal Archaeological Resource Preservation	RCW 27-53	This law addresses the discovery, identification, excavation, and study of archaeological resources, and the communication of information to state and federal agencies regarding the possible impact of construction activities on Washington State archaeological resources.
State Permits for Archaeological Excavation and Removal	WAC 25-48	This establishes application and review procedures for the issuance of archaeological excavation and removal permits, for the issuance of civil penalties for violations.
Potential Action-Specific ARARs[1]	**Source[2,3]**	**Description and Relevance**
Monitoring and Maintenance		
Federal Occupational Safety and Health Standards	29 CFR 1910.120	This requires that employers develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program must be designed to identify, evaluate, and control safety and health hazards and to provide for emergency response for hazardous waste operations.
State Occupational Health Standards	WAC 296-62	This establishes rules designed to protect the health of employees and help to create a healthy workplace by establishing requirements to control health hazards. Requirements for chemical hazard communication programs, workplace lighting levels, and exposure records are in the core safety and health rules of this chapter.
Well Construction Standards	WAC 173-160, Part Two	Part Two of this regulation defines minimum standards for the construction and decommissioning of the water resource protection wells that will be installed as part of the groundwater monitoring program to be implemented as part of the cleanup action. Resource protection wells may not be used to withdraw or inject water for domestic, industrial, municipal, commercial, or agricultural purposes.

Table 5.1
Applicable or Relevant and Appropriate Requirements

Potential Action-Specific ARARs[1]	Source[2,3]	Description and Relevance
Monitoring and Maintenance (continued)		
Groundwater Monitoring Plan	WAC 173-304-490	This regulation addresses groundwater monitoring requirements for solid waste landfills including provision for a minimum of one upgradient and two downgradient monitoring wells. The monitoring plan must specify procedures for sample collection, preservation and shipment, laboratory analysis and associated quality control protocols, and health and safety. Although this requirement applies only to landfills that operated after 1985, these monitoring requirements will be incorporated into the long-term groundwater monitoring program that will be conducted as part of the cleanup action.
Excavation and Filling		
State Particulate Matter Standards	WAC 173-470	This establishes maximum acceptable levels for particulate matter in ambient air based on the criteria defining particulate matter that have been developed by the U.S. Environmental Protection Agency. This regulation establishes requirements for monitoring, measuring, and reporting particulate matter data. It applies to dust-producing activities during implementation of the cleanup action, particularly excavation and filling.
PSCAA Fugitive Dust Standards	Regulation I	This establishes emission standards for fugitive dust. Like the previous ARAR, this regulation applies to dust-producing activities during implementation of the cleanup action, particularly excavation and filling.
Treatment, Discharge, and Disposal		
NPDES Permit	WAC 173-220	This establishes a state individual permit program, applicable to the discharge of pollutants and other wastes and materials to the surface waters of Washington State, operating under state law. Permits issued under this chapter are designed to satisfy the requirements for discharge permits under both the Federal Water Pollution Control Act and Washington State Water Pollution Control Act. This requirement is applicable to the control, collection, management, and discharge of stormwater runoff during and after construction of the cleanup action.
State Waste Discharge General Permit Program	WAC 173-226	This establishes a state general permit program, applicable to the discharge of pollutants, wastes, and other materials to waters of the state, including discharges to municipal sewer systems. Permits issued under this regulation are designed to satisfy the requirements for discharge permits under the Federal Water Pollution Control Act and the Washington State Water Pollution Control Act. Although this permit is not required because of MTCA's permit exemption, it will be obtained for the drainage control systems to be constructed as part of the cleanup action because a NPDES permit is required and Ecology issues a combined NPDES/state waste discharge permit.
Industrial Waste Discharge to Metropolitan King County Sewer System	KCC 28.84.060	This establishes rules and regulations applicable to water pollution abatement activities, including the disposal of sewage into the metropolitan sewer system, whether delivered from within or from without the county. This also authorizes King County to develop and implement such procedures and to take any other actions necessary to ensure that local public sewers and private sewers discharging to or proposing to discharge into the metropolitan sewer system are constructed and developed in accordance with applicable laws, regulations, and plans. This regulation applies to implementation of the drainage control elements of the cleanup action.
State Minimum Functional Standards for Solid Waste Handling	WAC 173-304-460	This regulation applies to facilities that dispose of solid waste in landfills, with the exception of inert, demolition, and woodwaste landfills. The regulation establishes standards for landfill cover, surface water control, LFG collection, access control, and compliance monitoring.
King County Board of Health Regulations	Title 10	The requirements established in this regulation meet or exceed the requirements established by the Washington State Minimum Functional Standards for Solid Waste Handling (see above) and apply to the cleanup action for compliance monitoring programs and as performance standards for the design of control systems.
City of Seattle Review (in numerical order by SMC title and chapter)		
Street Use	SMC Title 15, as applicable	Requires a written permit for any proposed activities that use a City of Seattle street right-of-way, including construction activities and movement of equipment. Because the toe of the landfill extends into a City of Seattle right-of-way, it will be necessary to conduct work in the right-of-way to implement the cleanup action. City of Seattle review requirements apply to elements of the cleanup action.
Water Connection	SMC 21.04	This specifies an application and approval process for connecting to the City of Seattle water supply system. Water connection is potentially needed for dust control during grading.

Table 5.1
Applicable or Relevant and Appropriate Requirements

Potential Action-Specific ARARs[1]	Source[2,3]	Description and Relevance
City of Seattle Review (continued)		
Side Sewer Connection	SMC 21.16	This requires connection of all sources of polluted water with the nearest accessible sanitary sewer. Sewer connection will be needed for discharge of LFG condensate and possibly leachate.
Electrical Service Connection	SMC 21.49	This specifies an application and approval process for obtaining electrical service from Seattle City Light. Electrical service will be needed to power sump pumps for LFG condensate and blower motors for LFG control.
Building Codes	SMC Title 22, as applicable	This includes a number of requirements that apply to the cleanup action, including electrical, mechanical, fire, and energy codes, as well as regulations for grading, stormwater, drainage, and erosion control (see more detail below).
Stormwater, Drainage, and Erosion Control	SMC 22.802	This specifies a drainage control review and approval process for projects that involve land-disturbing activities or new or replaced impervious surface. The cleanup action will require a Drainage Control Plan and a Construction Stormwater Control Plan.
Grading	SMC 22.804	This specifies a process for application and approval of a grading permit for earth-moving activities. Grading must preserve natural drainage patterns and not create unstable slopes or contribute to increased turbidity or other forms of pollution in a watercourse.
Noise Control	SMC 25.08	This specifies maximum permissible noise levels for construction activities and facility operation in industrial zones, depending on the zoning designation of receiving properties.
Environmentally Critical Areas	SMC 25.09	This specifies development standards for actions affecting environmentally critical areas. Wetlands associated with drainage ditches were determined to not meet the City of Seattle's wetland definition.
City of Seattle Building Codes		
Methane Reduction Measures	SBC 1811.2	This specifies that all structures to be built within the 1,000-foot landfill zone need to be protected from potential methane migration. A licensed civil engineer will prepare and submit a report to the building official that will contain a description of the investigation and recommendations for preventing the accumulation of explosive concentrations of methane gas within or under enclosed portions of the building or structure.

Notes:

1 Because it is understood that MTCA is the overarching regulation governing all aspects of the cleanup action, it is not included in this table.
2 Pursuant to RCW Section 70.105D.090, potentially liable persons conducting a remedial action under an agreed order with Ecology are exempt from some state-administered procedural requirements and the procedural requirements of any local laws requiring or authorizing local government permits or approvals for the remedial action. However, the substantive requirements of state and local laws requiring permits or approvals shall be complied with.
3 Pursuant to WAC 173-340-710(9), the state agencies and local governments that have potential permits subject to the permit exemption have been consulted. The substantive requirements of the permits that are exempt, to the extent they are currently known, have been incorporated into this Cleanup Action Plan. Therefore, the substantive requirements of state and local laws subject to the permit exemption will be met during the cleanup action.

Abbreviations:

ARAR Applicable or relevant and appropriate requirement
CFR Code of Federal Regulations
Ecology Washington State Department of Ecology
KCC King County Code
LFG Landfill gas
MTCA Model Toxics Control Act
NPDES National Pollutant Discharge Elimination System
RCW Revised Code of Washington
SBC Seattle building code
SMC Seattle Municipal Code
WAC Washington Administrative Code

Table 6.1
Summary of Proposed Remedial Action by Parcel

Remedial Action Component	SPPD Parcel	SRDS (City of Seattle) Parcel	Right-of-Ways
Landfill Cap Installation and Maintenance	Interim Action specifications met the requirements; however, post-construction inspection indicated the presence of depressions in the paving where stormwater accumulated and erosion of one of the landscaped areas. This will be brought up to requirements as part of the final remedial action. Engineered cap consisting of: • A 12-inch minimum thickness of fill material placed over the solid waste to meet structural section requirements. • A 3-inch minimum thickness for asphaltic concrete or a 4-inch minimum thickness for cement concrete over the fill. Areas that will not be paved or receive hardscape will require: • A 24-inch minimum thickness soil layer. • A distinct visible barrier between the new improvements and the top of the solid waste. If redevelopment occurs that changes the existing building layout and pavement, then the new surface would need to be an engineered surface consistent with the requirements for the SPPD and SRDS parcels.	This parcel is undergoing Interim Action and redevelopment. The parcel will meet the requirements; details are presented in the IAWP and EDR. Post-construction confirmation will be included in the Construction Completion Report. Engineered cap consisting of: • A 12-inch minimum thickness of fill material placed over the solid waste to meet structural section requirements. • A 3-inch minimum thickness for asphaltic concrete or a 4-inch minimum thickness for cement concrete over the fill. Areas that will not be paved or receive hardscape will require: • A 24-inch minimum thickness soil layer. • A distinct visible barrier between the new improvements and the top of the solid waste. If redevelopment occurs that changes the existing building layout and pavement, then the new surface would need to be an engineered surface consistent with the requirements for the SPPD and SRDS parcels.	Annual monitoring and maintenance of the existing cap will be conducted to prevent direct contact with refuse. If redevelopment occurs that changes the existing building layout and pavement, then the new surface would need to be an engineered surface consistent with the requirements for the SPPD and SRDS parcels.
Landfill Cap Monitoring	Site-wide annual monitoring and reporting by the Subject PLPs to Ecology. Follow-up requirement for maintenance will be handled by the individual parcel owners.		
LFG Monitoring and Controls	Installation and operation of a combined active/passive LFG collection and treatment system. Monitoring will extend to the far side of 5th Avenue South. Existing and future buildings on the parcel will be monitored. Off-site monitoring of buildings along 5th Avenue South will be considered only if methane in perimeter probes persists at concentrations greater than the LEL and the supervising engineer concludes that methane cannot be effectively reduced by adjustments to the LFG control system.	Installation and operation of a LFG system designed to control off-site migration and protect all on-site structures in accordance with the MFS requirements. This system will be expected to protect not only the SRDS parcel but also the adjacent sections of 5th Avenue South. Monitoring of this system will extend to the SR 99 side of 5th Avenue South. Existing and future buildings on the parcel will be monitored. No off-site building monitoring is required.	LFG is located along 5th Avenue South only; monitoring and controls along 5th Avenue South are required as part of the SPPD and SRDS systems.
Stormwater Controls	Engineered stormwater collection and controls are designed to prevent direct contact between stormwater and refuse.	Engineered stormwater collection and controls are designed to prevent direct contact between stormwater and refuse.	The existing system provides adequate separation between solid waste and stormwater to prevent contamination of stormwater.
Stormwater Monitoring	Parcel-specific monitoring may be required consistent with NPDES permit requirements. The requirements are triggered by facility operations and not by the presence of the landfill.		
Groundwater Monitoring	Site-wide monitoring (including contingent actions related to groundwater contaminated by chemicals released from the landfill) and annual reporting by the Subject PLPs to Ecology.		

Table 6.1
Summary of Proposed Remedial Action by Parcel

Remedial Action Component	SPPD Parcel	SRDS (City of Seattle) Parcel	Right-of-Ways
OMMP	1. Establish an inspection and monitoring program to identify damaged or worn components of the landfill cap, stormwater system, and LFG systems and evaluate their potential to affect the remedial action. 2. Provide for timely repair and/or replacement of components. 3. Specify measures to minimize the potential for disturbances of solid waste, during routine use of the parcel, repair to subsurface structures (such as a utility line), and repairs to the remedial action components. 4. Specify requirements for record-keeping of inspections and repairs, and reporting.	1. Establish an inspection and monitoring program to identify damaged or worn components of the landfill cap, stormwater system, and LFG systems and evaluate their potential to affect the remedial action. 2. Provide for timely repair and/or replacement of components. 3. Specify measures to minimize the potential for disturbances of solid waste, during routine use of the parcel, repair to subsurface structures (such as a utility line), and repairs to the remedial action components. 4. Specify requirements for record-keeping of inspections and repairs, and reporting.	There is no OMMP for the roadways. Ongoing maintenance is addressed by the Environmental (Restrictive) Covenant that is being prepared jointly by the Seattle Department of Transportation and Ecology.
Environmental Covenants	Yes	Yes	No; the institutional controls will be addressed using an alternative to environmental (restrictive) covenants under WAC 173-340-440(8)(b).
Remedial Action Timeframe	Interim Action 2014	Interim Action or Final Action 2017	As detailed in the schedule, the alternative to environmental (restrictive) covenants are to be drafted for Ecology's review within 180 days after the effective date of the Consent Decree.

Abbreviations:

Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
IAWP	Interim Action Work Plan
LEL	Lower explosive limit
LFG	Landfill gas
MFS	Minimal Functional Standards for Solid Waste Handling (Chapter 173-304 WAC)
NPDES	National Pollutant Discharge Elimination System
OMMP	Operations, Maintenance, and Monitoring Plan
PLP	Potentially liable person
SPPD	South Park Property Development, LLC
SR	State Route
SRDS	South Recycling and Disposal Station
WAC	Washington Administrative Code

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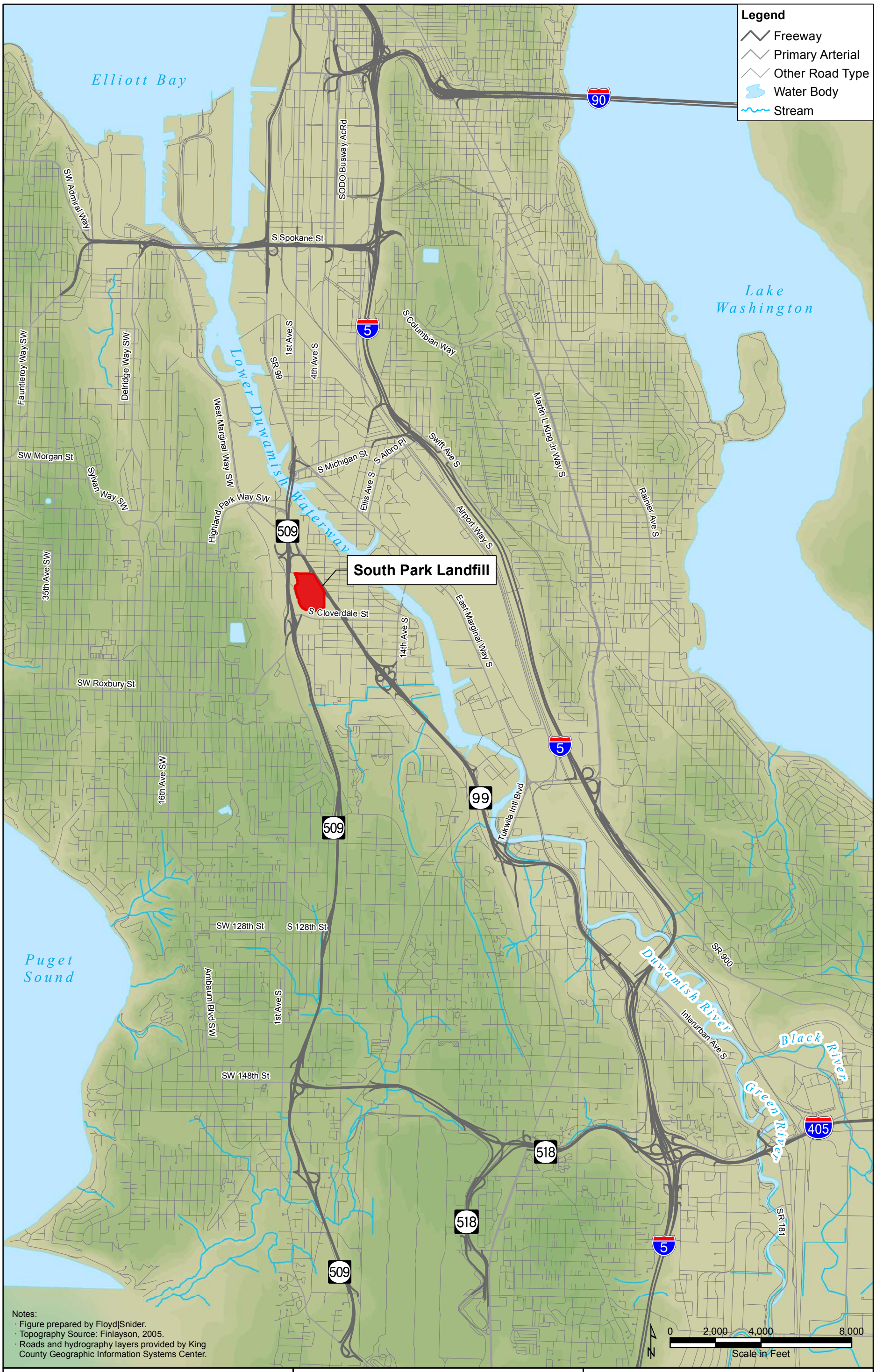
Figures



Notes:
- Figure prepared by Floyd|Snider.
- Topography Source: Finlayson, 2005.
- Roads and hydrography layers provided by King County Geographic Information Systems Center.

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Figure 2.1
Vicinity Map

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9/28/2017

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Seattle, Washington

Figure 2.2
South Park Landfill Site Parcel Map with Right-of-Ways

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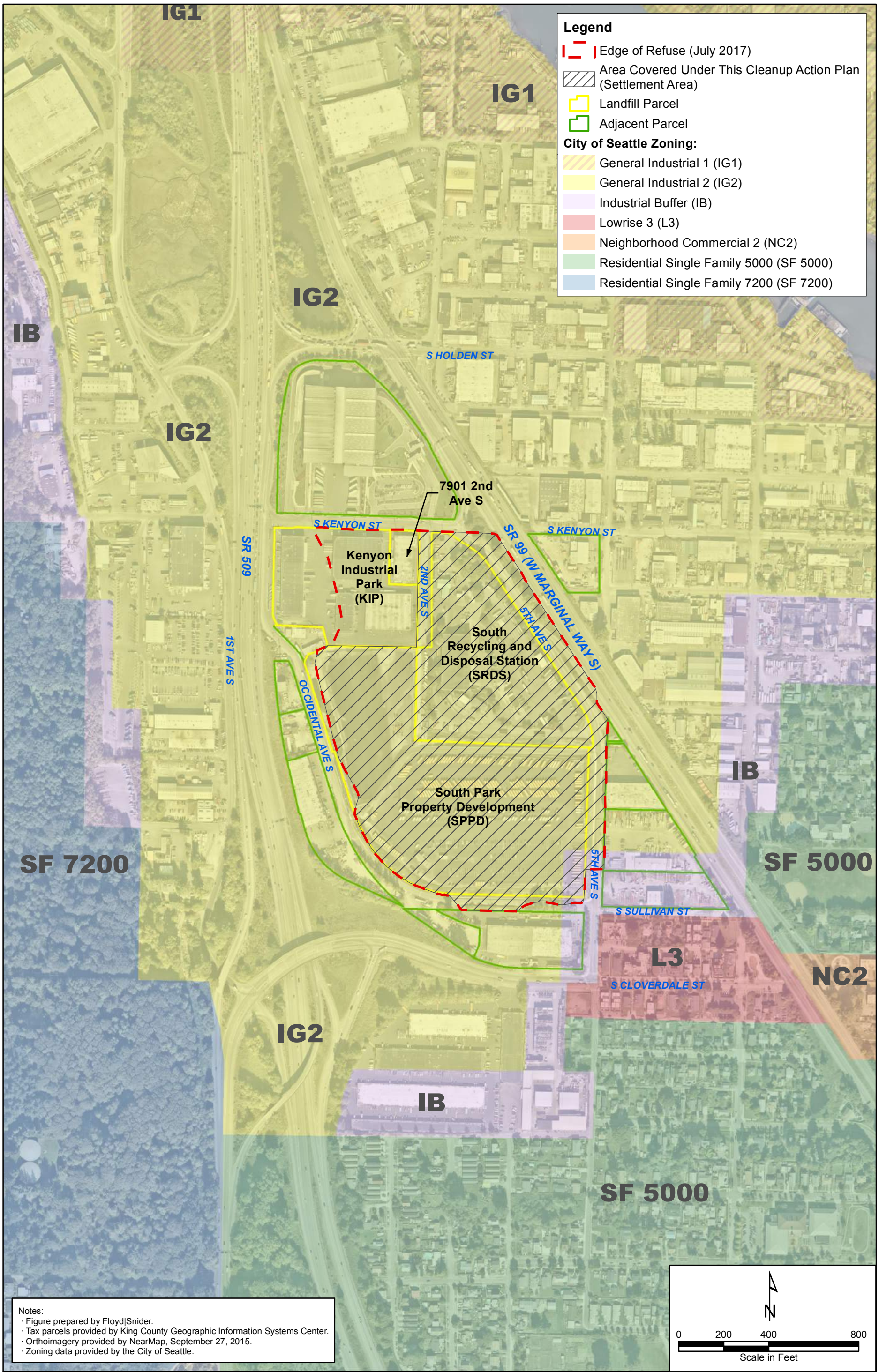
2/13/2018



Notes:
- Figure prepared by Floyd|Snider.
- Tax parcels provided by King County Geographic Information Systems Center.
- Orthoimagery provided by NearMap, September 27, 2015.
- Zoning data provided by the City of Seattle.

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Figure 2.3
Land Use and Zoning

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2/12/2018

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
Description	This stage occurs under aerobic conditions during placement of waste and for a period of days/weeks following. During this stage, H_2O and CO_2 are the main products. As wastes hydrolyze, the leachate becomes salty from the dissolution of major cations (sodium, potassium, calcium, and magnesium), chloride from food and other degradable waste, and carbonate from the CO_2. The leachate is neutral in pH and salty.	Stage 1 processes resulted in a depletion of O_2 in the waste and changed the waste to anaerobic conditions. Carbohydrates, proteins, and lipids are further decomposed to CO_2 , H_2, ammonia, and organic acids. Gas concentrations in the waste during Stage 2 may rise to levels of up to 80% CO_2 and 20% H_2. Organic acids that are produced at this stage make the leachate acidic, with acetic acid becoming one of the major constituents.	During this stage under anaerobic conditions, the H_2 and CO_2 levels begin to decrease. The low H_2 levels promote the methane-generating micro-organisms, the methanogens, which begin to generate methane and CO_2. The leachate continues to be salty and slightly acidic. The common solvents, PCE and TCE, which were relatively stable during the first two stages, now readily undergo reductive dechlorination to produce DCEs and vinyl chloride.	This stage is the main landfill gas (LFG) generation stage with the LFG typically composed of approximately 60% methane and 40% CO_2. The reactions during this stage are relatively slow, taking many years for completion. The conditions continue to be anaerobic as in Stages 2 and 3. Stage 4 typically commences 6 months to several years after the waste has been placed in the landfill depending on the water content and water circulation. Significant concentrations of LFG are generated after between 3 and 12 months, depending on the available micro-organisms and waste-degradation products. The LFG will continue to be generated for periods of between 15 and 30 years after final deposition of waste, but can continue to generate low levels of LFG for up to 100 years after waste placement. Early in this stage the majority of the easily degraded wastes, such as food, have been degraded. The salt content of the leachate decreases; the organic acids are consumed by micro-organisms as soon as they are produced to maintain the methane production and the leachate returns to neutral. Very little solvent (TCE and PCE) remains because it is degraded to DCEs as quickly as it comes into contact with the methanogenic microbes. The methanogenic microbes then convert the DCEs to vinyl chloride and vinyl chloride to non-toxic end-products. This conversion will continue past vinyl chloride as long as there is sufficient waste degradation occurring in the landfill mass to maintain methanogenic conditions.	This final stage of degradation occurs when the acids used in the production of methane and CO_2 have been depleted and the landfill returns to aerobic conditions.
Processes	Waste placement and burial Primary physical breakdown, hydrolysis, and aerobic degradation	Hydrolysis and fermentation	Acetogenesis	Methanogenesis	Oxidation
Leachate	Aerobic, salty	Organic acids, ammonia, anaerobic, pH begins to drop	Anaerobic, salty, pH acidic due to acetic acid	Anaerobic, slightly salty, near neutral pH	Aerobic, neutral pH
Landfill Gas	CO_2 & H_2O	H_2, CO_2, H_2O, & NH_3	H_2, CO_2, H_2O, NH_3, & CH_4	CH_4 & CO_2	CO_2

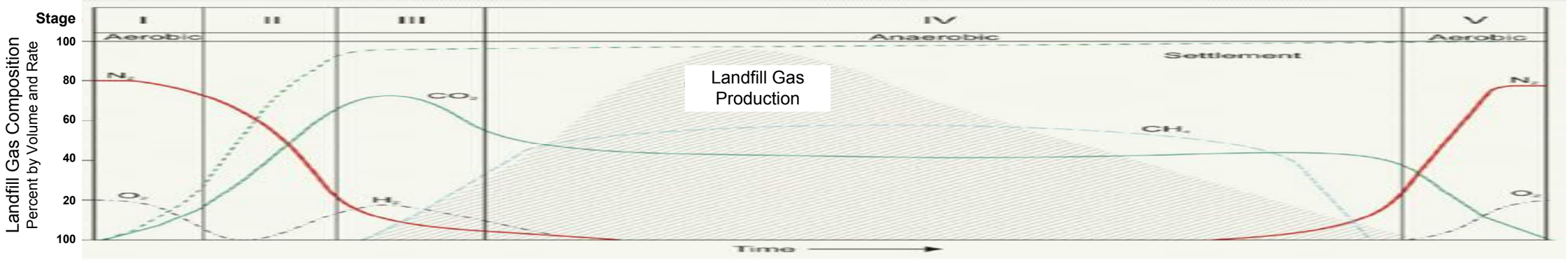

Figure: Changes in the Production and Composition of Landfill Gas with Time (based on Farquhar and Rovers 1973 with additions from Golder 2011).

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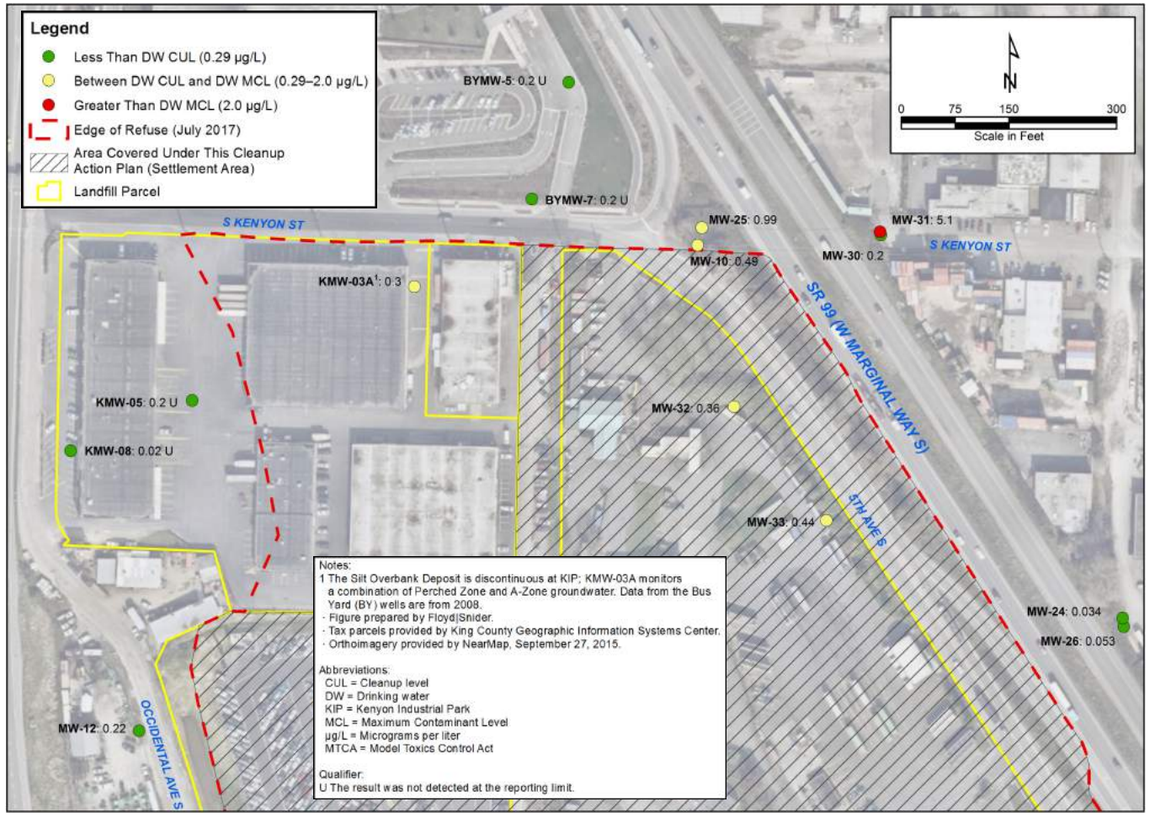
Figure 3.1
Changes in the Production and Composition of Landfill Gas with Time

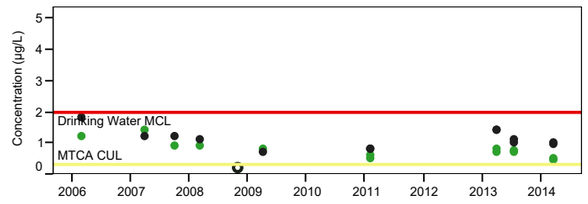


Interior Well

KMW-03A (Perched Zone and A-Zone)

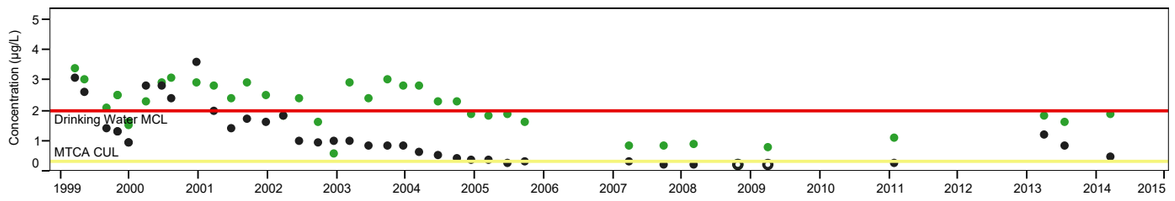
Point-of-Compliance Well

MW-25 (A-Zone)

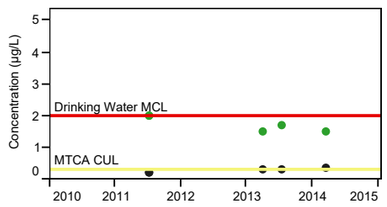


Point-of-Compliance Wells

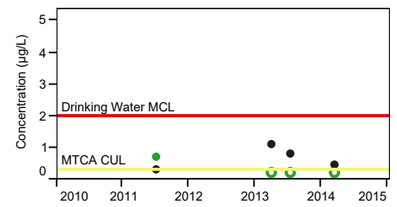
MW-10 (B-Zone)



MW-32 (A-Zone)

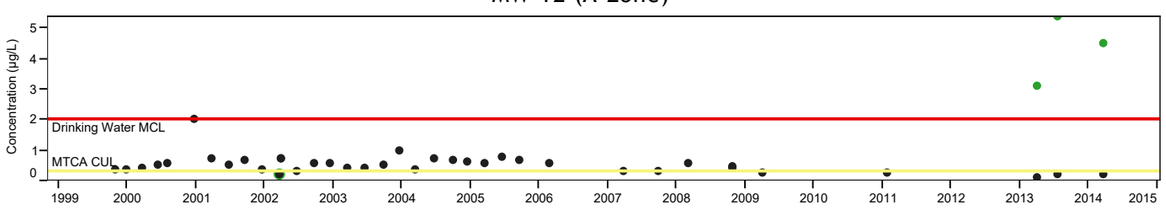


MW-33 (A-Zone)

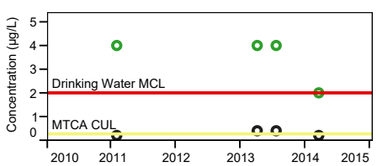


Upgradient Locations

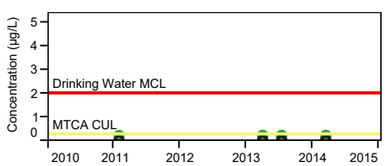
MW-12 (A-Zone)



KMW-05 (Perched Zone and A-Zone)

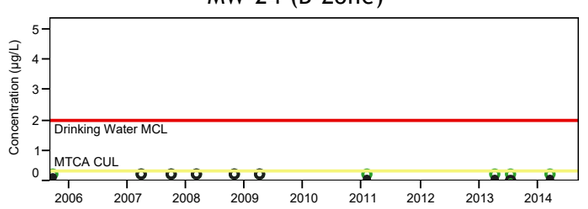


KMW-08 (Perched Zone and A-Zone)

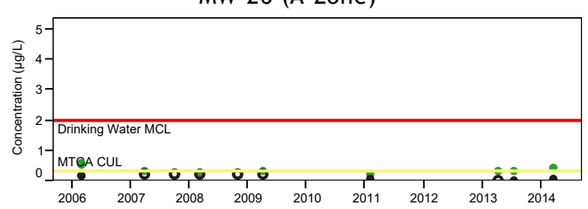


Downgradient Wells

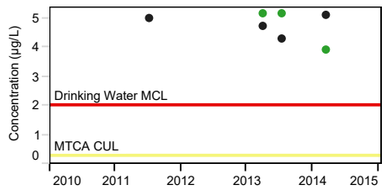
MW-24 (B-Zone)

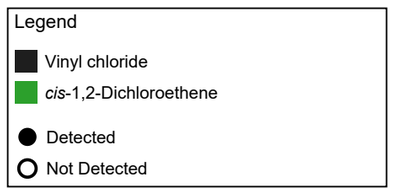


MW-26 (A-Zone)



MW-31 (A-Zone)





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Seattle, Washington

Figure 4.1
Vinyl Chloride in Groundwater—
March 2014

F:\projects\COS-SPARK\5000 - CAP\06 SPARK CAP Public Review Final\Figures\Figure 4.1 VC in GW.pdf
9/25/2017

Notes:
- Data for probes adjacent to SPPD represent post-Interim Action data. Other probes represent the conditions during the RI/FS sampling. The most recent data are shown.
- Tax parcels provided by King County Geographic Information Systems Center.
- Orthoimagery provided by NearMap, September 27, 2015.

Abbreviations:
LEL = Lower explosive limit
RI/FS = Remedial Investigation/Feasibility Study

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Figure 4.2
Perimeter Landfill Gas Probe Network

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2/12/2018

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State of Washington

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Seattle, Washington

Figure 6.1
Landfill Cap Requirements by Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\Figure 6.1 Landfill Cap Requirements by Parcel.mxd
3/9/2018

Notes:
- Figure prepared by Floyd|Snider.
- This figure is for information only. The figures in the attached OMMP, as modified over time by Washington State Department of Ecology, govern.
- Tax parcels provided by King County Geographic Information Systems Center.
- Orthoimagery provided by NearMap, September 27, 2015.

Abbreviation:
OMMP = Operation, Maintenance, and Monitoring Plan

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Cleanup Action Plan
South Park Landfill
Seattle, Washington

Figure 6.2
Locations of Long-Term Monitoring Wells and LFG Probes

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\Figure 6.2 Locations of Long-Term Monitoring Wells and LFP Probes.mxd
2/12/2018

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State of Washington

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Figure 6.3
Environmental Covenant Parcels

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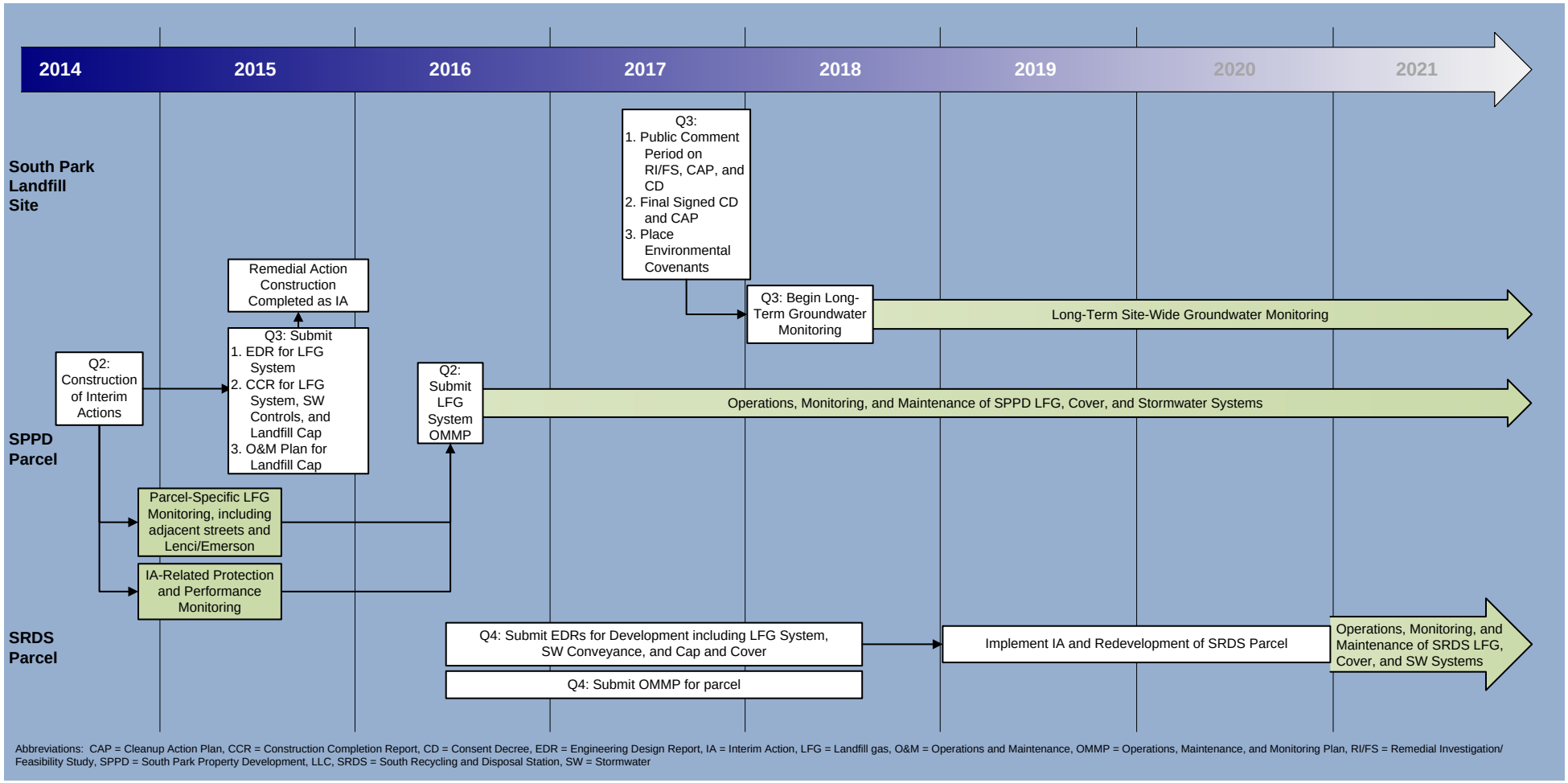
2/13/2018



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Cleanup Action Plan
South Park Landfill
Seattle, Washington

Figure 7.1
Development Process and Timeline

South Park Landfill

Final Cleanup Action Plan

Appendix A
Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Prepared for

City of Seattle
South Park Property Development, LLC

March 2018

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
CAP	Cleanup Action Plan
CIMP	Cap Inspection and Maintenance Plan
Ecology	Washington State Department of Ecology
GWMCP	Groundwater Monitoring and Contingency Plan
LFG	Landfill gas
LFGMCP	Landfill Gas Monitoring and Contingency Plan
MTCA	Model Toxics Control Act
OMM	Operations, maintenance, and monitoring
OMMP	Operations, Maintenance, and Monitoring Plan
PLP	Potentially liable person
SR	State Route
WAC	Washington Administrative Code

1.0 Introduction

This Landfill Post-Closure Operations, Maintenance, and Monitoring Plan (OMMP) is an appendix to, and an integral and enforceable part of, the Cleanup Action Plan (CAP) for the "Settlement Area," which is a portion of the South Park Landfill Site (discussed in Section 2.1). The South Park Landfill Site is a former municipal solid waste landfill in the South Park neighborhood of Seattle, Washington (Figure A.1). It is located in the Lower Duwamish Valley near the western valley wall between State Route (SR) 509 and SR 99. Details regarding the Settlement Area, environmental conditions, and specific components of the remedy are documented in the CAP.

This OMMP is composed of several plans that describe required components of the CAP in detail. These plans include the following:

- **Attachment A.1 – Landfill Cap Inspection and Maintenance Plan (Landfill CIMP):** This plan addresses the inspection and maintenance of the landfill cap, including pavement, roadways, surficial stormwater features, and vegetated areas.
- **Attachment A.2 – Landfill Gas Monitoring and Contingency Plan (LFGMCP):** This plan includes requirements for perimeter probe monitoring and building monitoring along with necessary contingencies necessary to document the effectiveness of the landfill gas (LFG) system(s) at the Settlement Area.
- **Attachment A.3 – Groundwater Monitoring and Contingency Plan (GWMCP):** This plan includes long-term groundwater monitoring requirements to evaluate the effectiveness of cleanup actions on groundwater quality for the Settlement Area and describes associated contingency actions.

An Annual Report Checklist is also provided, as Attachment A.4.

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2.0 Implementation of the OMMP

Because the Settlement Area contains two parcels with different owners and operating facilities, implementation of OMMP requirements may be performed parcel by parcel, and the potentially liable person (PLP) who has signed onto the Consent Decree (referred to as a "Subject PLP") who is also the owner of a parcel may work with the Washington State Department of Ecology (Ecology) on adjusting the OMMP requirements to address the needs of that parcel. The OMMP attachments set out in detail what is required for a parcel to meet the CAP requirements. While each Parcel Owner who is a Subject PLP may coordinate with Ecology to determine OMMP requirements needed for their parcel, it is the responsibility of all the Subject PLPs (collectively or individually) to ensure the requirements in the CAP and OMMP are met throughout the Settlement Area, regardless of ownership of a parcel. Ecology may institute legal or administrative action against the Subject PLPs for failure to meet the requirements of the Consent Decree, which includes a failure to implement any requirement of this OMMP. The Model Toxics Control Act (MTCA) establishes that the Subject PLPs are strictly, jointly, and severally liable for the remediation of the Settlement Area as detailed in the CAP.

2.1 SETTLEMENT AREA

The Settlement Area is detailed in the Consent Decree and includes: the South Park Property Development Parcel, the South Recycling and Disposal Station parcel, and certain adjacent right-of-ways.

2.2 PROJECT CONTACTS AND RESPONSIBILITIES

To accomplish the work to be performed under this OMMP in the most efficient manner, certain parties have elected to take the lead in performing various aspects of the work required. Language in this OMMP reflects this agreement. However, the Subject PLPs remain strictly, jointly, and severally liable for the performance of any and all obligations under this OMMP. In the event the party identified as a lead should fail to timely and properly complete performance of all or any portion of its work, the other party or parties must perform that remaining work, if any.

This section provides relevant contact information and associated responsibilities for individuals or groups of individuals who are leading long-term operations, maintenance, and monitoring (OMM) at their parcel. A list of current contacts and their contact information is provided in Table A.1. An updated copy of this table will be provided to Ecology by the Site Coordinator on an annual basis.

2.2.1 Parcel Owners

The Parcel Owner is responsible for filing an Environmental (Restrictive) Covenant on their property and for compliance with the Environmental (Restrictive) Covenant.

2.2.2 Subject Potentially Liable Persons

The PLPs who have signed onto the Consent Decree (referred to as "Subject PLPs") are responsible for compliance with the CAP including the OMMP, communications with Washington State Department of Ecology (Ecology), and for reporting of on-parcel activities.

Subject PLPs who are also Parcel Owners will be responsible for implementing the CAP requirements at the parcel for which they are the owner.

2.2.3 Site Coordinator

The Site Coordinator will be designated by the Subject PLPs to perform the long-term monitoring and reporting required under the CAP and this OMMP. The Site Coordinator will conduct the work as detailed in Section 6.2.6 of the CAP and includes carrying out the responsibilities specific to Attachments A.1 (Landfill CIMP), A.2 (LFGMCP), and A.3 (GWMCP) of this OMMP.

The Site Coordinator is responsible for compiling, reporting, and record retention for all OMM activities that are associated with the cleanup action in accordance with this OMMP.

2.3 OMMP UPDATES AND REVISIONS

This OMMP is an exhibit to, and an integral and enforceable part of, the Consent Decree. Any amendment of the OMMP is considered an amendment of the Consent Decree and must be approved as detailed in the Consent Decree, Section XV (Amendment of Decree).

The individual plans identify plan-specific aspects that may need to change or evolve over time, such as monitoring schedule and locations, analytical schedule, and the specific analytical methods. These changes are typically considered to be minor and can be approved by the Ecology project manager. Ecology will inform the Subject PLPs if any suggested change is considered a major amendment.

3.0 General Health and Safety Requirements

Worker health and safety measures will be implemented by all parties performing work outlined in this OMMP per Washington Administrative Code (WAC) 173-340-810, Worker Safety and Health, which provides general provisions and requirements for health and safety plans for work at MTCA sites. General provisions are based on requirements under the Occupational Safety and Health Act of 1970 and the Washington Industrial Safety and Health Act. General Occupational Health Standards for the State of Washington, as established in WAC 296-62, are applicable to work associated with OMM activities at the Landfill, and provide rules designed to protect the health of employees by establishing requirements to control health hazards.

Specific health and safety requirements are included in the individual plans, identified in Section 1.0 and included as attachments to this OMMP.

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4.0 Reporting and Record Keeping

Record keeping and annual reporting are the responsibility of the Site Coordinator and are a critical component of this OMMP. Contingency reporting responsibility depends on the contingency action that is triggered and is discussed in the individual plans. In general, contingency reporting may be done by the Site Coordinator, the Parcel Owner (who is a Subject PLP), the parcel operator (who is a Subject PLP), or a member of the Subject PLPs.

4.1 RECORD KEEPING

To document compliance with the OMMP and its individual plans, copies of all OMM records (for OMM not completed by the Site Coordinator) must be provided to the Site Coordinator within 60 days of completion of an OMM event. Specific documentation necessary for compliance with each individual plan are provided in the reporting and record keeping section of each plan and may include copies of field notes, monitoring forms, analytical reports, photographic documentation, and the like. All records, reports, documents, and underlying data relevant to the implementation of this OMMP shall be maintained by the Site Coordinator during the pendency of the Consent Decree and for a period of no less than 10 years after the date the Consent Decree is no longer in effect.

4.2 ANNUAL OPERATION, MAINTENANCE, AND MONITORING REPORT

Annual OMM Reports will be prepared and submitted to Ecology by March 31 of each calendar year to document OMM activities at the Settlement Area over the course of each previous calendar year. Unless otherwise directed by Ecology, the Consent Decree requires monthly progress reports of the remedial actions at the Settlement Area; that reporting is independent of the annual reporting required by this OMMP. The content of OMM Reports will include routine monitoring results from landfill cap annual inspections (per the Landfill CIMP, Attachment A.1), LFG collection system monitoring (per the LFGMCP, Attachment A.2), and groundwater monitoring (per the GWMCP, Attachment A.3). Documentation of non-routine subsurface work, such as construction or utility repair that results in exposure of material beneath the cap, will also be included if completed within the previous calendar year. The OMM Annual Reports will summarize OMM activities, data, and mitigation measures (if necessary), and will include, at a minimum, field forms, copies of analytical laboratory reports, updated trend plots for vinyl chloride, cis-1,2-dichloroethene, benzene, iron, manganese, and arsenic in groundwater, and groundwater contour maps.

The Site Coordinator is responsible for compiling the necessary site-wide OMM documentation and submittal of the OMM Annual Report. An Annual Report Checklist (included in Attachment A.4) should be completed and submitted with each Annual Report to facilitate preparation and to ensure that the minimum contents are included for each year.

4.3 CONTINGENCY REPORTING

Contingency actions for LFG and groundwater are included in the LFGMCP (Attachment A.2) and the GWMCP (Attachment A.3), respectively. There are additional reporting requirements associated with each of these plans that must be followed if a contingency action is implemented.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Tables

Table A.1
Contact List[1]
Last Updated: March 2018

Contact Title	Name	Affiliation	Mailing Address	Email Address	Primary Phone
Site Coordinator	To be determined				
Parcel Owner	Rob Howie	South Park Property Development, LLC	165 NE Juniper Street, Suite 100 Issaquah, WA 98027	rhowie@seaconllc.com	(425) 837-9720
Landfill Closure Program Manager	Jeff Neuner	City of Seattle	P.O. Box 34018 Seattle, WA 98124-4018	Jeff.Neuner@seattle.gov	(206) 684-7693

Note:
1 This list is to be reviewed and updated by the Site Coordinator (or other designee) as needed at a minimum on a yearly basis, or if there is a personnel change or change in contact information for any of the above contacts.

Table A.1
Contact List[1]
Last Updated: March 2018

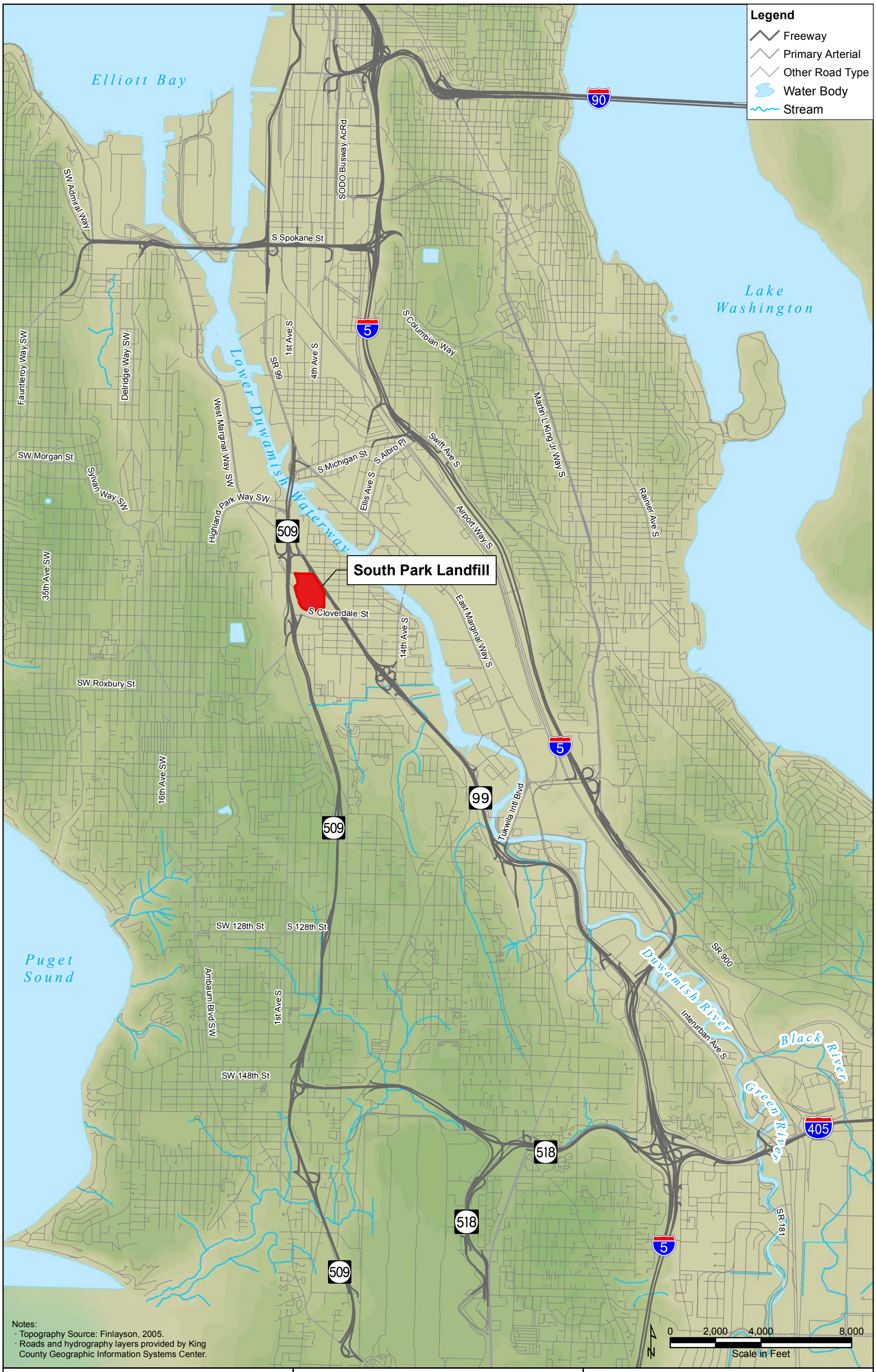
Contact Title	Name	Affiliation	Mailing Address	Email Address	Primary Phone
Site Coordinator					
Parcel Owner					

Note:
1 This list is to be reviewed and updated by the Site Coordinator (or other designee) as needed at a minimum on a yearly basis, or if there is a personnel change or change in contact information for any of the above contacts.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Figures



Notes:
· Topography Source: Finlayson, 2005.
· Roads and hydrography layers provided by King County Geographic Information Systems Center.

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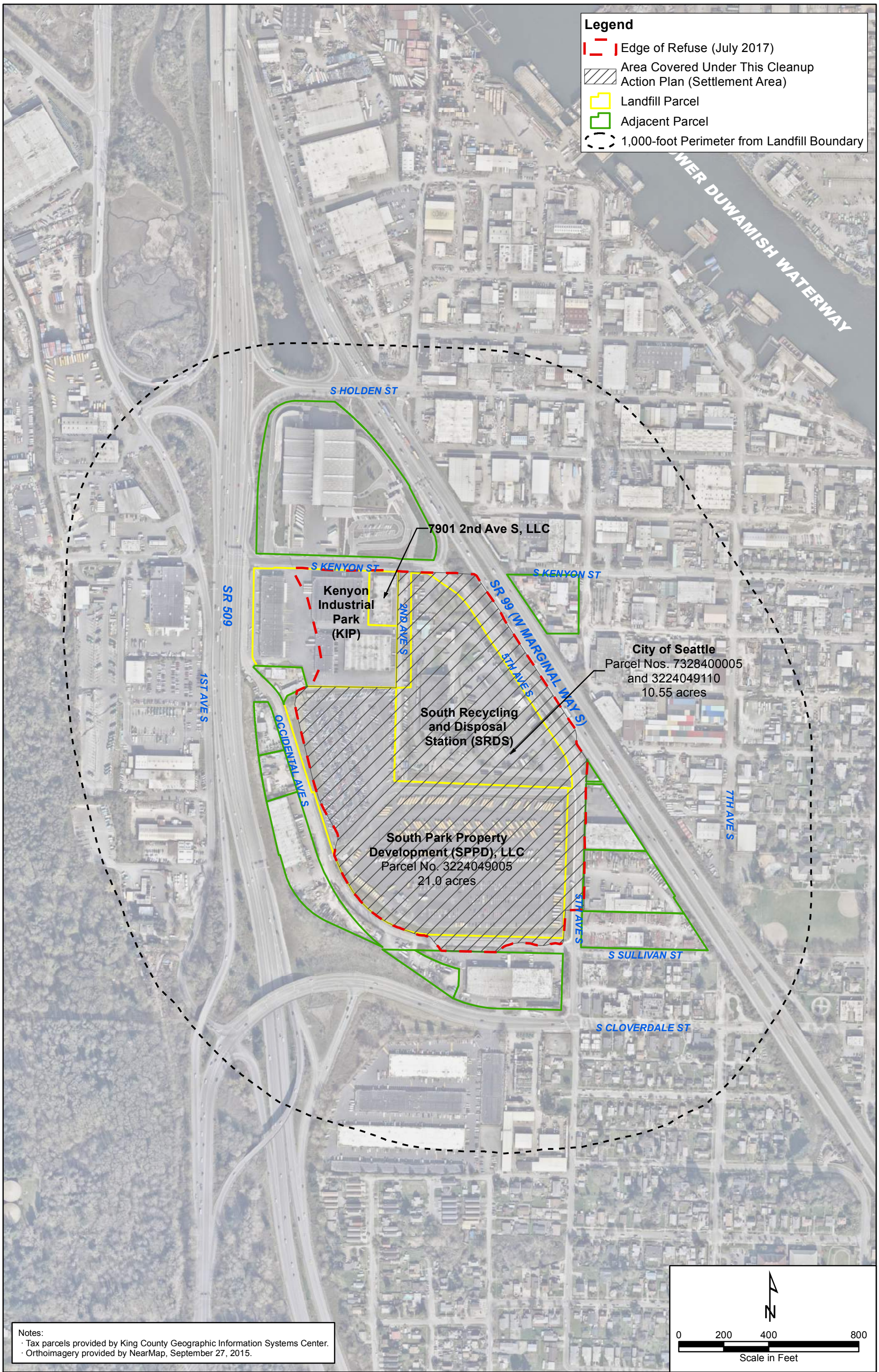
Figure A.1
Site Vicinity Map

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP\OMMP\Figure A.1 Site Vicinity Map.mxd
9/28/2017



Notes:
· Tax parcels provided by King County Geographic Information Systems Center.
· Orthoimagery provided by NearMap, September 27, 2015.

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Figure A.2
Site Plan and Parcel Map

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\Figure A.2 Site Plan and Parcel Map.mxd
2/12/2018

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.1
Landfill Cap Inspection and Maintenance Plan

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
CAP	Cleanup Action Plan
CIMP	Cap Inspection and Maintenance Plan
City	City of Seattle
Ecology	Washington State Department of Ecology
IA	Interim Action
IAWP	Interim Action Work Plan
LFG	Landfill gas
OMM	Operations, Maintenance, and Monitoring
OMMP	Operations, Maintenance, and Monitoring Plan
PPE	Personal protective equipment
PLP	Potentially liable person
ROW	Right-of-way
SPPD	South Park Property Development
SR	State Route
SRDS	South Recycling and Disposal Station

1.0 Introduction

This Landfill Cap Inspection and Maintenance Plan (CIMP) is an attachment to the Landfill Post-Closure Operations, Maintenance, and Monitoring Plan (OMMP), which is an appendix to, and integral and enforceable part of, the Cleanup Action Plan (CAP) for the Settlement Area portion of the South Park Landfill Site. The South Park Landfill Site is a former municipal solid waste landfill in the South Park neighborhood of Seattle, Washington (Figure A.1 of the OMMP). It is located in the Lower Duwamish Valley near the western valley wall between State Route (SR) 509 and SR 99. Details regarding the Settlement Area, environmental conditions, and specific components of the remedy are documented in the CAP.

The monitoring and maintenance requirements for the landfill cap are provided in this Landfill CIMP. The Landfill CIMP implementation will begin 180 days after the effective date of the Consent Decree in accordance with the schedule in the CAP.

The purpose of this Landfill CIMP is to confirm that the landfill cap remedy is performing in a manner that protects human health and the environment. The landfill cap consists of pavement, buildings, and geomembrane/soil layers and must be maintained in such a manner to prevent contact with the solid waste/soil beneath the cap, prevent "short-circuiting" of the landfill gas (LFG) controls, and prevent interference with the stormwater controls; the cap is not required to entirely block the infiltration of stormwater. The cap must be inspected annually, and it must be repaired if it is damaged or becomes worn.

Environmental (Restrictive) Covenants on the individual parcels allow continued access for the Washington State Department of Ecology (Ecology) and the Subject potentially liable persons (PLPs) to inspect the remedy, as well as restrictions on future changes which may disturb the landfill cap. Because the Settlement Area consists of two parcels with different owners and operating industrial facilities, the primary responsibility for maintenance of the landfill cap is with the Parcel Owner who is also a PLP who has signed onto the Consent Decree (referred to as a "Subject PLP").

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2.0 Landfill Parcels and Coordination

The landfill cap is a low permeability surface (i.e., asphalt and concrete) that is present at the Settlement Area above areas containing solid waste. The landfill cap prevents direct contact with solid waste by humans, plants, and animals. The limits of the cap are consistent with the landfill boundary and the extent of solid waste at the landfill, as shown as the red dashed line on Figure A.1.1, with parcel-specific details shown in Figures A.1.1a through A.1.1.c. A summary of the parcels and right-of-ways (ROWs) that make up the Settlement Area are included below:

- **South Park Property Development (SPPD) Parcel.** This parcel includes 21.0 acres of land and a single small office building. In 2014 and 2015, SPPD performed an Interim Action (IA) for cleanup at the parcel per the 2013 Ecology-approved Interim Action Work Plan (IAWP) under Amendment No. 1 of Agreed Order No. DE 6706 for the Site (Farallon 2013). The IA was performed simultaneously with the redevelopment of the property. The property redevelopment includes a modular building for employees and paved parking for employees and visitors. The IA work included regrading and capping the landfill surface, installing and operating a LFG control system, and implementing institutional controls.
- **South Recycling and Disposal Station (SRDS) parcel.**[1] The SRDS parcel is defined by King County tax parcel 7328400005, encompassing 10.55 acres. Two additional strips of land, 60 feet wide on the west of the SRDS parcel and 30 feet wide on the south, were incorporated into the property in 2003 by the City of Seattle (the City) Ordinance 121306. This additional land is in the process of being recorded by King County and brings the site area to approximately 11 acres. Until 2016, the parcel served as one of the City's solid waste transfer station. That use has now ceased. Under Amendment No. 2 of Agreed Order No. DE 6706, an IA will take place on this property as detailed in the 2015 Ecology-approved IAWP (Herrera and Aspect 2015). The IA includes installation of asphalt, concrete, or membrane caps, and LFG and surface water controls; implementation of institutional controls; and compliance monitoring.
- **Transportation Corridors.** The landfill is surrounded by City streets and State highways. The Settlement Area extends beneath sections of the following roads and/or ROWs, as shown in Figure A.1.1:
    - 5th Avenue South, where the landfill is present, has complex ownership as shown on Figure 2.2 of the CAP.

[1] The City's landfill parcel is known as the SRDS in this CAP, to be consistent with other landfill-related documents. It is called the South Transfer Station Phase II in other City documents, as it is being redeveloped to provide services that complement the new South Transfer Station across the street.

- The section adjacent to the City's SRDS parcel is deeded by quitclaim deed (King County Record No. 9012260159 dated December 14, 1990, Blocks 6, 7, 17, & 18 of plat – 1st Add to River Park, Vol. 8, p. 65) to the City from the State, as a turn back ROW of SR 99. The quitclaim deed conveys all right, title, and interest for road purposes only.
- On the section adjacent to the SPPD parcel, the western 20-foot-wide strip is held by the City through accepted deeds from King County, for street and general corporate purposes under Ordinance 96099; while the western 30-foot-wide strip is held as easement by the City (through the original platting).

o South Sullivan Street, where the landfill is present, was accepted under Ordinance 96099, for street and general corporate purposes by the City.

o Southbound lanes of SR 99 (West Marginal Way S.) were originally part of US Route 99 (1926 to 1972) and part of Primary State Highway 1 (1937 to 1964), then became SR 99 in 1972. The landfill extends to the near edge of pavement of the southbound lanes (i.e., under the right shoulder of the southbound lanes).

2.1 COORDINATION AND RESPONSIBILITIES

To accomplish the work to be performed under this CIMP in the most efficient manner, certain parties have elected to take the lead in performing various aspects of the work required. Language in this CIMP reflects this agreement. However, the PLPs who signed the Consent Decree remain strictly, jointly, and severally liable for the performance of any and all obligations under this CIMP. In the event the party identified as a lead should fail to timely and properly complete performance of all or any portion of its work, the other party or parties must perform that remaining work, if any.

The following sections define the roles required for compliance with this Landfill CIMP; one person may perform more than one role.

2.1.1 Parcel Owners

The Parcel Owners own the parcels and are responsible for filing an Environmental (Restrictive) Covenant and then compliance with their parcel's Environmental (Restrictive) Covenant, which includes inspection and maintenance of the landfill cap. As regards activities in this CIMP, the Parcel Owner, who is also a Subject PLP, is expected to perform the following:

- Perform on-going inspection and maintenance of the pavement, soil caps, and geomembranes that cover the landfill surface consistent with this plan, with the exception of the annual inspection and reporting performed by the Site Coordinator. For Parcels that do not meet the requirements in Section 6.2.1.1 of the CAP, the parcel owner will perform quarterly inspections of the landfill cap and report the results to the Site Coordinator.

- Submit information on repairs per Section 4.3 to the Site Coordinator for their annual reporting to Ecology.
- Grant access, as needed, for cap inspection by the Site Coordinator and/or Ecology.

2.1.2 Subject Potentially Liable Persons

The Subject PLPs are responsible for compliance with the CAP including the OMMP, communications with Washington State Department of Ecology (Ecology), and for reporting of on-parcel activities. The Subject PLPs are responsible for annual inspection and reporting to Ecology, through the Site Coordinator. In addition, in the event that Ecology becomes aware that a Parcel Owner who is not a Subject PLP is unable to maintain the cap on their parcel, Ecology shall provide written notice to the Subject PLPs that the Parcel Owner is unable to complete the work. Upon the receipt of such notice, the Subject PLPs will repair the parcel's cap to meet minimum standards consistent with Section 6.2.1 of the CAP.

2.1.3 Site Coordinator

The Site Coordinator is responsible for site-wide monitoring, including the annual Settlement Area-wide cap inspections, and for annual reporting. Additional clarification of his or her duties exists in the CAP, OMMP, and in later sections of this Landfill CIMP.

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3.0 Description of Landfill Cap Requirements

The cleanup action requires a landfill cap covering all areas at the Settlement Area that contain solid waste. The primary goal of the landfill cap is to block access or exposure to the solid waste and soil; secondary goals are to limit stormwater infiltration and to facilitate the performance of the LFG systems. Minimum standards for the landfill cap and requirements for continued monitoring and maintenance of the cap are discussed in Section 6.2.1 of the CAP.

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4.0 Landfill Cap Inspection and Maintenance Requirements

This Landfill CIMP establishes an inspection and maintenance program to identify damaged cap systems, provide for timely repair and replacement needed to restore damaged or intruded cap systems, specify measures to minimize the potential for disturbances of solid waste, and specify requirements for record-keeping of inspections, repairs and reporting.

4.1 BASELINE CAP CONDITIONS AT THE SETTLEMENT AREA

The first inspection conducted under this plan will occur during the first spring following the effective date of the Consent Decree, and it will be considered a "baseline" event. The baseline inspection will gather additional information that is needed beyond what was collected under the Remedial Investigation/Feasibility Study, for each parcel within the Settlement Area. Specifically, the inspection will review:

- Available as-built plans from the individual Parcel Owners, including building foundations, pavement sections, and stormwater system(s).
- A field survey that identifies the location of the different pavements, buildings, and landscaped features (for the ROWs, this will include the location of vegetated strips, surficial stormwater features, and sidewalks) and the generation of a scaled plan set to document the features.
- A publically available aerial photograph taken within the prior 2 years showing the parcel. This aerial will be available electronically as a georeferenced document.

This information will be maintained by the Site Coordinator and submitted to Ecology in the Year 1 Annual Report.

4.2 LANDFILL CAP INSPECTIONS

A complete inspection of the Settlement Area cap, including the ROWs, must be conducted on an annual basis in late spring to allow for repairs in the dry season. Inspections will be conducted by the Site Coordinator. Routine cap inspections for all parcels will consist of a visual survey of the entire cap surface exterior to buildings, including drainage features and surface components of stormwater conveyance (i.e., catch basins, swales). The integrity of the cap across the entire Settlement Area must be documented via notes, sketches, and photographs. The main objective of the annual inspection is to document areas of the cap that are compromised and require maintenance. To facilitate the inspection, a field inspection form must be completed during each routine annual inspection; a blank field inspection and maintenance form is included in Exhibit A.1.1.

If the following disturbances to the cap are identified, they must be noted on the field inspection form and documented via sketches (for location) and photographs.

- Cracking
- Uneven settlement or potholes
- Pooling or ponding of stormwater
- Separation of pavement from curbs, gutters, or catch basins
- Sloughing or crumbling of edge materials
- Erosion
- Any other signs of cap damage, failure, deterioration, or disturbance

If any of the above are identified during an inspection, a recommendation for repairs should be included on the field inspection and maintenance form.

4.3 LANDFILL CAP MAINTENANCE

If the results of the annual inspection indicate that an area of the cap requires maintenance, the following procedures should be followed.

- Notify Ecology of the repair needed and the intent to follow the procedure below within a timeframe specified in the notice, unless additional planning and approval are required by Ecology.
- Repair the cap with similar materials and construction procedures; refer to the CAP Section 6.2.1 for specifications.
- Make all cuts into the cap with neat continuous lines (i.e., saw cut).
- Make sure there is a complete and effective bond between the newly placed surface and the existing surface.
    - In the case of the asphaltic concrete cap, seams and seals must be properly constructed per standard paving practices and in such a way that no cracks or weak seams occur after repair that would be conduits for transmitting infiltrating stormwater or short-circuiting the LFG collection system, or that would present an exposure pathway to the soil beneath.
    - In the case of the low-permeability membrane cap, seams and seals must be properly constructed per manufacturer directives and in such a way that cracks that could be conduits for transmitting infiltrating stormwater or short-circuiting the LFG collection system, or that would present an exposure pathway to the soil beneath do not occur.
- Use a seal coat to seal cracks.

The following scheduling guidelines should be followed if cap inspection indicates that cap maintenance is necessary.

- If a crack, depression, or pothole is identified that exposes the underlying material, maintenance and repair activities should be scheduled as soon as practical (within 60 days).
- Minor surface cracks or ponding (not temporary puddles that form during rainstorms) that reduces the pavements ability to transport rainfall/stormwater to catch basins, but does not expose underlying material, will require a follow-up inspection within 3 to 6 months. If the follow-up inspection indicates that differential settlement in these areas is worsening (i.e., deeper, larger footprint, or cracking), then maintenance or repair must be completed within 6 months of the follow-up inspection. If there is no change to the area during the follow-up inspection, then monitoring of the area should continue at a frequency of every 6 months.
- Repairs of minor cracks, potholes, or otherwise damaged or deteriorated cap surfaces that do not expose underlying material should be made within the calendar year before they can get worse or provide a direct conduit for infiltration.

All maintenance activities should be documented on an inspection and maintenance form, with supporting sketches, figures, and/or photographs attached. An example form is provided in Exhibit A.1.1.

4.4 STORMWATER INFRASTRUCTURE MAINTENANCE

A visual inspection of all surface components of stormwater conveyance and management facilities that are within the cap boundaries shall be performed during each annual cap inspection to document any disturbance, erosion, or penetration concerns. Field observations must be documented on the inspection and maintenance form, along with documentation of any necessary maintenance or repairs.

4.5 FENCING

Several of the parcels contain security fencing isolating some or all of the parcel from public access. Security fencing that does not penetrate the cap may be repaired as needed. Fencing that does penetrate the cap and contacts refuse will need Ecology notification and approval for repairs.

4.6 UNFORESEEN EVENTS

An unforeseen emergency or extreme weather event, such as earthquakes, fires, or floods, or other natural or man-made disaster would trigger an out of sequence cap inspection to ensure that the cap integrity is maintained. Such unforeseen events could cause a sudden differential settlement of the cap that could affect the integrity of the cap, which may result in exposure to

the underlying material or methane gas, or could affect safe operation of the LFG control system. The following criteria for unforeseen events would trigger an inspection of the landfill cap.

- An earthquake along the Seattle fault that registers 4.0 or greater on the Richter scale.
- An earthquake within 100 miles of Seattle that registers 5.0 or greater on the Richter scale.
- A flood or major storm that produces greater than 3.0 inches of rainfall within a 24-hour period.
- Any fire that occurs on or below the cap.
- Any other damage in the area of the Landfill observed by the Parcel Owners and facility workers or the public, such as damage sustained by high winds, facility or vehicular accidents.

If any of the above unforeseen events occur, then the Site Coordinator should schedule a cap inspection with the appropriate personnel as soon as safe and practical (generally within 48 hours). Inspection and maintenance activities must be documented on an inspection and maintenance form, with any supporting sketches, figures, and photographs attached. If the integrity of the cap is significantly compromised as a result of an unforeseen event, Ecology must be notified within 1 business day of the discovery of the event and repairs initiated as soon as practicable.

5.0 Health and Safety

Maintenance personnel and contractors must follow general health and safety procedures while performing cap inspection and maintenance activities at the Settlement Area. Each facility that comprises the Settlement Area will have vehicular traffic and other potential hazards associated with active operation. Maintenance personnel and contractors must be aware of these hazards and take appropriate precautions while performing the work outlined in this Landfill CIMP. At a minimum, personnel preforming routine inspections and maintenance must wear a high visibility safety vest at all times and should be aware of traffic patterns and facility operations. If work on a specific parcel/facility requires other specific personal protective equipment (PPE), such as a hard hat or steel-toed boots, then the additional PPE requirements must be met to complete the inspection and maintenance work.

The work associated with this Landfill CIMP would not typically involve exposure to contaminated media beneath the cap; therefore, a site-specific health and safety plan is not necessary for this work.

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6.0 Reporting and Record Keeping

To document compliance with the Landfill CIMP, the Site Coordinator must keep the following records to document the completion of an operations, maintenance, and monitoring (OMM) event.

Inspection Records. These should include a completed Annual Cap Inspection and Maintenance Form and associated sketches and photographic documentation. These should also include any recommendations for maintenance.

In addition, the maintenance contractor must document the following and provide copies to the Site Coordinator within 60 days of the completion of a maintenance event.

Maintenance Records. These should include a description of the maintenance area and type of repair. These should also include photographic documentation and a field sketch and/or figure documenting the location.

In accordance with the OMMP, the results of the cap inspections and any necessary maintenance will be reported to Ecology annually in the OMM Annual Report. The Site Coordinator is responsible for compiling the necessary site-wide OMM documentation and submittal of the OMM Annual Report.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.1
Landfill Cap Inspection and Maintenance Plan

Figures

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HERRERA

Cleanup Action Plan
OMMP
South Park Landfill
Seattle, Washington

Attachment A.1: Landfill Cap Inspection and Maintenance Plan
Figure A.1.1
Landfill Cap Requirements by Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\LCMP\Figure A.1.1 Landfill Cap Requirements.mxd
3/9/2018

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HERRERA

Cleanup Action Plan
OMMP
South Park Landfill
Seattle, Washington

Attachment A.1: Landfill Cap Inspection and Maintenance Plan
Figure A.1.1a
Landfill Cap Boundary–SPPD Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\LCMP\Figure A.1.1a Landfill Cap Boundary - SPPD Parcel.mxd
3/9/2018

RESERVED-TO BE UPDATED AFTER DEVELOPMENT

Legend

- Edge of Refuse (July 2017)
- Landfill Parcel
- Adjacent Parcel

S KENYON ST

SR 99 (W MARGINAL WAY S)

2ND AVE S

5TH AVE S

South Recycling and Disposal Station (SRDS)

Notes:
· This figure was current as of June 2016.
· Tax parcels provided by King County Geographic Information Systems Center.
· Orthoimagery provided by NearMap, September 27, 2015.

Abbreviation:
OMMP = Operation, Maintenance, and Monitoring Plan

N

0 50 100 200

Scale in Feet

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HERRERA

Cleanup Action Plan
OMMP
South Park Landfill
Seattle, Washington

Attachment A.1: Landfill Cap Inspection and Maintenance Plan
Figure A.1.1b
Landfill Cap Boundary–SRDS Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\LCMP\Figure A.1.1b Landfill Cap Boundary - SRDS Parcel.mxd
2/12/2018

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Cleanup Action Plan
OMMP
South Park Landfill
Seattle, Washington

Attachment A.1: Landfill Cap Inspection and Maintenance Plan
Figure A.1.1c
Landfill Cap Boundary–Right-of-Ways

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\LCMP\Figure A.1.1c Landfill Cap Boundary - ROW.mxd
2/14/2018

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.1
Landfill Cap Inspection and Maintenance Plan

Exhibit A.1.1
Cap Inspection and Maintenance Field Form

South Park Landfill

Cap Inspection and Maintenance Form

Date: _____ Location: _____

Inspector: _____ Owner: _____

☐**Annual Inspection** ☐**Non-Routine Inspection**

Annual Inspection must include a visual survey of the entire cap surface, including drainage features on surface components for stormwater systems. Complete the checklist (Form A) and attach to this form for documentation.

For Non-Routine Inspections, provide reason:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Attach documentation as necessary (photographs, sketches, notes).

☐**Maintenance Event, provide reason:**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Complete Maintenance Documentation (Form B) and attach for documentation.

South Park Landfill

Cap Inspection Form A

Date: _____ Location: _____

Inspector: _____ Owner: _____

☐ **Annual Inspection** ☐ **Non-Routine Inspection**

Reason: _____

VISUAL INSPECTION CHECKLIST

Asphaltic Concrete

	Yes	No	Needs Repair	If Yes, Describe:
Minor Cracking	☐	☐	☐	_____
Open Cracks/Ruts	☐	☐	☐	_____
Differential Settlement	☐	☐	☐	_____
Pot Holes	☐	☐	☐	_____
Pooling or Ponding	☐	☐	☐	_____
Separation of Pavement from Curbs, Gutters, or Catch Basins	☐	☐	☐	_____
Sloughing or Crumbling of Edge Materials	☐	☐	☐	_____
Erosion	☐	☐	☐	_____
Other Signs of Cap Damage, Failure, Disturbance	☐	☐	☐	_____

Recommended Maintenance or Repair Type/Location:

_____

_____

Low-Permeability Membrane

	Yes	No	Needs Repair	If Yes, Describe:
Erosion of Cover Soil	☐	☐	☐	_____
Exposed Geotextile Barrier	☐	☐	☐	_____
Holes/Signs of Unauthorized Digging	☐	☐	☐	_____

Recommended Maintenance or Repair Type/Location: _____

_____

Stormwater Management Facilities

	Yes	No	Needs Repair	If Yes, Describe:
Signs of Water Infiltration below Structures	☐	☐	☐	_____
Erosion of Soil	☐	☐	☐	_____
Exposed Geotextile Membrane	☐	☐	☐	_____
Holes/Signs of Unauthorized Digging	☐	☐	☐	_____
Invasive/Deep-Rooted Plants	☐	☐	☐	_____

Recommended Maintenance or Repair Type/Location: _____

_____

Attach necessary documentation such as photographs, sketches, and additional notes.

South Park Landfill

Cap Maintenance Form B

Date: _____ Location: _____ Owner: _____

Maintenance Contractor: _____

Reason for Maintenance: _____

_____

Describe maintenance location (attach sketch, photographs).

_____

_____

_____

Describe maintenance or repair performed (attach photos and additional documentation as necessary).

_____

_____

_____

_____

_____

_____

_____

Is the maintenance activity complete? ☐ Yes ☐ No

If no, explain:

_____

_____

_____

_____

Approval/inspection of maintenance/repair:

_____ _____

SITE COORDINATOR DATE

All maintenance and repair documentation must be provided to the Site Coordinator within 60 days of the completion of the maintenance/repair OR by March 1 if the activity is completed within 60 days prior to March 1.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.2
Landfill Gas Monitoring and Contingency Plan

Table of Contents

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
CAP	Cleanup Action Plan
City	City of Seattle
Ecology	Washington State Department of Ecology
HASP	Health and Safety Plan
KIP	Kenyon Industrial Park
LEL	Lower explosive limit
LFG	Landfill gas
LFGMCP	Landfill Gas Monitoring and Contingency Plan
mL	Milliliters
OMM	Operations, maintenance, and monitoring
OMMP	Operations, Maintenance, and Monitoring Plan
PLP	Potentially liable person
PPE	Personal protective equipment
ppmv	Parts per million by volume
PVC	Polyvinyl chloride
SPPD	South Park Property Development, LLC
SR	State Route
SRDS	South Recycling and Disposal Station

1.0 Introduction

This Landfill Gas Monitoring and Contingency Plan (LFGMCP) is an attachment to the Landfill Post-Closure Operations, Maintenance, and Monitoring Plan (OMMP), which is an appendix to, and integral and enforceable part of, the Cleanup Action Plan (CAP) for the Settlement Area portion of the South Park Landfill Site. The South Park Landfill Site is a former municipal solid waste landfill in the South Park neighborhood of Seattle, Washington (Figure A.1 of the OMMP). It is located in the Lower Duwamish Valley near the western valley wall between State Route (SR) 509 and SR 99. Details regarding the Settlement Area, environmental conditions, and specific components of the remedy are documented in the CAP.

The operations, maintenance, and monitoring (OMM) requirements related to landfill gas (LFG) are provided in this LFGMCP. The LFGMCP implementation will begin 180 days after the effective date of the Consent Decree in accordance with the schedule in the CAP.

1.1 PURPOSE AND APPLICABILITY

The goal of LFG control system OMM is to confirm that the landfill remedy is performing in a manner that protects human health and the environment. Specifically, this requires meeting the following LFG criteria under the Minimum Functional Standards (MFS) as defined in Washington Administrative Code (WAC) 173-304-460 and King County Board of Health Title 10 regulations:

- **On-Site Structures.** Methane concentrations inside buildings and structures within the landfill boundary must not exceed 1.25 percent by volume, or 25 percent of the lower explosive limit (LEL). This criterion is typically measured in the buildings/structures with either calibrated hand-held monitors or installed building monitors/alarms.
- **Perimeter Gas Probes.** Methane concentrations in soil at the landfill boundary must not exceed 5 percent by volume, the LEL for methane. This criterion is typically measured by LFG probes along the landfill boundary.
- **Off-Site Structures.** Methane concentrations inside buildings and structures outside the landfill boundary must not exceed 100 parts per million by volume (ppmv). This criterion is typically measured in the buildings/structures with either calibrated hand-held monitors or installed building monitors/alarms.

1.2 LANDFILL GAS CONTROL SYSTEMS

The LFG control system consists of parcel-specific solutions designed to operate separately, but be compatible and synergistic in how they control LFG Settlement Area-wide. Those parcels with engineered systems include a network of piping under the landfill cap and associated conveyance and venting components that can operate either passively or actively. LFG controls depend on the specific layout (location of buildings, pavement, utilities, etc.) of each parcel. Other parcels may not have LFG generation and do not, therefore, require LFG systems; yet others may rely on passive venting as sufficient means for meeting perimeter probe and on-site building compliance. Routine OMM of the systems and monitoring in buildings requires long-term coordinated access with the owners/operators of the buildings. For this reason, separate solutions were selected for remedy implementation and are shown in aerial extent on Figure A.2.1; descriptions of the remedies follow:

- **South Park Property Development, LLC (SPPD) Parcel.** The SPPD parcel has been designed to protect buildings on the SPPD parcel and to control gas migration along the southern, western, and eastern perimeter of the Settlement Area. This includes sections of 5th Avenue South, Occidental Avenue South, and South Sullivan Street that are adjacent to the SPPD parcel.
- **South Recycling and Disposal Station (SRDS) Parcel.** The LFG system for the SRDS parcel has been designed to protect buildings on the SRDS parcel and to control gas migration along parts of the northern and eastern perimeter of the Settlement Area. This includes the sections of 5th Avenue South and South Kenyon Street that are adjacent to the SRDS parcel.
- **Street Right-of-Ways.** As discussed above, the LFG systems at SPPD and SRDS are designed to control methane in the adjacent right-of-ways.

1.3 COORDINATION AND RESPONSIBILITIES

To accomplish the work to be performed under this LFGMCP in the most efficient manner, certain parties have elected to take the lead in performing various aspects of the work required. Language in this LFGMCP reflects this agreement. However, the PLPs who signed the Consent Decree remain strictly, jointly, and severally liable for the performance of any and all obligations under this LFGMCP. In the event the party identified as a lead should fail to timely and properly complete performance of all or any portion of its work, the other party or parties must perform that remaining work, if any.

LFG monitoring is conducted Settlement Area-wide by the Site Coordinator. To effectively and efficiently protect on-site building and off-site migration, the three LFG control systems need to operate separately, but in such a way as to supply LFG controls to the whole Settlement Area. The following sections define the roles required for compliance with this LFGMCP; one person may perform more than one role.

1.3.1 Parcel Owners

The Parcel Owners own the parcels and are responsible for compliance with their respective Environmental (Restrictive) Covenant, which includes requirements on landfill gas controls, monitoring, and mitigation, specific to the parcel's environmental covenant. As regards activities in this LFGMCP, the LFG system operator for each parcel reports to the Parcel Owner and is responsible for the day-to-day operations and maintenance of the parcel's LFG system, including building methane detectors and alarms, and the Parcel Owners or their assigned representatives report to the Site Coordinator quarterly.

The responsibilities in this document do not supersede or exclude other relevant regulations for owners of properties located on landfills, such as Seattle Building Code 1811.2 for protection of structures from methane intrusion.

1.3.2 Subject Potentially Liable Persons

The potentially liable persons (PLPs) who have signed onto the Consent Decree (referred to as "Subject PLPs") are responsible for compliance with the CAP including the OMMP, communications with Washington State Department of Ecology (Ecology), and for reporting of on-parcel activities. For the LFG system monitoring program, the Subject PLP who is a property owner/operator will maintain their on-parcel building methane detectors and alarms, will report quarterly to the Site Coordinator, will provide notifications to Ecology and Public Health − Seattle & King County, and will implement contingent actions affecting the parcel's LFG system and on-parcel buildings.

1.3.3 Site Coordinator

The Site Coordinator is responsible for site-wide monitoring, including the quarterly site-wide LFG perimeter probe monitoring events, and for annual reporting. Additional clarification of his or her duties exists in the CAP, OMMP, and in later sections of this LFGMCP.

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2.0 Landfill Gas Controls

LFG controls depend on the specific layout (location of buildings, pavement, utilities, etc.) of the property, and monitoring in buildings requires long-term coordinated access with the owners/operators of the buildings. A general description of the LFG controls for each parcel is included in the following sections. Refer to Figure A.2.1 for the locations relative to one another. The locations of buildings within the landfill boundary and within 100 feet of the landfill boundary are shown on Figure A.2.2.

2.1 SPPD PARCEL LANDFILL GAS SYSTEM

An active LFG control system was installed at the SPPD parcel as part of the Interim Action redevelopment in 2014 and 2015. The system consists of a network of vertical gas collection wells and horizontal gas collection trenches. LFG is extracted under an applied vacuum (via vacuum blower) and discharged out a vent stack in the surface component equipment enclosure, which is located on the northwest portion of the parcel.

The LFG system is owned by SPPD and was activated in December 2014 as part of the SPPD Interim Action. It will be operated by SPPD or their delegated LFG OMM professional in accordance with a Landfill Gas Collection and Control System OMMP (Farallon 2016), which has been prepared by Farallon Consulting, LLC, approved by Ecology, and is on file at Ecology.

2.2 SRDS PARCEL LANDFILL GAS SYSTEM

The LFG control system proposed for the SRDS parcel (as of November 2015) includes a gas collection network of piping under the landfill cap and conveyance and venting components. The system is being planned to operate passively; however, in the event additional collection control is necessary, the system can be converted to an active collection system. An active manifold will be installed next to the passive manifold at the time the passive system is built. The active manifold could be connected to a blower and a vacuum applied for LFG extraction to allow passive-to-active collection at discrete locations throughout the site.

The LFG system will be owned by the City of Seattle (City) and will likely be constructed and in service starting between 2020 and 2023. It will be operated by the City or their delegated LFG OMM professional in accordance with a LFG Collection and Control System OMMP, which will likely be prepared as part of the Engineering Design Report for the SRDS Interim Action. Once approved by Ecology, it will be on file at Ecology.

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3.0 Landfill Gas Monitoring Plan

Monitoring LFG collection systems serves two purposes: (1) performance monitoring within the system to guide its operation and (2) post-construction compliance monitoring to confirm that the system is controlling LFG emissions as required in the remedial action. Monitoring will be performed on a parcel-by-parcel basis because the LFG controls are parcel-dependent. The primary goal of perimeter probe monitoring is to evaluate potential lateral off-site LFG migration and the primary goal of building monitoring is to protect human health. This monitoring is necessary to document the effectiveness of the LFG system(s) at the Settlement Area.

Throughout this section (and consistent with common terminology in LFG discussions), the term "monitoring" will refer to field measurements using calibrated meters, while the term "sampling" refers to the collection of a LFG, soil vapor, or ambient air sample for analysis at a laboratory. Perimeter gas probes can be monitored with meters or sampled for later analysis at a laboratory.

3.1 PERIMETER PROBE MONITORING

Methane concentrations in soil at the landfill boundary must not exceed 5 percent by volume, the LEL for methane. This criterion will be measured by monitoring LFG probes along the landfill boundary (perimeter probes) on a quarterly basis. The perimeter probes are shown on Figure A.2.3, and are summarized in Table A.2.1.

3.1.1 General Procedures for Perimeter Probe Monitoring

The preferred condition for LFG probe monitoring is low barometric pressure following at least 2 hours of falling barometric pressure, with a drop of at least 0.25 inches mercury. Barometer charts available at the following links will be used to forecast appropriate monitoring conditions. The first link provides a graphical barometric record over the previous 6 days from accessing the link; the second link provides a 10-day forecast map:

- http://www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html (Tillman and Johnson 2015)
- http://www.wunderground.com/weather-forecast/US/WA/Seattle.html (The Weather Channel 2015)

LFG probe and vent monitoring will be conducted according to the general procedures summarized below:

- Calibrate Landtec GEM™ 2000 (Plus) or equivalent meter using a 4 percent oxygen span gas and a 50 percent methane/35 percent carbon dioxide calibration gas according to the instrument's instruction manual.

- Connect the meter to the LFG probe using silicone or polyethylene tubing and filter. Typically the probe will have a labcock or pressure fitting plug with a quick connect.
- Open the labcock or connect the quick connect and measure the barometric and static pressure at each probe with the meter prior to purging.
- If possible, measure the water level in the gas probe to determine the water level and to confirm that static water is not above the top of the probe screen. If the water level is above the probe screen, then the probe cannot be monitored.
- Purge the probe until methane, carbon dioxide, and oxygen percentages stabilize, defined as when readings change by less than 10 percent for three consecutive measurements over 10-second intervals.
- Evacuate a minimum of one probe volume before recording the final instrument readings. Note that 3/4-inch-diameter Schedule 40 polyvinyl chloride (PVC) probe volume is 100 milliliters (mL) per foot and 2-inch-diameter Schedule 40 PVC probe volume is 620 mL per foot. For reference, the GEM flow rate is 300 mL per minute. Table A.2.2 provides a summary of perimeter probe construction details and purging volumes.
- An SKC Inc., pump or equivalent (AirChek Sampler – intrinsically safe) may be used for deeper probes with larger volumes to decrease evacuation time. The pump has the capacity to evacuate at 3,000 mL per minute and would be connected directly to the LFG probe and then the meter with a barbed Tee connector.

Results for each perimeter monitoring event must be recorded on the Gas Probe Monitoring Field Form included in Exhibit A.2.1 (electronic forms, including those that download directly into a database, are also acceptable).

3.1.2 Criteria for Reduction of Monitoring Locations and Frequency

LFG production will continue to decline over time. A reduction of monitoring frequency may be allowed if the LFG systems are stable and perimeter monitoring results are consistently less than criteria thresholds.

As part of the Annual Report, the Subject PLPs may request reductions in sample locations and/or frequency (on a probe-by-probe basis). The request will include supporting data and rationale. The request will become effective once approved by Ecology. Significant changes in individual LFG systems (such as system failure, or a switch from active to passive) may warrant additional sampling as part of their operations.

3.2 BUILDING MONITORING

All occupied buildings on the Settlement Area (on-site buildings) must have continuous (i.e., operate 24 hours per day, 7 days per week) methane detectors with alarms. Methane concentrations inside buildings and structures within the landfill boundary must not exceed 1.25 percent by volume, or 25 percent of the LEL; meters in all buildings will be set with a low alarm warning at 10 percent of the LEL and the high alarm at 25 percent of the LEL. Building monitoring will be conducted based on the flowchart presented in Figure A.2.5. Quarterly inspections of these alarms must be completed in accordance with the manufacturer's recommendations to ensure proper operation and protection of human health. The inspections will also consist of calibrating the detector consistent with the manufacturer's operating manual.

Methane concentrations inside buildings and structures outside the landfill boundary must not exceed 100 ppmv, equivalent to 0.01 percent by volume or 0.2 percent of the LEL. Off-site building monitoring will be conducted by the building owners following notification, as indicated in the flow chart presented in Figure A.2.6. These criteria are typically measured in the buildings/structures with either handheld or mounted equipment. It should be noted that each building is different, so the specific protocol for each building is field-dependent. Monitoring indoor air for methane if needed for off-site buildings will be conducted in accordance with the following general procedures.

- Notify the Parcel Owners and tenants and offer to perform building monitoring.
- Inspect the building to assess construction characteristics, such as heating, ventilation, and air conditioning systems, and for possible sources of volatile contaminants that may influence monitoring results, such as petroleum hydrocarbons and chemical products.
- Monitor interiors of buildings using a detector capable of measuring methane to below 100 ppmv according to manufacturer instructions.
- Complete a walk-through of the building with the monitoring instrument operating continuously; pay particular attention to cracks in concrete slab floors or other features with a potential for LFG flow.
- Record measurements when methane is detected, noting locations and concentrations.

Results for each off-site building monitoring event must be recorded on the Building Monitoring Field Form included in Exhibit A.2.1.

3.2.1 Contingency Actions

If the methane concentrations described in Section 3.2 are exceeded, then additional contingency actions must occur. Refer to the building monitoring flow charts for triggers and contingent actions, included as Figure A.2.5 (on-site) and Figure A.2.6 (off-site).

3.3 PARCEL-SPECIFIC MONITORING REQUIREMENTS

Compliance monitoring for LFG is limited to the perimeter probe monitoring described in Section 3.1; however, each of the active LFG control systems includes operational monitoring requirements in order to maintain efficient operations. This operational monitoring is part of the site-specific LFG system OMMPs referenced in Section 2.0.

3.4 UNFORESEEN EVENTS

An unforeseen emergency or extreme weather event, such as earthquakes, fires, or floods, or other natural or man-made disaster would trigger a requirement for an immediate Settlement Area-wide inspection to ensure the integrity of the LFG control systems and controls are maintained. Such unforeseen events could cause a sudden differential settlement of the landfill contents and/or cap that could affect the integrity of the landfill cap and the infrastructure below, including LFG vent systems, monitoring probes, and electronic controls. This compromise may result in exposure to methane gas or could affect safe operation of the LFG control system. The following criteria for unforeseen events would trigger an inspection of the LFG systems and controls.

- An earthquake along the Seattle fault that registers 4.0 or greater on the Richter scale.
- An earthquake within 100 miles of Seattle that registers 5.0 or greater on the Richter scale.
- A flood or major storm that produces greater than 3.0 inches of rainfall within a 24-hour period.
- Any fire that occurs on or below the cap.
- Any other damage in the area of the Settlement Area observed by the Parcel Owners and facility workers or the public, such as damage sustained by high winds, facility, or vehicular accident(s).

If any of the above unforeseen events occur, then the Site Coordinator should schedule an inspection with the appropriate personnel as soon as safe and practical (generally within 48 hours). If the integrity of the LFG control systems or controls are significantly compromised as a result of an unforeseen event, Ecology must be notified and repairs must be initiated no later than within 24 hours of the discovery of the event or as soon as practicable.

4.0 Health and Safety

Maintenance personnel and contractors must follow general health and safety procedures while performing LFG OMM activities at the Settlement Area. Each facility that comprises the Settlement Area will have vehicular traffic and other potential hazards associated with active operation. Maintenance personnel and contractors must be aware of these hazards and take appropriate precautions while performing the work outlined in this LFGMCP. At a minimum, personnel performing routine OMM must wear a high visibility safety vest at all times and should be aware of traffic patterns and facility operations. If work on a specific parcel or facility requires other specific personal protective equipment (PPE), such as a hard hat or steel toed boots, then the additional PPE requirements must be met to complete the inspection and maintenance work.

A site-specific Health and Safety Plan (HASP) must be prepared for the operation of active LFG systems. A HASP should be included in the parcel-specific OMMP for each parcel (SPPD and SRDS).

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5.0 Reporting and Record Keeping

To document compliance with this LFGMCP, the Site Coordinator must keep the following records to document the completion of an OMM event:

- Routine monitoring, which, at a minimum, should include copies of field OMM forms, direct upload into a database, or a tabular summary of routine monitoring data.
- Maintenance Records, which should include a description of the maintenance performed and reason/type of repair. This should also include photographic documentation if appropriate.

In accordance with the OMMP, the results of the LFG OMM will be reported annually to Ecology in the OMM Annual Report, which is due on March 31 of each year for the previous calendar year's OMM activities. The Site Coordinator is responsible for compiling the necessary site-wide OMM documentation and submittal of the OMM Annual Report. A brief discussion of any important or relevant changes in Settlement Area conditions or personnel changes will be included in the annual monitoring reports. In addition, recommendations for a reduction in frequency or location for the perimeter probe monitoring network will be included, as applicable.

Individual Parcel Owners are responsible for other reporting associated with parcel-specific LFG system OMM outside of CAP requirements. For example, to comply with permit requirements for discharging treated LFG to the atmosphere, separate annual reports providing results of monitoring and information regarding discharge treatment equipment maintenance may be required by the Puget Sound Clean Air Agency.

All records, reports, documents, and underlying data relevant to the implementation of this LFGMCP shall be maintained by the Site Coordinator for a period consistent with requirements in the Consent Decree.

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6.0 References

Farallon Consulting (Farallon). 2013. *South Park Landfill Site Interim Action Work Plan, Appendix C: Interim Action Compliance Monitoring Plan*. Prepared for South Park Property Development, LLC. 22 February.

Farallon Consulting (Farallon). 2016. *South Park Landfill Site Landfill Gas Collection and Control System Operation, Maintenance, and Monitoring Plan*. Prepared for South Park Property Development, LLC. 19 May.

Herrera and Aspect Consulting (Herrera and Aspect). 2015. *Interim Action Work Plan: South Transfer Station Phase II*. 24 July.

Tillman, James E. and Neal C. Johnson. 2015. Live from Earth and Mars. Department of Atmospheric Sciences, University of Washington; supported by NASA IITA Program, Office of Aeronautics; in collaboration with Pathfinder Project, NASA JPL, Office Space Sciences. http://www-k12.atmos.washington.edu/k12/. Last accessed 11/19/2015.

The Weather Channel, LLC. 2015. Weather Underground. http://www.wunderground.com/. Last accessed 11/19/2015.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.2
Landfill Gas Monitoring and Contingency Plan

Tables

Table A.2.1
Perimeter Gas Probe Locations

Perimeter Probe	Adjacent LFG System	Adjacent Off-Site Buildings[1]
GP-37	SRDS	No
GP-09	SRDS	No
GP-26	SRDS	Yes
GP-23	SRDS	Yes
GP-07	SRDS/SPPD	Yes
GP-27	SPPD	Yes, 5th Avenue South
GP-28	SPPD	Yes, 5th Avenue South
GP-29	SPPD	Yes, 5th Avenue South
GP-16[2]	SPPD	No
GP-31[2]	SPPD	Yes
GP-15	SPPD	Yes, Lenci/Emerson
GP-32[2]	SPPD	Yes
GP-03[2]	SPPD	No
GP-13	SPPD	Yes
GP-11	SPPD	Yes
GP-38	None	No
GP-33	SPPD	Yes

Notes:

1 Adjacent off-site buildings within 100 feet are shown on Figure A.2.2.
2 Due to shallow groundwater, these probes are only measured when the water table is low enough for the probes to function.

Abbreviations:

Lenci Lenci Frank Corporation
LFG Landfill gas
SPPD South Park Property Development, LLC
SRDS South Recycling and Disposal Station

Table A.2.2
Perimeter Gas Probe Purge Times

Gas Probe	Depth (ft)	Stickup (ft)	Total Length (ft)	Probe Diameter (ft)	Probe Radius (ft)	Volume (ft^3)	Volume (cc)	GEM™2000 1 Purge Volume Time 300 cc/min pump (min)	SKC Inc. Pump 1 Purge Volume Time 3,000 cc/min pump (min)
GP-37	10	0	10	0.063	0.031	0.03	868	2.89	0.29
GP-09	9	1.35	10.35	0.063	0.031	0.03	899	3.00	0.30
GP-26	10	0	10	0.063	0.031	0.03	868	2.89	0.29
GP-23	6	2	8	0.167	0.083	0.17	4,940	16.47	1.65
GP-07	4.5	1.48	5.98	0.063	0.031	0.02	519	1.73	0.17
GP-27	14	0	14	0.063	0.031	0.04	1,216	4.05	0.41
GP-28	12	0	12	0.063	0.031	0.04	1,042	3.47	0.35
GP-29	10	0	10	0.063	0.031	0.03	868	2.89	0.29
GP-16	7.5	2	9.5	0.167	0.083	0.21	5,867	19.56	1.96
GP-31	10	0	10	0.063	0.031	0.03	868	2.89	0.29
GP-15	7	2	9	0.167	0.083	0.20	5,558	18.53	1.85
GP-32	10	0	10	0.063	0.031	0.03	868	2.89	0.29
GP-03	7	1.35	8.35	0.063	0.031	0.03	725	2.42	0.24
GP-13	4.5	2	6.5	0.167	0.083	0.14	4,014	13.38	1.34
GP-11	5.5	2	7.5	0.167	0.083	0.16	4,632	15.44	1.54
GP-38	10	0	10	0.063	0.032	0.03	882	2.94	0.29
GP-33	10	3.2	13.2	0.063	0.032	0.04	1,165	3.88	0.39

Abbreviations:

cc Cubic centimeters
ft Feet
ft^3 Cubic foot
min Minutes

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.2
Landfill Gas Monitoring and Contingency Plan

Figures

Notes:
1 An active LFG control system was installed as part of the SPPD parcel redevelopment in 2014/2015, in accordance with the Ecology-approved Interim Action Work Plan (Farralon 2013).
2 The LFG control system will be installed in 2017/2018 by the City of Seattle as part of redevelopment, in accordance with the Ecology-approved Interim Action Work Plan (Herrera and Aspect 2015). The LFG system is intended to initially operate passively, but will have the ability to convert to active operation if necessary.
· Tax parcels provided by King County Geographic Information Systems Center.
· Orthoimagery provided by NearMap, September 27, 2015.

Abbreviations:
Ecology = Washington State Department of Ecology
Landfill = South Park Landfill
LFG = Landfill gas
OMMP = Operation, Maintenance, and Monitoring Plan

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Attachment A.2: Landfill Gas Monitoring and Contingency Plan
Figure A.2.1
Landfill Gas Controls

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Attachment A.2: Landfill Gas Monitoring and Contingency Plan
Figure A.2.2
Buildings within the Landfill and within 100 feet of the Landfill Boundary

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\LGMCP\Figure A.2.2 Buildings within 100 feet of the Landfill Boundary.mxd
2/13/2018

Legend

- Edge of Refuse (July 2017)
- Area Covered Under This Cleanup Action Plan (Settlement Area)
- Landfill Parcel
- Adjacent Parcel
- Gas Probe

S HOLDEN ST

GP-38

GP-37

S KENYON ST

GP-09

S KENYON ST

SR 509

7901 2nd Ave S, LLC

Kenyon Industrial Park (KIP)

2ND AVE S

SR 99 (W MARGINAL WAY S)

5TH AVE S

GP-26

GP-23

1ST AVE S

GP-33

GP-11

OCCIDENTAL AVE S

South Recycling and Disposal Station (SRDS)

GP-07

GP-27

GP-13

South Park Property Development (SPPD)

GP-28

GP-29

GP-16

5TH AVE S

GP-03

GP-15

GP-31

S SULLIVAN ST

GP-32

S CLOVERDALE ST

Notes:
· Tax parcels provided by King County Geographic Information Systems Center.
· Orthoimagery provided by NearMap, September 27, 2015.

Abbreviation:
OMMP = Operation, Maintenance, and Monitoring Plan

N

0 125 250 500

Scale in Feet

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Attachment A.2: Landfill Gas Monitoring and Contingency Plan
Figure A.2.3
Perimeter Gas Probe Network

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\LGMCP\Figure A.2.3 Perimeter Gas Probe Network.mxd
2/12/2018

START HERE
for Perimeter Probe Monitoring

Measure LFG concentrations at Perimeter Probes
under Site Coordinator (SC) oversight
(locations listed on table below and Figure A.2.3)

Perimeter LFG probes are assessed probe by probe

Is the methane concentration < 1.25% by volume (25% of LEL)

Yes → Record results and return to routine monitoring program.

No

Are methane concentrations < 5% by volume

Yes → Has this LFG level been shown to be protective previously? (see table)

Concentrations are between 1.25 and 5%.

Yes → Review LFG system at adjacent parcel and continue monitoring probe weekly until situation returns to < 1.25% or is demonstrated to be protective in adjacent buildings.

No, new condition

No

Perimeter Probe Locations

Perimeter Probe	Adjacent LFG System	Adjacent Off-site Buildings [1]
GP-37	SRDS	No
GP-09	SRDS	No
GP-26	SRDS	Yes
GP-23	SRDS	Yes
GP-07	SRDS/SPPD	Yes
GP-27	SPPD	Yes, 5th Avenue South
GP-28	SPPD	Yes, 5th Avenue South
GP-29	SPPD	Yes, 5th Avenue South
GP-16 [2]	SPPD	No
GP-31 [2]	SPPD	Yes
GP-15	SPPD	Yes, Lenci/Emerson
GP-32 [2]	SPPD	Yes
GP-03 [2]	SPPD	No
GP-13	SPPD	Yes
GP-11	SPPD	Yes
GP-38	None	No
GP-33	SPPD	Yes

Notes:
1 Adjacent off-site buildings within 100 feet are shown on Figure A.2.2.
2 Due to shallow groundwater, these probes are only measured when the water table is low enough for the probes to function.

Contingent Action Triggered by Exceedance

1. SC notifies the Ecology PM, Public Health – Seattle & King County, and the rest of the PLP Group.
2. Parcel staff adjust adjacent LFG system to increase control on LFG, and continue DAILY monitoring at probe until control is established (using criteria above) then weekly for 4 weeks.
2. SC arranges monitoring of indoor air for LFG in any off-site buildings within 100 feet of the Landfill boundary (Figure A.2.2). Refer to Figure A.2.6 for triggers and actions based on indoor measurements.
3. SC notifies Ecology PM and Public Health – Seattle & King County of the actions taken and their effectiveness. If the adjustments to the adjacent gas system are not effective, then a plan must be prepared and submitted for approval.
4. SC reports exceedances and actions in Annual Report to Ecology.

Abbreviations: Ecology = Washington State Department of Ecology; LEL = Lower Explosive Limit; LFG = Landfill gas; OMMP = Operations, Maintenance, and Monitoring Plan; PLP = Potentially liable person; PM = Project manager; SPPD = South Park Property Development, LLC; SRDS = South Recycling and Disposal Station

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Attachment A.2: Landfill Gas Monitoring and Contingency Plan
Figure A.2.4
Flow Chart for Triggers and Contingent Actions for Perimeter Probe Monitoring

START HERE
for On-Site Building Monitoring

All occupied buildings on Landfill have 24/7 methane detectors with alarms.

Alarm goes off

Routine monitoring consists of quarterly checks of alarms

Is the detector with alarm in working order?

Yes

No

Reset, repair, or replace methane detector with alarm.

Does the alarm indicate safe conditions (< 1.25% methane = 25% of LEL)

Yes

No

Record results and return to routine monitoring program.

Facility staff at the parcel notify Parcel Owner. Owner notifies Ecology and ensures that indoor monitoring is initiated with handheld unit with 100 ppm detection limit.

Environmental Covenant will indicate that its requirements must be part of any tenant leases.

< 100 ppm Methane (by volume)	**100 ppm < Methane < 1.25% (by volume)**		**> 1.25% Methane (by volume)**
Record results and return to routine monitoring program.	Methane between 100 and 5,000 ppm	Methane between 5,000 ppm and 1.25%	• Evacuate building • ID source or entry point
	• Monitor daily	• Evacuate building • ID source or entry point	
	Verify methane concentrations with second meter		
	Notifications and Reporting by Owner • PLP Group • Owner already notified • Ecology PM • Public Health – Seattle & King County		
	Potential Corrective Measures • Seal cracks in foundation • Increase building ventilation • Modify LFG system operation, including switching to active, if passive		

Abbreviations: Ecology = Washington State Department of Ecology; Landfill = South Park Landfill; LEL = Lower Explosive Limit; LFG = Landfill gas; OMMP = Operations, Maintenance, and Monitoring Plan; PLP = Potentially liable person; PM = Project manager; ppm = Parts per million

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Attachment A.2: Landfill Gas Monitoring and Contingency Plan
Figure A.2.5
Flow Chart for Triggers and Contingent Actions for LFG Monitoring in On-Site Buildings

F:\projects\COS-SPARK\5000 - CAP\06 SPARK CAP Public Review Final\04 Appendix A OMMP\Attachment A.2 Landfill Gas MCP\03 Figures\Figure A.2.4 thru A.2.6 Flow Chart for Triggers and Perimeter Probe Monitoring_2017-0512.vsd

09/25/2017

START HERE
for Off-Site Building Monitoring

This chart is initiated when an adjacent perimeter probe has methane > 5% (Figure A.2.4). Required notice has been given except to the owner of the off-site building when this chart begins.

Does the building have a methane detector with alarm in working order and an access agreement?

No → Site coordinator (SC) gives notice to off-site building owner(s) and requests permission to come on-site for monitoring.

Was access granted?

No → SC notify Public Health – Seattle & King County of current conditions and lack of access.

Yes → SC initiates monitoring with handheld unit with 100 ppm detection limit.

Yes → Use the chart in Figure A.2.5 for on-site buildings, except the work is initiated by SC in accordance with the access agreement.

< 100 ppm Methane (by volume)	**100 ppm < Methane < 1.25% (by volume)**		**> 1.25% Methane (by volume)**
Record results and return to routine monitoring program.	Methane between 100 and 5,000 ppm	Methane between 5,000 ppm and 1.25%	• Evacuate building • ID source or entry point
	• Monitor daily	• Evacuate building • ID source or entry point	
	Verify methane concentrations with second meter		
	Notifications and Reporting • PLP Group • Owner already notified • Ecology PM • Public Health – Seattle & King County		
	Potential Corrective Measures • Seal cracks • Increase ventilation • Install methane detector with alarm • Perform active collection • Modify adjacent LFG system		

Abbreviations: Ecology = Washington State Department of Ecology; LFG = Landfill gas; OMMP = Operations, Maintenance, and Monitoring Plan; PLP = Potentially liable person; PM = Project Manager; ppm = Parts per million

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Attachment A.2: Landfill Gas Monitoring and Contingency Plan
Figure A.2.6
Flow Chart for Triggers and Contingent Actions for LFG Monitoring in Off-Site Buildings

F:\projects\COS-SPARK\5000 - CAP\06 SPARK CAP Public Review Final\04 Appendix A OMMP\Attachment A.2 Landfill Gas MCP\03 Figures\Figure A.2.4 thru A.2.6 Flow Chart for Triggers and Perimeter Probe Monitoring_2017-0512.vsd

09/25/2017

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.2
Landfill Gas Monitoring and Contingency Plan

Exhibit A.2.1
Perimeter Probe and Building Monitoring Field Forms

South Park Landfill

Gas Probe Monitoring Field Form

Gas Probe ID: _____ **Date and Time:** _____

Casing Volume Purged	Volume Purged (cc)	Purge Rate (ml/min)	Purge Time				CH_4 (% Volume)	CO_2 (% Volume)	O_2 (% Volume)	H_2S (% Volume)
0			0	min	0	sec				
1/4				min		sec				
1/2				min		sec				
3/4				min		sec				
1				min		sec				
1-1/4				min		sec				
1-1/2				min		sec				
1-3/4				min		sec				
2				min		sec				
2-1/4				min		sec				
2-1/2				min		sec				
2-3/4				min		sec				
3				min		sec				

Comments/Special Instructions:

Barometric Pressure: _____ **Well Diameter:** _____

Well Head Pressure: _____ **Water Level/Well Bottom:** _____ **Screen**: _____

Equipment Used: Gem™ 2000 (Plus), Water Level Meter, SKC Pump, Other: _____

Off-Site Building Monitoring

Date: _____ **Location:** _____

Inspector: _____ **Owner:** _____

Reason for Monitoring: _____

_____

_____

_____

_____

Instrument Used: _____

Describe monitoring; include locations, building type, cracks in foundation or floors, etc.:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Table of Contents

List of Tables

List of Figures

List of Exhibits

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
CAP	Cleanup Action Plan
COC	Chemical of concern
CPOC	Conditional point of compliance
CUL	Cleanup level
DCE	Dichloroethene
Ecology	Washington State Department of Ecology
GWMCP	Groundwater Monitoring and Contingency Plan
µg/L	Micrograms per liter
MTCA	Model Toxics Control Act
NAVD 88	North American Vertical Datum of 1988
OMM	Operations, maintenance, and monitoring
OMMP	Operations, Maintenance, and Monitoring Plan
PLP	Potentially liable person
PPE	Personal protective equipment
SAP	Sampling and Analysis Plan
SR	State Route
QAPP	Quality Assurance Project Plan

1.0 Introduction

This Groundwater Monitoring and Contingency Plan (GWMCP) is an attachment to the Landfill Post-Closure Operations, Maintenance, and Monitoring Plan (OMMP), which is an appendix to, and integral and enforceable part of, the Cleanup Action Plan (CAP) for the Settlement Area. The Settlement Area consists of the Settlement Area portion of the South Park Landfill Site. The South Park Landfill Site is a former municipal solid waste landfill in the South Park neighborhood of Seattle, Washington (Figure 2.1 of the CAP). It is located in the Lower Duwamish Valley near the western valley wall between State Route (SR) 509 and SR 99. Details regarding the Settlement Area, environmental conditions, and specific components of the remedy are documented in the CAP.

The Model Toxics Control Act (MTCA) CAP for the site requires long-term groundwater monitoring to continue until all groundwater chemicals of concern (COCs) are in compliance at the conditional point of compliance (CPOC). This plan presents the framework for that monitoring. The operations, maintenance, and monitoring (OMM) requirements related to groundwater are provided in this GWMCP. The GWMCP implementation will begin at a date in accordance with the schedule in the CAP.

1.1 PURPOSE AND APPLICABILITY

The goal of long-term groundwater monitoring is to confirm that the cleanup action is performing in a manner protective of human health and the environment. This includes assessing current groundwater concentrations and monitoring trends to confirm that vinyl chloride, *cis*-1,2-dichloroethene (DCE), benzene, arsenic, iron, and manganese concentrations continue to decrease over time and in a reasonable restoration timeframe. Long-term monitoring will confirm that trends in the concentrations either remain stable or decrease further, especially after cleanup actions are implemented (landfill cap and landfill gas extraction).

1.2 GROUNDWATER AT THE LANDFILL

The physical conceptual site model for the landfill is discussed in greater detail in Section 3.1 of the CAP. At the landfill, groundwater has been investigated in three zones:

- **The Perched Zone.** A shallow zone of groundwater and infiltrating stormwater, typically less than 1 foot in thickness perched on top of the Silt Overbank Deposit where it is present. This zone reflects very localized conditions.
- **A-Zone Groundwater.** The groundwater in the Duwamish Valley Aquifer beneath the Silt Overbank Deposit, generally located at an elevation from 0 to -15 feet North American Vertical Datum of 1988 (NAVD 88).
- **B-Zone Groundwater.** Groundwater deeper in the Duwamish Valley Aquifer, generally at an elevation from -15 to -35 feet NAVD 88 but above the estuarine/marine deposits.

This zone does not exist along the upgradient edge of the landfill near the valley wall because the Shallow Aquifer becomes thinner and only the A-Zone is present.

Groundwater migration through the Duwamish Valley Aquifer is through both the A-Zone and the B-Zone.

1.3 COORDINATION AND RESPONSIBILITIES

Long-term groundwater monitoring is conducted Settlement Area-wide by the Site Coordinator. The following sections define the roles required for compliance with this GWMCP; one person may perform more than one role. Roles are discussed in Section 2.0 of the OMMP and that language governs. The language below is intended to clarify those roles for groundwater monitoring. To accomplish the work to be performed under this GWMCP in the most efficient manner, certain parties have elected to take the lead in performing various aspects of the work required. Language in this GWMCP reflects this agreement. However, the potentially liable persons (PLPs) who signed the Consent Decree remain strictly, jointly, and severally liable for the performance of any and all obligations under this GWMCP. In the event the party identified as a lead should fail to timely and properly complete performance of all or any portion of its work, the other party or parties must perform that remaining work, if any.

1.3.1 Parcel Owners

The Parcel Owner is responsible for filing an Environmental (Restrictive) Covenant on their property and for compliance with the Environmental (Restrictive) Covenant, which includes prohibitions and requirements on groundwater use, groundwater monitoring, access, and noninterference with remedial action.

1.3.2 Subject Potentially Liable Persons

The PLPs who have signed onto the Consent Decree (referred to as “Subject PLPs”) are responsible for compliance with the CAP including the OMMP, communications with Washington State Department of Ecology (Ecology), and for reporting of on-parcel activities.

Subject PLPs who are also Parcel Owners will be responsible for implementing the CAP requirements at the parcel for which they are the owner.

Under the terms of the CAP, if groundwater contingent actions are triggered during monitoring, the Subject PLPs will be responsible for working with Ecology to develop an approach, scope of work, and schedule consistent with the CAP requirements and later sections of this GWMCP.

1.3.3 Site Coordinator

The Site Coordinator is responsible for Settlement Area-wide monitoring, including the quarterly site-wide groundwater monitoring events, and for annual reporting. Additional clarification of his or her duties exists in the CAP, OMMP, and in later sections of this GWMCP.

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2.0 Long-Term Groundwater Monitoring

The discussion in this section is intended to establish expectations regarding the scope of the groundwater monitoring program. A Sampling and Analysis Plan (SAP) with an associated Quality Assurance Project Plan (QAPP) for the GWMCP are provided in Exhibit A.3.1.

With Ecology's written approval, the GWMCP may be modified in the future as needed to support long-term monitoring as detailed in Section 2.3 of the OMMP (OMMP Updates and Revisions). Modifications may include changes in the monitoring well network, analytical requirements, or sampling frequency, and will be conducted in accordance with the OMMP and Consent Decree requirements.

2.1 MONITORING WELL NETWORK

A long-term groundwater monitoring well network at and near the Settlement Area includes 14 wells, as described in this section. The existing monitoring well network will be used to monitor groundwater conditions at, and downgradient of, the Settlement Area. The locations of the wells are shown on Figure A.3.1, and the wells are described in Table A.3.1.

Table A.3.1
Monitoring Well Network

Monitoring Well	Location	Zone	Screened Interval (feet bgs)
Upgradient Wells Representing Quality of Groundwater Entering the Landfill			
MW-12	Upgradient	A-Zone	10–15
MW-14	Upgradient	A-Zone	11.5–21.5
MW-29	Upgradient	A-Zone	20–30
Downgradient Wells Representing Conditions at the Edge-of-Refuse (POC wells)			
MW-18	Edge-of-refuse	B-Zone	30–40
MW-25	Downgradient	A-Zone	22–27
MW-32	Edge-of-refuse	A-Zone	19–24
MW-33	Edge-of-refuse	A-Zone	20–25
MW-26	Downgradient	A-Zone	15–25
MW-27	Downgradient	A-Zone	10–20
MW-10	Downgradient	B-Zone	35–45
MW-24	Downgradient	B-Zone	35–45
MW-08	Downgradient	B-Zone	35.5–45.5
Downgradient Wells Representing Conditions near the Former Glitsa Property			
MW-30	Downgradient	Perched Zone	8–13
MW-31	Downgradient	A-Zone	18–23

Abbreviations:
bgs Below ground surface
Glitsa Glitsa American, Inc.
POC Point of compliance

2.2 SETTLEMENT AREA-WIDE GROUNDWATER MONITORING COMPONENTS

Groundwater monitoring will consist of measuring groundwater levels, sampling groundwater for the site-specific COC (such as vinyl chloride and other relevant chemicals), and reporting the groundwater flow directions and laboratory analytical results for each monitoring event. Refer to the SAP/QAPP included as Exhibit A.3.1 for details regarding the monitoring components, field methods, and associated sampling procedures.

2.3 ANALYTICAL SCHEDULE

Groundwater samples will be analyzed for the COCs (vinyl chloride, iron, manganese, benzene, *cis*-1,2-DCE, and arsenic), and parameters useful for understanding geochemical conditions. These parameters, presented in Table A.3.2, shall be monitored during each routine groundwater monitoring event in accordance with the schedule provided in Section 2.4. After the first 10 years of monitoring, requests can be made by the Subject PLPs to the Ecology to decrease this analytical schedule (including locations and analytes), as appropriate.

Table A.3.2
Analytical Schedule

Chemical/Parameter	Analytical Method[1]	Monitoring Well
Vinyl chloride	SW846 – 8260 Short List	All wells
Iron, total	SW846 –6020 Short List	All wells
Manganese, total	SW846 – 6020 Short List	All wells
Benzene	SW846 – 8260 Short List	MW-25
cis-1,2-DCE	SW846 – 8260 Short List	All wells
Arsenic, dissolved	SW846 – 6020 Short List	MW-12, MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27, MW-32, and MW-33
Specific conductivity	Field parameter	All wells
pH	Field parameter	All wells

Notes:
1 An equivalent, U.S. Environmental Protection Agency-approved method may be substituted.

2.4 MONITORING FREQUENCY

Long-term monitoring will have the following schedule:

Years 1 through 5: Monitoring will occur quarterly but be reported annually unless a contingency trigger occurs. Long-term groundwater monitoring will include vinyl chloride, iron and manganese, cis-1,2-DCE (the precursor for vinyl chloride) in wells where vinyl chloride is measured, benzene in one well in the northern part of the landfill (MW-25) to track a localized plume that appears to originate in upgradient of the Settlement Area, and arsenic in wells MW-12, MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27, MW-32, and MW-33. Note that MW-27 is not a CPOC well for arsenic. If benzene remains in compliance in MW-25 for 2 years (eight additional quarters), benzene analysis would be terminated. If iron and manganese concentrations are stable or decreasing for 2 years (eight additional quarters) decreased frequency of monitoring may be requested. If arsenic remains in compliance in MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-32, and MW-33 for 2 years (eight additional quarters), arsenic analysis would be terminated.

Years 6 through 10: Monitoring will occur semi-annually in the wet and dry seasons, but wells that have been in compliance for the previous 2 years would be dropped from the sampling requirements. The list of analyses would also be decreased to field parameters and those COCs that remain out of compliance. Monitoring results would be reported annually unless a contingency trigger occurs.

Year 11 and below: Monitoring would continue on an annual basis, if and only if one or more wells remained out of compliance. Monitoring would be limited to those wells and COCs that are not in compliance. Monitoring results would be reported annually unless a contingency trigger occurs.

2.5 UNFORESEEN EVENTS

An unforeseen emergency or extreme weather event, such as earthquakes, fires, or floods, or other natural or man-made disaster would trigger an inspection of the monitoring well network. Such unforeseen events could cause a sudden differential settlement of the cap that could affect the integrity of the monitoring wells. The following criteria for unforeseen events would trigger an inspection of the monitoring well network.

- An earthquake along the Seattle fault that registers 4.0 or greater on the Richter scale.
- An earthquake within 100 miles of Seattle that registers 5.0 or greater on the Richter scale.

- A flood or major storm that produces greater than 3.0 inches of rainfall within a 24-hour period.
- Any fire that occurs on or below the cap.
- Any other damage in the area of the Settlement Area observed by the parcel owners and facility owners or the public, such as damage sustained by high winds, facility, or vehicular accident.

If any of the above unforeseen events occur, then the Site Coordinator should schedule an inspection of the monitoring well network with the appropriate personnel as soon as safe and practical (generally within a few weeks). If the integrity of critical monitoring wells is significantly compromised as a result of an unforeseen event, Ecology must be notified and repairs or replacement must be initiated as soon as practicable.

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3.0 Groundwater Contingency Action Triggers

The landfill has been closed for almost 50 years, and groundwater conditions over the last decade indicate that only vinyl chloride, arsenic, iron, and manganese exceed the groundwater cleanup levels (CULs) at the CPOC; and that these concentrations are continuing to decrease slowly by means of natural attenuation. A long-term groundwater monitoring well network at and near the Settlement Area includes 14 wells. This existing well network will be used to monitor groundwater conditions at, and downgradient of, the Settlement Area. Contingency action is discussed in Section 6.2.4 of the CAP and that language governs. The language below is intended to repeat the language for ease of use in this document. A flow-chart outlining the contingency plan is included as Figure A.3.2.

3.1 TRIGGER CONDITIONS FOR VINYL CHLORIDE

Two conditions that will trigger contingent actions will be monitored in the existing compliance monitoring well network:

- **Condition 1.** Condition 1 (the concentration trigger) is based on groundwater concentrations. In about half of the downgradient wells, the vinyl chloride concentrations exceed the CUL of 0.29 micrograms per liter (µg/L), with concentrations in one well (MW-25) fairly consistently between 0.7 and 1.4 µg/L. If concentrations in any downgradient well exceed 1.45 µg/L (5 times the CUL) for two consecutive sampling events, this constitutes Condition 1, and a contingent response is triggered. This trigger is not applied to MW-30 and MW-31, whose concentrations are affected by a non-landfill source in addition to the landfill.
- **Condition 2.** Condition 2 (the trend trigger) is based on the trend of groundwater concentrations over time in the monitoring wells. Condition 2 is reported using trend plots supported with simple statistical tools in ProUCL.[1] Condition 2 is designed to capture statistically meaningful increases in groundwater concentrations. The trend identification will use a well-established, non-parametric statistical method for trend analysis available in ProUCL called the Mann-Kendall method and will be applied to downgradient wells where the concentration of vinyl chloride is greater than the CUL. The trend analysis will include MW-31 (which is screened in the alluvial aquifer), but not MW-30 (which is screened in the Silt Overbank Deposit). The trend test will be performed at a 95 percent confidence interval.

[1] ProUCL is currently approved by Ecology for use for this test. Other software may be used in the future but will require approval by Ecology.

3.2 CONTINGENT RESPONSES TO TRIGGER CONDITIONS

If either or both of the trigger conditions occur, the following actions will be implemented:

1. Ecology will be notified within 30 days of data validation to report that a trigger condition has occurred.
2. Within 90 days of the notification, the Subject potentially liable persons (PLPs) will submit a written evaluation that considers the following:
    a. Is the cause of the trigger event (source of the contamination) known?
    b. Does it likely represent a transient condition or a new condition?
    c. Do the data indicate that the most likely source is the Settlement Area?
    d. Does a focused exposure assessment indicate an exposure threat to human health or the environment?
    e. If the source is likely within the Settlement Area, what actions are appropriate at this time? Actions may include, but are not limited to, one or more of the following:
        i. Continued monitoring to confirm that it is a transitory effect. For example, construction that disturbs the Silt Overbank Deposit may cause a short-term increase that may be acceptable to Ecology as part of the construction project.
        ii. Modified sampling to understand the cause or source.
        iii. Changes in operations of landfill gas systems.
        iv. Changes in some site-related activity, if practicable.
        v. Additional investigation at the Site.
        vi. Confirmation that natural attenuation conditions are stable and favorable and possible implementation of in situ modification (such as the addition of a reducing agent or microbial enhancement), if needed.
        vii. Pump and/or treat if determined to be appropriate and effective.
        viii. Other technologies that are appropriate to the situation.
    f. If additional remedial action beyond the above actions is considered, it will be evaluated in a manner consistent with a focused feasibility study under MTCA, leading to a proposed corrective action.

If an increasing trend is observed for MW-31, the following actions will be implemented:

1. Ecology will be notified within 30 days of data validation to report that a trigger condition has occurred.

2. Because monitoring wells MW-25, MW-32, and MW-33 are between the Settlement Area and MW-31, if an increasing trend is observed in MW-31, the concentrations at these wells will be evaluated to determine if the source could be the Settlement Area or if it is another location. If concentrations at the Settlement Area indicate that the probable source is the Settlement Area, the Subject PLPs will proceed with the action in 2e above. If Ecology determines the data at the Settlement Area indicates that the Settlement Area is not the cause of the increasing trend, it is Ecology's expectation that no additional action is required under the Consent Decree.

3.3 CONTINGENT TRIGGERS AND ACTIONS FOR IRON AND MANGANESE

Iron and manganese are elevated at concentrations greater than background in several downgradient CPOC wells, as discussed in Section 4.2 of the CAP. Trend plots shown in Appendix J of the Remedial Investigation/Feasibility Study indicate that concentrations are slowly decreasing and are expected to come into compliance within 10 years (Floyd|Snider et al. 2017). As long as the concentrations are stable or decreasing, no further action is required beyond monitoring. If concentrations are showing an increasing trend, monitoring will continue while the Subject PLPs and Ecology evaluate the situation to determine next steps. Once a dataset of eight quarterly events has been collected for iron and manganese during long-term monitoring, Ecology may approve a decreased frequency of monitoring for iron and manganese.

3.4 CONTINGENT TRIGGERS AND ACTIONS FOR ARSENIC

There are known cement kiln dust deposits upgradient of the Edge of Refuse on the KIP parcel, and downgradient of the Edge of Refuse east of 5th Avenue South (see Figure 5.13 of the 2017 Remedial Investigation/Feasibility Study). As long as the concentrations of arsenic are stable or decreasing in downgradient wells MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-32, and MW-33, no further action is required beyond monitoring. If arsenic remains in compliance with the CUL for 2 years (eight additional quarters), arsenic analysis would be terminated.

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4.0 Health and Safety

Groundwater sampling personnel must follow general health and safety procedures while performing groundwater monitoring activities at the Settlement Area. Each facility that comprises the Settlement Area will have vehicular traffic and other potential hazards associated with active operation. Sampling personnel must be aware of these hazards and take appropriate precautions while performing the work outlined in this GWMCP. At a minimum, personnel performing routine groundwater monitoring must wear a high visibility safety vest at all times and should be aware of traffic patterns and facility operations. If work on a specific parcel or facility requires other specific personal protective equipment (PPE), such as a hard hat or steel-toed boots, then the additional PPE requirements must be met to complete the sampling.

Groundwater monitoring will be conducted in accordance with a site-specific Health and Safety Plan, which will be prepared by the Site Coordinator prior to conducting monitoring.

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5.0 Reporting and Record Keeping

To document compliance with the GWMCP, the Site Coordinator must maintain and compile the following records after the completion of the monitoring event:

- Routine monitoring field forms/notes
- Analytical reports
- Updated trend plots for vinyl chloride, benzene, cis-1,2-DCE, arsenic, iron, and manganese.
- Groundwater level measurements and updated groundwater contour maps
- Well maintenance records, if necessary, which should include a description of the maintenance performed and reason/type of repair, as well as photographic documentation, if appropriate

In accordance with the OMMP, the results of the long-term groundwater monitoring will be reported annually, unless a trigger condition occurs, which would require special reporting considerations, discussed in Section 3.0. The OMM Annual Report will be due on March 31 of each year for the previous calendar year's sampling. A brief discussion of any important or relevant changes in the Settlement Area conditions will be included in the annual monitoring reports. The Site Coordinator is responsible for compiling the necessary site-wide OMM documentation and submittal of the OMM Annual Report.

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6.0 References

Floyd|Snider, Aspect Consulting, Herrera, and BHC Consultants. 2017. *Remedial Investigation/ Feasibility Study*. Prepared for City of Seattle and South Park Property Development, LLC. July.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Figures

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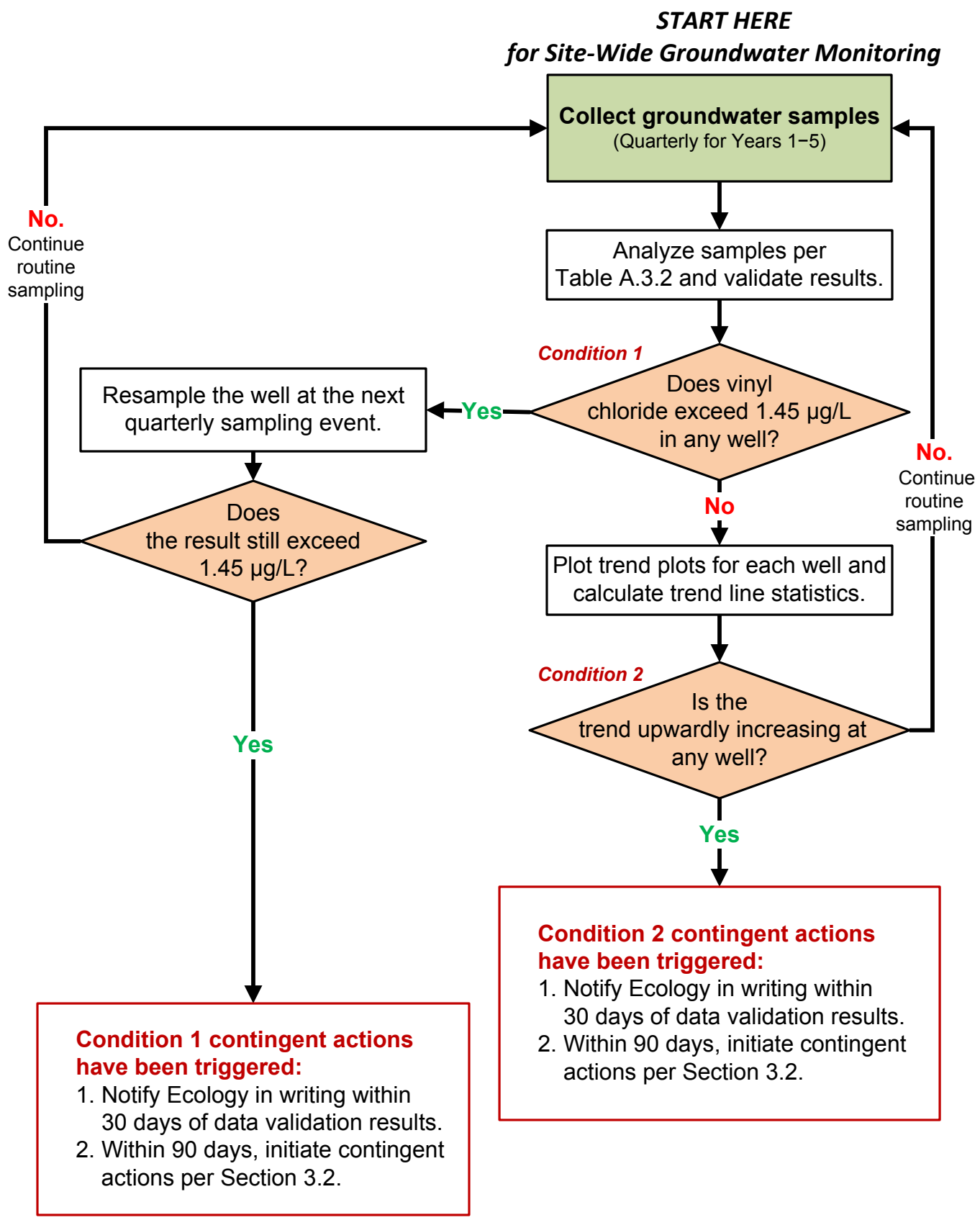
Cleanup Action Plan
OMMP
South Park Landfill
Seattle, Washington

Attachment A.3: Groundwater Monitoring and Contingency Plan
Figure A.3.1
Perimeter Groundwater Monitoring Well Network

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\GWMCP\Figure A.3.1 Perimeter Groundwater Monitoring Well Network.mxd
2/12/2018



Abbreviations: Ecology = Washington State Department of Ecology; µg/L = micrograms per liter; OMMP = Operations, Maintenance, and Monitoring Plan

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Attachment A.3: Groundwater Monitoring and Contingency Plan
Figure A.3.2
Flow Chart for Triggers and Contingent Actions for Groundwater Monitoring

F:\projects\COS-SPARK\5000 - CAP\06 SPARK CAP Public Review Final\04 Appendix A OMMP\Attachment A.3 Groundwater MCP\02 Figures\Figure A.3.2 GW Contigency Plan Flowchart 2017-0929.vsd

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Exhibit A.3.1
Sampling and Analysis Plan and Quality Assurance Project Plan

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List of Abbreviations/Acronyms

Acronym/ Abbreviation	Definition
°C	Degrees Celsius
CAP	Cleanup Action Plan
COC	Chemical of concern
CPOC	Conditional point of compliance
CUL	Cleanup level
DCE	Dichloroethene
DQO	Data quality objective
Ecology	Washington State Department of Ecology
EDD	Electronic data deliverable
GWMCP	Groundwater Monitoring and Contingency Plan
LNAPL	Light non-aqueous phase liquid
MTCA	Model Toxics Control Act
PLP	Potentially liable person

Acronym/ Abbreviation	Definition
POC	Point of compliance
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
redox	Oxidation-reduction (potential)
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

1.0 Introduction

This Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) presents the specific quality assurance/quality control (QA/QC) procedures associated with the long-term groundwater monitoring recommended in the Groundwater Monitoring and Contingency Plan (GWMCP), which is Attachment A.3 of the Operations, Maintenance, and Monitoring Plan (OMMP), which is Appendix A of the Cleanup Action Plan (CAP) for the Settlement Area portion of the South Park Landfill Site located in Seattle, Washington (Floyd|Snider et al. 2017).

This SAP/QAPP provides guidance for field personnel regarding sampling, sample handling and storage, chain-of-custody, laboratory and field analyses, and documentation and reporting. It was developed in accordance with guidance from the Washington State Department of Ecology (Ecology; Ecology 2004) and the Washington State Model Toxics Control Act (MTCA), Washington Administrative Code (WAC), Section 173-340.

1.1 BACKGROUND

Based on the historical groundwater quality data and the Remedial Investigation/Feasibility Study (RI/FS; refer to Section 5.6 of the RI/FS [FloydSnider et al. 2017]), vinyl chloride, iron, and manganese are groundwater chemicals of concern (COCs) that are out of compliance at the site because of detected concentrations that exceeded the cleanup levels (CULs). Three other COCs (benzene, arsenic, and *cis*-1,2-dichloroethene [DCE]) will be monitored to confirm that their concentrations are less than their respective groundwater CULs. The evaluation of potential remedial alternatives (refer to Section 13.5 of the RI/FS) resulted in the selection of a preferred remedial action consisting of long-term groundwater monitoring with contingent action if concentrations from the Settlement Area increase in the future.

1.2 CLEANUP LEVELS AND POINTS OF COMPLIANCE

As defined in the MTCA regulations, the cleanup standard for a contaminated site consists of the CULs and the location(s) at which the CULs apply (i.e., the point of compliance [POC]). The POC for groundwater monitoring that is part of the landfill closure is defined as the edge-of-refuse, which under MTCA is considered a conditional POC (CPOC). At the Settlement Area, several downgradient monitoring wells are located at the edge-of-refuse within the Settlement Area boundary. These wells will be used as a CPOC because no other wells are located immediately downgradient beyond the Settlement Area boundary. For further details, refer to Section 5.6.2 of the RI/FS.

The CPOC for groundwater at the Settlement Area is located along the downgradient edge-of-refuse, which includes the following monitoring wells: MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27 (not CPOC for arsenic), MW-32, and MW-33 (Figure 1).

The site-specific CULs for groundwater at the Settlement Area, which are based on the protection of groundwater as a potential drinking water source, are indicated in the following table.

Chemical	Cleanup Level
Vinyl chloride (COC)	0.29 µg/L
Iron (Total)	27 mg/L (A-Zone) 31 mg/L (B-Zone)
Manganese (Total)	2.1 mg/L (A-Zone) 1.1 mg/L (B-Zone)
cis-1,2-DCE	16 µg/L
Benzene	5.0 µg/L
Arsenic	5.0 µg/L (background)

Abbreviations:
µg/L Micrograms per liter
mg/L Milligrams per liter

1.3 PROJECT RESPONSIBILITIES

Under the authorization of the potentially liable persons (PLPs), the Project Team will perform the field activities described in this SAP/QAPP. An accredited laboratory will be the primary project laboratory, performing all the environmental laboratory analyses. The various management, QA, laboratory, and field responsibilities of key project personnel are defined below.

1.3.1 Management Responsibilities

Team Project Manager

The Project Manager will have overall responsibility for project implementation. The Project Manager will be responsible for the overall QA on this project, ensuring that it meets the technical and contractual requirements. The Project Manager will report directly to the PLPs and is responsible for technical QC and project oversight.

The Project Manager will perform the following:

- Monitor project activity and quality.
- Provide an overview of field activities to the PLPs.
- Provide technical presentations of project activities.

- Communicate with the PLPs and Ecology.
- Approve the SAP/QAPP.

1.3.2 Quality Assurance Responsibilities

Team Data Quality Assurance Manager

The Data QA Manager will report directly to the Team Project Manager and will be responsible for ensuring that the data QA/QC procedures established for this project are followed. The Data QA Manager will be responsible for the data validation of all sample results from the analytical laboratories. Additional responsibilities include the following:

- Providing an oversight and review of field QA/QC.
- Coordinating the supply of performance evaluation samples and review results from performance audits.
- Reviewing laboratory QA/QC data.
- Advising on data corrective action procedures.
- Reviewing lab and data reports and preparing the QA/QC reports.
- Representing QA/QC of project activities.

1.3.3 Laboratory Responsibilities

A qualified laboratory will provide all of the analytical services in support of the site-wide long-term groundwater monitoring activities.

Laboratory Project Manager

The Laboratory Project Manager will report directly to the Data QA Manager and will be responsible for the following:

- Ensuring that all resources of the laboratory are available.
- Advising the Data QA Manager of laboratory status.
- Reviewing and approving final analytical reports.
- Coordinating laboratory analyses.
- Supervising in-house chain-of-custody procedures.
- Scheduling sample analyses.
- Overseeing data review.

1.3.4 Field Responsibilities

Team Field Quality Assurance Officer

The Field QA Officer will be responsible for leading and coordinating the day-to-day activities in the field. The Field QA Officer will report directly to the Team Project Manager.

Specific responsibilities include the following:

- Coordinating day-to-day with the Team Project Manager.
- Developing and implementing work plans and establishing the field schedule.
- Coordinating and managing field staff, including sampling personnel.
- Reviewing technical data provided by the field staff, including field measurement data.
- Adhering to the work schedule.
- Coordinating and overseeing subcontractors.
- Identifying problems, resolving difficulties in consultation with the Team Project Manager, implementing and documenting corrective action procedures, and acting as a liaison for communications between the team and upper management.
- Preparing the data reports.

2.0 Groundwater Sampling and Analysis Plan

The requirements and objectives of long-term groundwater monitoring, described in Section 6.2.4 of the CAP, can be met by means of the groundwater sampling program described the Groundwater Monitoring and Contingency Plan in the OMMP and in this section.

Long-term groundwater monitoring is intended primarily to monitor groundwater quality and water levels. The monitoring locations, sample collection details, and reporting requirements are discussed in the following subsections.

2.1 MONITORING WELL NETWORK

A summary of the monitoring wells to be used for long-term groundwater monitoring is provided in Table 1 and Figure 1. In addition to the POC wells (MW-08, MW-10, MW-18, MW-24, MW-25, MW-26, MW-27, MW-32, and MW-33), the monitoring well network also includes monitoring wells used to monitor upgradient groundwater conditions (MW-12, MW-14, and MW-29) and downgradient monitoring wells used to monitor groundwater conditions adjacent to the former Glitsa American, Inc., property (MW-30 and MW-31).

As discussed in Section 5.1 of the RI/FS, the monitoring wells have been completed primarily in one of three groundwater zones (Perched Zone, A-Zone, or B-Zone), all of which are part of the Shallow Aquifer. The Perched Zone is a thin discontinuous layer of groundwater above the Silt Overbank Deposit, which can often be in contact with solid waste and is, therefore, conceptually equivalent to leachate in those locations. The A-Zone is immediately below the Silt Overbank Deposit and is the critical zone where leachate (and perched water) can enter the groundwater system and move off-site. The B-Zone represents the base of the Shallow Aquifer, overlying finer grained estuarine deposits and is where dense non-aqueous phase liquids would accumulate, if present. Well construction logs for the wells in the monitoring well network are provided in Attachment A.

2.2 SITE-WIDE GROUNDWATER MONITORING COMPONENTS

Groundwater monitoring will consist of measuring groundwater levels, sampling groundwater for the site-specific COC and other relevant chemicals, and reporting the groundwater flow directions and laboratory analytical results for each monitoring event. This section summarizes the monitoring components, the monitoring schedule, and the reporting requirements.

2.2.1 Groundwater Level Measurements

Groundwater levels will be measured to provide an indication of groundwater elevations, flow directions, and gradients. A complete round of applicable groundwater levels will be measured

by hand before groundwater sampling begins. This will include both the monitoring well network in Table 1 and any remaining interior wells.[1] Groundwater levels will be measured with a precision of 0.01 foot using an electric water level indicator. All groundwater level measurements will be made relative to the surveyed top of the polyvinyl chloride (PVC) well casing or other defined measuring point at the wellhead. The water level indicator will be lowered to contact the water in the well casing (contact determined by a light or sonic alarm on the indicator) and the reading will be noted. The indicator will then be immediately withdrawn from the water and the measurement repeated. If the two readings are consistent (i.e., within 0.1 foot of each other), the reading will be recorded on the Groundwater Sampling Record (provided in Attachment B), along with the measurement date and time. If the two readings are not consistent, the measurements will be repeated until a reproducible result is obtained.

After each groundwater level measurement is completed and before the next measurement, the water level indicator will be decontaminated according to the following procedure:

1. Rinse and preclean in potable water.
2. Wash in a solution of laboratory-grade non-phosphate soap (for example, Liquinox) and potable water.
3. Rinse with distilled water.

In instances where light non-aqueous phase liquids (LNAPLs) are present, as historically noted in Well KMW-05, the thickness of the LNAPL will be measured using an oil-water interface probe in accordance with the procedures discussed above.

2.2.2 Sampling Methods

Groundwater samples will be collected according to low-flow sampling procedures using either a dedicated bladder pump or a peristaltic pump with disposable low-density polyethylene and silicon tubing as outlined in Table 1. Using low-flow sampling procedures, the monitoring wells will be purged at a flow rate of 500 milliliters/minute or less to obtain samples that are representative of the groundwater conditions.

During well purging, field parameters, including temperature, pH, specific conductivity, dissolved oxygen, and oxidation-reduction (redox) potential will be monitored at 3- to 5-minute intervals until the readings stabilize, using a calibrated multiparameter probe with a flow-through cell or equivalent. Of these parameters, dissolved oxygen and redox potential are considered the most important because they determine the redox conditions of the groundwater, which plays an important role in the potential natural attenuation of the COCs. Because dissolved oxygen and redox potential are also expected to take the longest to stabilize, stabilization is defined as three

[1] Some interior wells will be decommissioned and abandoned as part of redevelopment and cleanup.

successive readings where dissolved oxygen varies by less than 10 percent, and redox potential varies by less than 10 millivolts. Additional stability criteria include variations of 0.5 degrees Celsius (°C) for temperature, 10 percent for specific conductivity, and 0.1 unit for pH. Flow rate (and depth to water, if possible) will also be measured during well purging. In addition, sampling, a turbidity measurement will be collected to help evaluate the groundwater quality and evaluate the function of the monitoring well. All field measurements will be documented on the Groundwater Sampling Record (provided in Attachment B) for each well (electronic forms, including those that download directly into a database, are also acceptable).

The groundwater samples will be collected directly from the pump discharge line upstream of the flow-through cell by filling the laboratory-provided bottles at the same low-flow purge rate.

Samples will be stored in a cooler with ice in order to maintain the samples at a temperature of approximately 6°C until delivery to a certified Washington State laboratory. A chain-of-custody form will be completed for each sample location, indicating the sample identification, number of bottles collected, date and time of collection, and analysis to be performed at the laboratory. The samples will be labeled as described in Section 3.2.

Field duplicates will be collected at a frequency of approximately 10 percent or fraction thereof of the total number of sample locations per sampling event, exclusive of other QC samples. Field duplicates will be collected under the same conditions as the primary samples. The field duplicates will be labeled as described in Section 3.2.

2.2.3 Analytical Parameters

Groundwater samples will be analyzed for the vinyl chloride, iron, manganese, *cis*-1,2-DCE, benzene, and arsenic (Table 2). The analytical methods, reporting limits, and sample collection and preservation requirements are discussed in Section 3.0.

2.2.4 Management of Investigation Derived Wastes

All water from the well purging and decontamination wash water will be collected and stored in 55-gallon drums, which will be stored on-site at a location indicated by the PLPs. The drums will be clearly labeled with a description of the contents and designated as nonhazardous waste. The water will be characterized based on the analytical results from the quarterly groundwater monitoring events. Periodically, the Project Team will coordinate the disposal of the water at an appropriate facility.

Disposable materials (e.g., nitrile gloves and empty tubing) used during the field work that do not contain significant contaminants may be disposed of as conventional refuse.

2.3 MONITORING SCHEDULE

Long-term groundwater monitoring will initially be conducted quarterly, beginning 180 days after the effective date of the Consent Decree. The groundwater monitoring schedule will continue as described in the main text of the GWMCP.

2.4 REPORTING REQUIREMENTS

The results of the long-term groundwater monitoring will be reported annually, unless a trigger condition occurs, which would require special reporting considerations that are discussed in the GWMCP. The annual report will be due on March 31 of each year for the previous calendar year's sampling. The report will contain the following:

- Groundwater analytical results
- Trend plots for vinyl chloride as required to evaluate the potential for contingent action as discussed in the GWMCP
- Groundwater level data
- Groundwater contour maps

A brief discussion of any important or relevant changes in the site conditions will be included in the annual monitoring event reports.

3.0 Quality Assurance Project Plan

3.1 DATA QUALITY OBJECTIVES

This section describes the data quality objectives (DQOs) to be used during the long-term groundwater monitoring at the Settlement Area, per the requirements in WAC 173-340-820.

The overall goal of the DQOs is to ensure that the data are of known and defensible quality. This section describes the procedures for field sampling, provides the chain-of-custody protocols, indicates the laboratory analyses to be performed, and describes the data verification and validation procedures, and outlines the reporting requirements to ensure that the DQOs are met. The DQOs of the long-term groundwater monitoring plan are the following:

- Collect high quality and verifiable data
- Use resources cost-effectively
- Collect data that are suitable for their intended use by the PLPs and Ecology

To achieve the long-term groundwater monitoring plan objectives, data quality indicators of precision, accuracy (bias), comparability, completeness, representativeness, and sensitivity are used to assess the DQOs.

The Project Team will conduct a technical review of the QA and QC features to ensure compliance with this QAPP and perform an overall assessment of the data collected as part of this project.

3.2 SAMPLE COLLECTION AND ANALYSIS

The groundwater samples (Table 1) including field and QC samples will be collected and analyzed by an accredited laboratory using applicable analytical test methods for monitoring groundwater quality. Samples will be collected from each well using low-flow sampling techniques and placed in new sample bottles beginning with the most sensitive (e.g., volatile) parameters.

The samples will be labeled at the time of sampling, and the labels will include sample name, location, date, time, sampler's initials, analyte, and preservatives if any are used.

Samples will be given unique identifiers according to the following naming structure.

SPL-GW-###-mmyy

Where:

SPL-GW	Identifies the sample as Settlement Area groundwater.
###	Identifies the monitoring well type and number (e.g., KMW05 or MW30).
mmyy	Indicates month and year sample was collected (e.g., 0313 for March 2013).

A fictitious identification identifier will be assigned to the two types of QA/QC samples (field duplicate and trip blank), using the following sample number ranges. Consecutive numbers will be required beginning with the lower limit of the range for each QA/QC sample type.

QA/QC Sample Type	Identifier Range
Field duplicate	MW60 to MW69
Trip blank	MW80 to MW89

Samples will be handled (including containerization and preservation, in accordance with Table 2), temporarily stored, and transported in a manner that preserves the nature and integrity of the sample and complies with chain-of-custody protocols and documentation.

Groundwater samples will be analyzed by SW-846 8260C for a custom list of analytes (Table 2), and by USEPA 6020.

To generate data of sufficient quality, the following approach for groundwater samples will be followed:

- Field and laboratory QC samples (field replicates, trip blanks, and temperature blanks) will be used for assessing data quality.
- Laboratory QA will be implemented and maintained as described in the accredited laboratory's Quality Assurance Plan and Standard Operating Procedures and in Table 3.
- Data summary packages will be generated and the documentation provided will be sufficient to perform a Level I data quality review.
- Data quality review will be performed on the analytical data according to the procedures specified below.

Data quality will be validated in accordance with the U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program guidelines (USEPA 2014, 2004, and 1999).

While a best effort will be made to achieve the project DQOs, there may be instances in which it is not possible to meet the specified objectives. Limitations in data quality due to analytical problems (e.g., elevated detection limits due to matrix effect) will be identified within 48 hours of the initial analysis and brought to the attention of the Team Project Manager. If necessary, corrective measures will be determined and implemented. The accredited laboratory will document the problem, the correction, and the results. In addition, this information will be discussed in the data validation report.

3.3 FIELD DOCUMENTATION

Field event and sample documentation will include the following information on field sampling log sheets or a project-specific field notebook:

- Sampling personnel
- Daily equipment calibration
- Equipment decontamination steps (if not dedicated or single use)
- Weather conditions
- Static water level
- Purging rate and volume
- Field parameters (pH, specific conductivity, turbidity, redox potential, temperature, and dissolved oxygen)
- Sampling times, bottle types, and preservation
- Physical appearance and odor of sample
- Presence of free product

The Project Team will file and maintain field logbooks, subcontractor reports, photographs, and sampling logs, chain-of-custody documents, laboratory reports, data validation reports and supporting documentation, and final versions of monitoring reports.

3.4 DATA MANAGEMENT PROCEDURES

Groundwater sample collection form or notebook requirements will include name of project/location, identities of field personnel, sequence of events, changes to the plan, site and atmospheric conditions, number of samples collected, sample details (date, time, location, sample identification, and description), instrument calibration procedures, field measurement results, identification of QC samples, and unusual circumstances that could affect interpretation of the data.

The groundwater monitoring data will include groundwater elevation measurements and analytical data. Data management will consist of database generation, data receipt, and input of field and analytical data, as well as other data generated during groundwater monitoring activities, and data presentation. The accredited laboratory will provide an electronic data deliverable (EDD) in the format specified by the Project Team. The accredited laboratory will also provide laboratory reports that contain a case narrative, description of any correction actions taken, changes to referenced methods, and an explanation of data qualifiers.

Upon data verification and validation (discussed below), the site data will be submitted to Ecology's Environmental Information Management (EIM) database.

3.5 DATA QUALITY, VERIFICATION, AND VALIDATION

Field and laboratory data results will be verified to ensure the following:

- Proper sample collection and handling protocols are followed.
- Holding times are met and sample receiving conditions documented.
- Laboratory data packages are complete and free of transcription errors or misidentifications.
- Complete EDD is delivered in an appropriate format.
- Chain-of-custody and sample receipt documentation is complete.
- Compound quantification and detection limits are appropriate.
- Method or trip blank results do not adversely affect the data results.
- Surrogate recovery values are within the acceptable range.
- Field and laboratory duplicate analysis is within the acceptable range.
- Laboratory data qualifiers are justified.
- Data results are complete and accurate.
- Established criteria for QA/QC are met.

The data quality review process for this project will follow the procedures in USEPA guidelines (USEPA 1999, 2014), as appropriate, but applicable to Method SW-846, this QAPP, method standard operating procedures, and professional judgment.

4.0 References

Floyd|Snider, Aspect Consulting, Herrera, and BHC Consultants. 2017. *Remedial Investigation/ Feasibility Study*. Prepared for City of Seattle and South Park Property Development, LLC. July.

Washington Department of Ecology (Ecology). 2004. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*. Publication No. 04-03-030. July

U.S. Environmental Protection Agency (USEPA). 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. EPA 540-R-99-008. Office of Emergency and Remedial Response. October.

_____. 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* OSWER 9240.1-45, EPA 540-R-04-004. Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, D.C. October.

_____. 2014. *USEPA National Functional Guidelines for Superfund Organic Methods Data Review (SOM02.2)*. EPA-540-R-14-002. Office of Superfund Remediation and Technology Innovation. August.

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Exhibit A.3.1
Sampling and Analysis Plan and Quality Assurance Project Plan

Tables

Table 1
Groundwater Monitoring Network

Well Name	Proposed POC Well	Location	Aquifer Zone	Groundwater Elevation	Chemical Analyses	Sample Collection Method
Groundwater Quality and Elevation Monitoring						
Upgradient Wells Representing Quality of Groundwater Entering the Site						
MW-12	No	Upgradient	A-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-14	No	Upgradient	A-Zone	Yes	Fe, Mn, DCE, VC	Bladder pump
MW-29	No	Upgradient	A-Zone	Yes	Fe, Mn, DCE, VC	Peristaltic pump
Downgradient Wells Representing Conditions at the Edge-of-Refuse						
MW-18	Yes	Edge of waste	B-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-25	Yes	Downgradient	A-Zone	Yes	B, A, Fe, Mn, DCE, VC	Bladder pump
MW-32	Yes	Edge of waste	A-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-33	Yes	Edge of waste	A-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-26	Yes	Downgradient	A-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-27	Yes[1]	Downgradient	A-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-10	Yes	Downgradient	B-Zone	Yes	A, Fe, Mn, DCE, VC	Peristaltic pump
MW-24	Yes	Downgradient	B-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
MW-08	Yes	Downgradient	B-Zone	Yes	A, Fe, Mn, DCE, VC	Bladder pump
Downgradient Wells Representing Conditions near Former Glitsa Property						
MW-30	No	Downgradient	Perched Zone	Yes	Fe, Mn, DCE, VC	Peristaltic pump
MW-31	No	Downgradient	A-Zone	Yes	Fe, Mn, DCE, VC	Bladder pump

Note:

1 MW-27 is not a CPOC well for arsenic.

Abbreviations:

B Benzene
A Arsenic
Fe Iron
Mn Manganese
Fe, Mn, DCE *cis* -1,2-Dichloroethene
Glitsa Glitsa American, Inc.
POC Point of compliance
VC Vinyl chloride

Table 2
Analytical Field Sample Requirements

Analysis	Method	Bottle Type	Preservative	Holding Time
Volatile Organic Compounds				
Benzene	SW-846 8260C	Three 40-mL vials, zero headspace	HCl to pH < 2.0, Cool to ≤ 6 °C	14 days, 7 days[1]
cis -1,2-DCE				
Vinyl chloride	SW-846 8260C SIM			
Metals				
Arsenic	USEPA 6020	One 1-L HDPE	HNO_3 to pH < 2.0	6 months
Iron	USEPA 6020			
Manganese	USEPA 6020			

Note:

1 When unpreserved.

Abbreviations:

°C Degrees Celcius
DCE Dichloroethene
HCl Hydrochloric acid
HDPE High-density polyethylene
HNO_3 Nitric acid
L Liter
mL Milliliter

Table 3
Data Quality Assurance Criteria

Parameter	Matrix	Reporting Limit/PQL	Precision	Accuracy	Completeness	Reference
Volatile Organic Compounds						
Benzene	Groundwater	0.2 µg/L	± 50%	± 50%	95%	SW-846 8260C
cis -1,2-DCE		0.2 µg/L				
Vinyl chloride		0.02 µg/L				
Monitored Natural Attenuation Parameters						
Arsenic	Groundwater	1 µg/L	± 20%	± 20%	95%	USEPA 6020
Iron		1 µg/L	± 20%	± 20%	95%	USEPA 6020
Manganese		1 µg/L	± 20%	± 20%	95%	USEPA 6020

Abbreviations:

DCE Dichloroethene
µg/L Microgram per liter
PQL Practical quantitation limit

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Exhibit A.3.1
Sampling and Analysis Plan and Quality Assurance Project Plan

Figure

FLOYD | SNIDER
strategy ▪ science ▪ engineering
Aspect CONSULTING
HERRERA

Cleanup Action Plan
OMMP
South Park Landfill
Seattle, Washington

Exhibit A.3.1: SAP/QAPP
Figure 1
Perimeter Groundwater Monitoring Well Network

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\OMMP\GWMCP\Figure 1 SAP QAPP Perimeter Groundwater Monitoring Well Network.mxd
2/12/2018

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Exhibit A.3.1
Sampling and Analysis Plan and Quality Assurance Project Plan

Attachment A
Monitoring Well Construction Logs

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-8 AKA MW-08	1 of 3

Project Name	South Park Custodial Landfill	Surface Elevation	12.88' NAVD 88
Location	King County	Water Depth (ft bgs)	4.5
Drilling Method	Hollow Stem Auger, 10.5" OD/6" ID	Start Date	December 7, 1998
Sampling Method	3" diameter, Split Spoon Sampler, 140 lb hammer	Finish Date	December 8, 1998

Depth feet	Well Construction	Methane	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
	Locking 8" steel monument						FILL
	Concrete seal						GRAVEL; gray; angular (GP)
							SILTY SANDY GRAVEL; brown-gray; subrounded to 1-inch diameter; moist, medium dense; no odors or discolorations (GM)
		0%		16 16 15			
	Bentonite chips						
	4.5 ft. bgs ATD 12/8/98, casing at 47.5 ft. bgs 5.02 ft. bgs 12/10/98						
5				3 2 6			SILTY SANDY GRAVEL; brown; wet, very loose; no odors or discoloration (GM)
				3 2 5			SAND; dark brown; some silt and gravel; wet, very loose to loose; no odors or discoloration (SP)
		0%					
10				4 4 6			
							RECENT ALLUVIUM
							SILTY SAND; gray; fine-grained; wet, loose; no odors or discoloration (SM)
	2" ID SCH 40 PVC Riser			5 8 10			
		0%					
15				7 5 18			
	Bentonite slurry 30% by weight						
				5 14 19			
		0%					SAND; black; fine to medium grained, trace silt and wood; wet, medium dense; no odors or discolorations (SP)

Sampler Type (ST):
- 3" Split Spoon Sampler
- No Recovery

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content
- ▽ ▼ Water Level (Date of Measurement)

Logged by: RSB
Approved by: JJS
Figure No. A-3

SPARKMW SPARKMW.GPJ August 18, 1999

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-8 AKA MW-08	2 of 3

Project Name	South Park Custodial Landfill	Surface Elevation	12.88' NAVD 88
Location	King County	Water Depth (ft bgs)	4.5
Drilling Method	Hollow Stem Auger, 10.5" OD/6" ID	Start Date	December 7, 1998
Sampling Method	3" diameter, Split Spoon Sampler, 140 lb hammer	Finish Date	December 8, 1998

Depth feet	Well Construction	Methane	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
				12 22 24			SAND; black; fine to medium grained, trace silt and wood; wet, medium dense; no odors or discolorations (SP)
		0%		7 10 14			
25	Bentonite slurry, 30% by weight						
		0%		11 17 21			
30							
		0%		14 24 33			
35	Well screen 2" ID SCH 40 PVC, 0.01" slot size						
	Filter pack, 10 x 20 Colorado silica sand	0%		12 17 14			

Sampler Type (ST):
- 3" Split Spoon Sampler
- No Recovery

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content
- ▽ ▼ Water Level (Date of Measurement)

Logged by: RSB
Approved by: JJS
Figure No. A-3

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SPARKMW SPARKMW.C

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-8 AKA MW1-08	3 of 3

Project Name	South Park Custodial Landfill	Surface Elevation	12.88' NAVD 88
Location	King County	Water Depth (ft bgs)	4.5
Drilling Method	Hollow Stem Auger, 10.5" OD/6" ID	Start Date	December 7, 1998
Sampling Method	3" diameter, Split Spoon Sampler, 140 lb hammer	Finish Date	December 8, 1998

Depth feet	Well Construction	Methane	ST	Blows/ 6"	Sample ID	Mll. Graphic	Description
							SILTY SAND; black; fine grained; wet, medium dense; no odors or discolorations (SM)
	Well screen 2" ID SCH 40 PVC, 0.01" slot size	0%		5 12 24			
45	Threaded end cap, 2" ID SCH 40 PVC						
	Bentonite chips						SAND; black; some silt; wet, medium dense (SP)
		0%		5 11 39			
50							Bottom of boring at depth 49 feet. Monitoring well installed to depth 45.59 feet. Soil sampler driven using 140-pound hammer falling 30-inches.
55							

Sampler Type (ST):

- 3" Split Spoon Sampler
- No Recovery

Lab Tests:

- C - Chemical Properties
- P - Permeability
- M - Moisture Content
- ▽ ▼ Water Level (Date of Measurement)

Logged by: RSB

Approved by: JJS

Figure No. A-3

SPARKMW SPARKMW.GPJ August 18, 1999

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-10	1 of 3

Project Name: South Park Custodial Landfill
Location: King County
Drilling Method: Hollow Stem Auger, 10.5" OD, 6" ID
Sampling Method: 3" diameter, Split Spoon Sampler, 140 lb hammer

Surface Elevation: 17.7' NAVD 88
Water Depth (ft bgs): 9
Start Date: December 9, 1998
Finish Date: December 9, 1998

Depth feet	Well Construction	Methane	ST	Blows/ 6"	Sample ID	Description
	Locking 8" steel monument					FILL
	Concrete seal					SAND; fine to medium grained, trace silt; moist, loose; no odors or discolorations (SP)
		0%		5 10 11		
	Bentonite chips					
5				4 3 10		5
						RECENT ALLUVIUM SILT; gray; with wood debris with roots; moist, firm, low plasticity; no odors or discolorations (ML)
						7 SAND; fine to medium grained, trace silt; moist, medium dense; no odors or discolorations (SP)
		0%		10 12 12		
	9 ft. bgs ATD 12/9/98					
	9.64 ft. bgs 12/10/98					
10				3 4 8		10 SILT; gray-brown; with burnt woody debris; moist, firm (ML)
	2" ID SCH 40 PVC Riser			3 6 8		12 SILTY SAND; gray; fine grained, with wood debris; wet, loose to medium dense (SM)
		0%				
15				24		
	Bentonite slurry, 30% by weight					
				7 8 18		13
		0%				SAND; black; fine to medium grained; wet, loose to medium dense (SP)

Sampler Type (ST):
- 3" Split Spoon Sampler
- No Recovery

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content
- Water Level (Date of Measurement)

Logged by: RSB
Approved by: JJS
Figure No. A-4

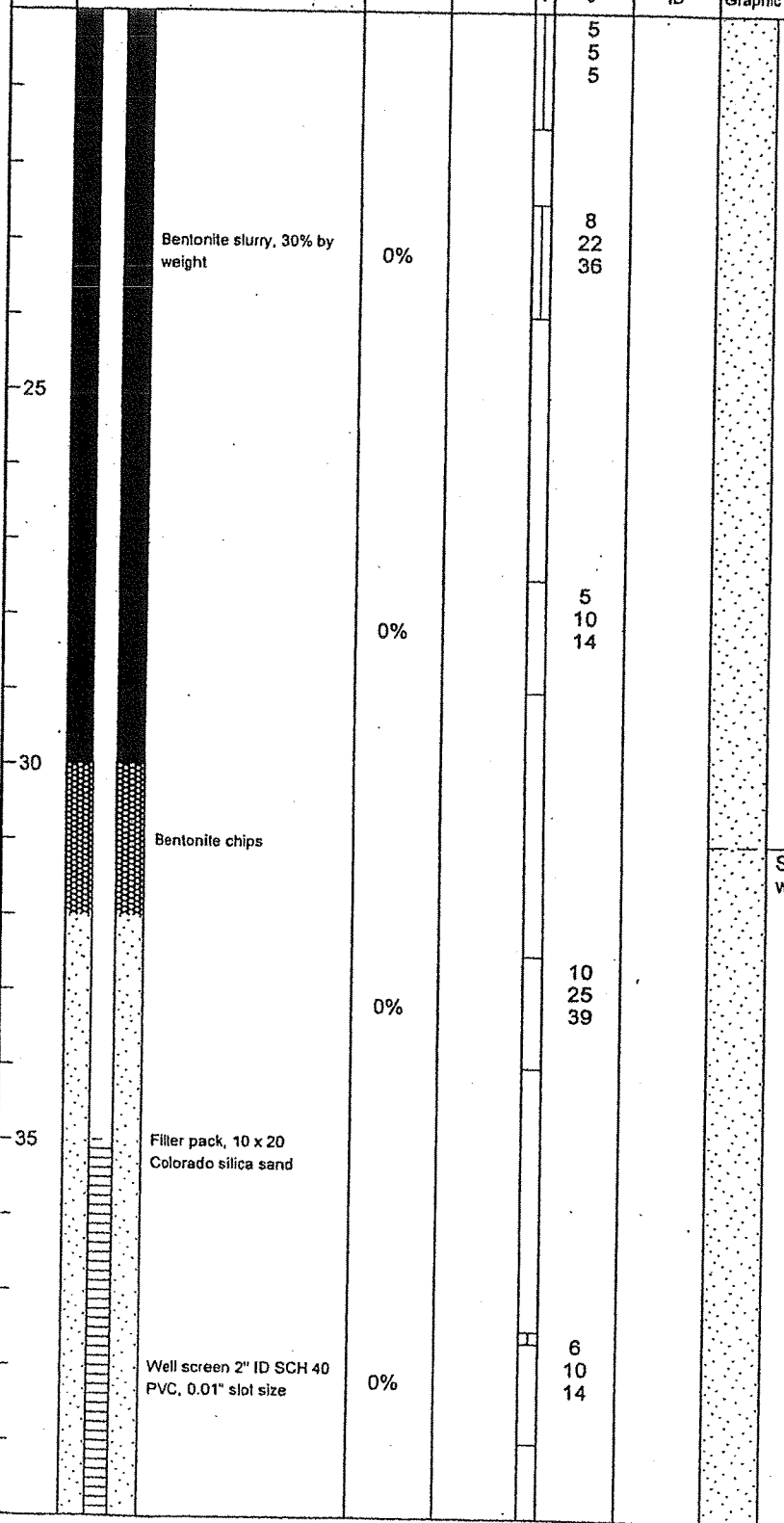
SPARKMW SPARKMW.GI gust 18, 1999

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-10	2 of 3

Project Name	South Park Custodial Landfill	Surface Elevation	17.7' NAVD 88
Location	King County	Water Depth (ft bgs)	9
Drilling Method	Hollow Stem Auger, 10.5" OD, 6" ID	Start Date	December 9, 1998
Sampling Method	3" diameter, Split Spoon Sampler, 140 lb hammer	Finish Date	December 9, 1998



Sampler Type (ST):

- 3" Split Spoon Sampler
- No Recovery

Lab Tests:

- C - Chemical Properties
- P - Permeability
- M - Moisture Content
- Water Level (Date of Measurement)

Logged by: RSB

Approved by: JJS

Figure No. A-4

SPARKMW SPARKMW.GPJ August 18, 1999

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-10	3 of 3

Project Name	South Park Custodial Landfill	Surface Elevation	17.7' NAVD 88
Location	King County	Water Depth (ft bgs)	9
Drilling Method	Hollow Stem Auger, 10.5" OD, 6" ID	Start Date	December 9, 1998
Sampling Method	3" diameter, Split Spoon Sampler, 140 lb hammer	Finish Date	December 9, 1998

Depth feet	Well Construction	Methane	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
							SAND; black; trace silt; wet, medium dense (SP)
	Well screen 2" ID SCH 40 PVC, 0.01" slot size	0%		7 8 36			
45	Threaded end cap, 2" ID SCH 40 PVC						SANDY SILT; dark gray; very moist, stiff, low plasticity (ML)
	Filter pack, 10 x 20 Colorado silica sand	0%		7 12 31			
50							Bottom of boring at depth 49 feet. Monitoring well installed to depth 45 feet. Soil sampler driven using 140-pound hammer falling 30-inches.
55							

Sampler Type (ST):

- 3" Split Spoon Sampler
- No Recovery

Lab Tests:

- C - Chemical Properties
- P - Permeability
- M - Moisture Content
- Water Level (Date of Measurement)

Logged by: RSB

Approved by: JJS

Figure No. A-4

ust 18, 1999 SPARKMW SPARKMW.GF

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-12	1 of 1

Project Name: South Park Custodial Landfill
Location: Seattle, Washington
Drilling Method: Hollow Stem Auger 10.5" OD/6" ID
Sampling Method: 2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop

Surface Elevation: 19.11
Water Depth (ft bgs): 7.34
Start Date: September 20, 1999
Finish Date: September 20, 1999

Depth feet	Well Construction	Methane %	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
	Locking, 8" Steel Monument						FILL
	Concrete seal						Firm, moist; brown and tan mottled SILT
		0		3 4 4	S-1		
	Bentonite chips						
5		0		4 4 3	S-2		RECENT ALLUVIUM Loose, moist; red-brown SAND; silty interbeds, sand fine to coarse, red grains angular
	6.5 ft bgs ATD, 9/20/99, casing at 7.5 ft bgs						
	7.34 ft bgs, 10/14/99						
		0		2 6 7	S-3		-grades medium dense, wet, with fine sand bedding
10	Filter pack, 10x20 Colorado silica sand						
	Well screen 2" ID SCH 40 PVC, 0.01" slot size						
		0		5 11 17	S-4		- grades black
15	Threaded end cap, 2" ID SCH 40 PVC						
							Medium dense, wet; gray-brown SAND; some silt, sand fine, trace organics
		0		4 5 6	S-5		
	Bentonite chips						
20							ESTUARINE DEPOSITS - shell fragments in cuttings
							GLACIAL SEDIMENT
		0		27 50/4"	S-6		Very dense, moist; gray SAND with GRAVEL; little silt
							Bottom of boring at 22.5 feet. Monitoring well installed to depth of 15.3 feet.

Sampler Type (ST):
- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:
C - Chemical Properties
P - Permeability
M - Moisture Content

Water Level (ATD) ▽ Static Water Level

Logged by: RRH
Approved by: JJS

Figure No. A-5

SPARKMW SPRK9_99.GPJ January 3, 2000

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-14	1 of 2

Project Name	South Park Custodial Landfill	Surface Elevation	19.05
Location	Seattle, Washington	Water Depth (ft bgs)	3.96
Drilling Method	Hollow Stem Auger 10.5" OD/6" ID	Start Date	September 14, 1999
Sampling Method	2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop	Finish Date	September 14, 1999

Depth feet	Well Construction	Methane %	S T	Blows/ 6"	Sample ID	Description
	Locking, 8" Steel Monument					TOPSOIL
	Concrete seal					Loose, moist; dark brown SAND with SILT and ORGANICS; concrete and bricks in cuttings
	Bentonite chips	0		14 10 6	S-1	FILL Medium dense, damp; brown SAND with SILT and GRAVEL; with brick
	3.96 ft bgs, 10/14/99					
5	4.5 ft bgs ATD, 9/14/99, casing at 5 ft bgs	0		4 3 5	S-2	Loose, wet; brown SILT; trace gravel, trace sand, trace wood
		0		4 8 9	S-3	RECENT ALLUVIUM Medium dense, wet; black SAND; silt interbeds to 1.5", sand fine to medium
10						
	Filter pack, 10x20 Colorado silica sand	0		4 9 9	S-4	- wood in auger
15						
	Well screen 2" ID SCH 40 PVC, 0.01" slot size					Stiff, wet; brown SILT; trace sand laminae, low plasticity
		0		2 5 5	S-5	
20						
	Threaded end cap, 2" ID SCH 40 PVC					- heaving at 21 feet
	Pea gravel					ESTUARINE DEPOSIT
		0		2 7 6	S-6	Medium dense, wet; brown SAND; few silt, trace shell framents
	Bentonite chips					

Sampler Type (ST):
- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content

Water Level (ATD) ▽ Static Water Level

Logged by: RRH
Approved by: JJS
Figure No. A -6

ary 3, 2000
SPARKMW SPRK9_99.GP

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-14	2 of 2

Project Name: South Park Custodial Landfill
Location: Seattle, Washington
Drilling Method: Hollow Stem Auger 10.5" OD/6" ID
Sampling Method: 2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop

Surface Elevation: 19.05
Water Depth (ft bgs): 3.96
Start Date: September 14, 1999
Finish Date: September 14, 1999

Depth feet	Well Construction	Methane %	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
	Bentonite chips	0		4 7 23	S-7		GLACIAL SEDIMENT Hard, wet; brown and gray mottled SILT; trace sand lenses, gravel in shoe
30		0		3 16 37	S-8		Hard, moist to wet; gray and tan mottled SILT; few sand
35							Bottom of boring at 34 feet. Monitoring well installed to depth of 21.8 feet.
40							
45							

Sampler Type (ST):
- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content

Water Level (ATD) ▽ Static Water Level

Logged by: RRH
Approved by: JJS

Figure No. A-6

SPARKMW SPRK9_99.GPJ January 3, 2000

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-18	1 of 2

Project Name: South Park Custodial Landfill
Location: Seattle, Washington
Drilling Method: Hollow Stem Auger 10.5" OD/6" ID
Sampling Method: 2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop

Surface Elevation: 20.78
Water Depth (ft bgs): 15.3
Start Date: September 17, 1999
Finish Date: September 17, 1999

Depth feet	Well Construction	Methane %	ST	Blows/ 6"	Sample ID	Mtl Graphic	Description
	Locking, 8" Steel Monument; Concrete seal						FILL
		0		6 9 8	S-1		Medium dense, damp; brown SAND with GRAVEL; trace silt, trace organics, 1 piece of glass
	Bentonite chips						REFUSE
5		0		7 7 7	S-2		Medium dense, damp; brown SAND, few gravels, trace silt, trace wood; plastic debris noted in shoe
		0.1		26 27 31	S-3		-very dense, damp; gray concrete cinder block
10		0		14 15 7	S-4		
	Bentonite slurry, 30% by weight						
		0		2 3 2	S-5A		Firm, moist to wet; gray grading to brown SILT some ORGANICS
					S-5B		RECENT ALLUVIUM
	14.5 ft bgs ATD, 9/17/99, casing at 17.5 ft bgs						Medium dense, moist; dark brown to black SAND; sand fine to medium, angular red grains visible of volcanic origin
15	15.30 ft bgs, 10/14/99						
		0		1 2 3	S-6A		- grades firm, wet, brown silt, some organics
					S-6B		Medium dense, wet; black SAND; sand fine to medium, angular red grains visible of volcanic origin
20							
		0		3 8 10	S-7		- trace silt interbeds

Sampler Type (ST):
- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content

▼ Water Level (ATD) ▽ Static Water Level

Logged by: RRH
Approved by: JJS
Figure No. A -7

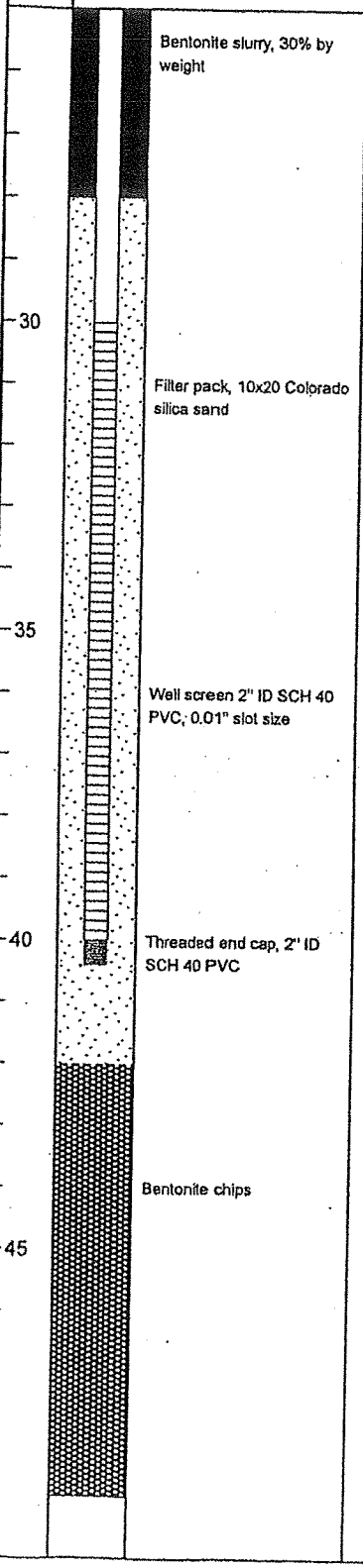
ary 3, 2000
SPARKMW SPRK9_99.GP

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-18	2 of 2

Project Name	South Park Custodial Landfill	Surface Elevation	20.78
Location	Seattle, Washington	Water Depth (ft bgs)	15.3
Drilling Method	Hollow Stem Auger 10.5" OD/6" ID	Start Date	September 17, 1999
Sampling Method	2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop	Finish Date	September 17, 1999



Depth feet	Methane %	ST	Blows/ 6"	Sample ID	Mil. Graphic	Description
	0		3 10 14	S-8		Medium dense, wet; black SAND; sand fine to medium, angular red grains visible of volcanic origin
	0		11 16 12	S-9		- sand fine to coarse
	0		7 8 16	S-10		- silt content increases
						Firm, wet; brown SILT few SAND; trace organics
	0		12 13 15	S-11		Medium dense, wet; black SAND; sand fine to medium, red grained and angular
	0		6 19 27	S-12		- grades dense, brown sand, trace silt, visible bedding
						Bottom of Boring at 49 feet. Monitoring well installed to depth of 40.4 feet.

Sampler Type (ST):
- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content

▼ Water Level (ATD) ▽ Static Water Level

Logged by: RRH
Approved by: JJS
Figure No. A -7

SPARKMW SPRK9_99.GPJ January 3, 2000

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-24	1 of 2

Project Name: South Park Custodial Landfill
Location: Seattle, Washington
Drilling Method: Hollow Stem Auger 10.5" OD/6" ID
Sampling Method: 2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop

Surface Elevation: 13.57
Water Depth (ft bgs): 8.35
Start Date: September 21, 1999
Finish Date: September 21, 1999

Depth feet	Well Construction	Methane %	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
	Locking, 8" Steel Monument						FILL
	Concrete seal						Medium dense, damp; dark red-brown SAND; sand fine to medium, sand angular
	Bentonite chips	0					
5							- grades moist to wet, dark brown to black
	6.0 ft bgs ATD, 9/21/99, casing at 7.5 ft bgs						
		0		1 3 6	S-1		Firm, wet to moist; brown SILT; mostly organics, peat-like
	8.35 ft bgs, 10/14/99						
10							- grades wet, gray and brown, trace sand
							RECENT ALLUVIUM
		0		3 2 9	S-2		Medium dense, wet; black SAND; some brown organic silt interbeds, sand fine to medium
15	Bentonite slurry, 30% by weight						
		0		5 11 14	S-3		- sand grades angular
20							
		0		2 15 37	S-4		- grades very dense

Sampler Type (ST):
- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:
- C - Chemical Properties
- P - Permeability
- M - Moisture Content

Water Level (ATD) ▽ Static Water Level

Logged by: RRH
Approved by: JJS
Figure No. A -8

I:\PARKMW SPRK9_99.GPJ January 3, 2000

ASSOCIATED EARTH SCIENCES, INC

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
BV97041	MW-24	2 of 2

Project Name	South Park Custodial Landfill	Surface Elevation	13.57
Location	Seattle, Washington	Water Depth (ft bgs)	8.35
Drilling Method	Hollow Stem Auger 10.5" OD/6" ID	Start Date	September 21, 1999
Sampling Method	2" diameter, Split Spoon Sampler, 140 lb hammer, 30-inch drop	Finish Date	September 21, 1999

Depth feet	Well Construction	Methane %	ST	Blows/ 6"	Sample ID	Mtl. Graphic	Description
	Bentonite slurry, 30% by weight						Very dense, wet; black SAND; some brown organic silt interbeds, sand fine to medium
		0		9 28 32	S-5		
30							
		0		9 24 33	S-6		
35	Filter pack, 10x20 Colorado silica sand						
		0		4 2 2	S-7		Firm, wet; dark brown SILT with SAND; organics present
40	Well screen 2" ID SCH 40 PVC, 0.01" slot size						Medium dense, wet; black SAND; sand fine to medium and angular
		0		4 8 10	S-8		
45	PVC slip cap, 55 screws						- grades siltier
	Pea gravel						
	Bentonite chips	0		3 9 14	S-9		- grades few silt, trace wood and organics
							Bottom of Boring at 49 feet. Monitoring well installed to depth of 45.3 feet.

Sampler Type (ST):

- 3.25" OD D&M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

Lab Tests:

- C - Chemical Properties
- P - Permeability
- M - Moisture Content

▼ Water Level (ATD) ▽ Static Water Level

Logged by: RRH

Approved by: JJS

Figure No. A-8

SPARKMW SPRK9_99.GPJ January 3, 2000

Aspect consulting
IN-DEPTH PERSPECTIVE

Monitoring Well Construction Log

Project Number	Well Number	Sheet
970041	MW-25	1 of 1

Project Name	South Park Custodial Landfill	Ground Surface Elev (NAVD88)	17.30
Location	Seattle, Washington	Top of Casing Elev. (NAVD88)	20.09
Driller/Method	Holt / Hollow Stem Auger	Depth to Water (BTOC)	12.54
Sampling Method	3.25" OD D&M Split-Spoon; 300 lbs Hammer	Start/Finish Date	2/23/2006

Depth / Elevation (feet)	Well Completion	Sample Type/ID	Tests / PID	Blows/ 6"	Material Type	Description
15	Above ground locking monument with bollards and slip cap; Concrete surface seal	S-1		3 3 3		FILL Loose, damp, brown, slightly silty fine SAND
5	Bentonite chip seal	S-2		3 3 4		RECENT ALLUVIUM Medium stiff, moist, gray SILT; scattered organics, wood debris
	▽ 2/23/2006					5.5
10		S-3		4 4 5		Loose, wet, black, fine to medium SAND
						7
10	2-inch PVC blank casing	S-4		1 0 1		Very soft, wet, gray SILT; abundant wood debris
						10
5	▽ 2/27/2006	S-5		1 1 1		
15		S-6		1 1 1		Very soft, wet, gray, sandy SILT; sand fine
						15
0	Bentonite pellet plug	S-7		2 2 1		
20		S-8		4 6 7		Medium dense, wet, black, slightly silty, fine to medium SAND
						20
-5	10-20 filter pack	S-9	DS25060223-	6 10 12		
25	2-inch, 20-slot, PVC well screen					Bottom of Boring at 26'
-10						Coordinates N: 197657.49 E: 1270566.75

Set pump intake ~ 24 ft BTOC

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon
- Ring Sampler

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: TDC
Approved by: JJS
Figure No. A-2

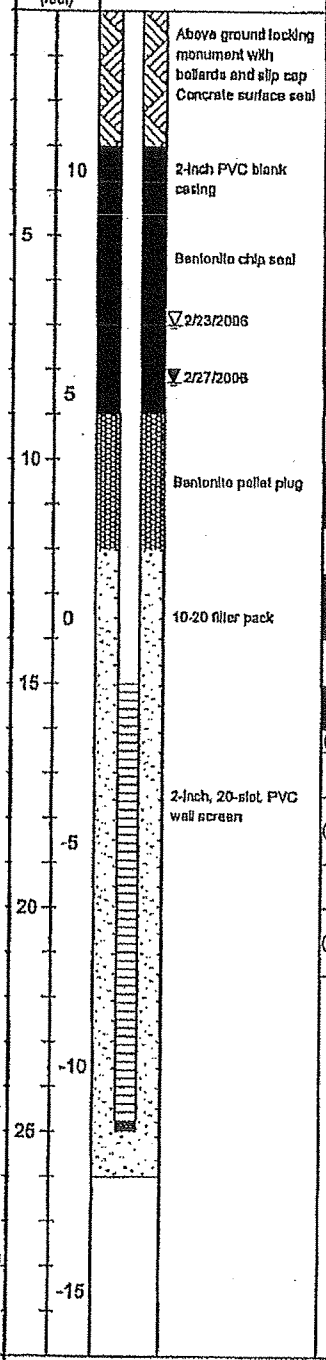
MONITORING WELL SOUTHPARK_WELLS.GPJ March 10, 2006

Aspect consulting
IN-DEPTH PERSPECTIVE

Monitoring Well Construction Log

Project Number	Well Number	Sheet
970041	MW-26	1 of 1

Project Name	South Park Custodial Landfill	Ground Surface Elev (NAVD88)	13.55
Location	Seattle, Washington	Top of Casing Elev. (NAVD88)	15.84
Driller/Method	Holt / Hollow Stem Auger	Depth to Water (BTOC)	8.27
Sampling Method	3.25" OD D&M Split-Spoon; 300 lbs Hammer	Start/Finish Date	2/23/2006



Sample Type/ID	Tests / PID	Blows/ 6"	Material Type	Description
				FILL Loose, damp, brown, fine to medium SAND
S-1		4 4 5		Loose, damp to wet, black, fine SAND
S-2		2 1 1		
S-3 S-4		1 1 1		RECENT ALLUVIUM Very soft, wet, brown SILT; abundant organics Very soft, wet, brown SILT; few organics
S-5		2 4 4		Grades to medium stiff, wet, gray sandy SILT; sand fine
S-6		1 2 2		Very loose to loose, wet, black, fine SAND; trace silt
S-7	DS26060223-	3 4 5		
S-8		4 4 4		
S-9		3 3 4		
				Bottom of Boring at 26'

Set pump intake ~ 20 ft BTOC

Coordinates N: 197121.60
E: 1271164.40

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon
- Ring Sampler

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: TDC
Approved by: JJS
Figure No. A-3

MONITORING WELL SOUTHPARK_WELLS.GPJ March 10, 2006

Aspect consulting
IN-DEPTH PERSPECTIVE

Monitoring Well Construction Log

Project Number	Well Number	Sheet
970041	MW-27	1 of 1

Project Name	South Park Custodial Landfill	Ground Surface Elev (NAVD88)	12.72
Location	Seattle, Washington	Top of Casing Elev. (NAVD88)	14.76
Driller/Method	Holt / Hollow Stem Auger	Depth to Water (BTOC)	6.91
Sampling Method	3.25" OD D&M Split-Spoon; 300 lbs Hammer	Start/Finish Date	2/23/2006

Depth / Elevation (feet)	Well Completion	Sample Type/ID	Tests / PID	Blows/ 6"	Material Type	Description
10	Above ground locking monument with bollards and slip cap Concrete surface seal	S-1		7 10 11		FILL (Loose), moist, gray, GRAVEL Medium dense, damp, brown-gray, silty sandy GRAVEL
5	2-inch PVC blank casing Bentonite chip seal	S-2		3 2 2		Medium dense to loose, damp to wet, slightly silty, slightly gravelly, fine SAND
	▽ 3/3/2006					
5		S-3				Loose, wet, brown, medium to fine SAND; trace silt, trace gravel
	10-20 filter pack					
10		S-4		2 1 1		-Very loose, wet, gray-brown GRAVEL: well rounded to 0.5-inch
0		S-5		2 2 2		RECENT ALLUVIUM Loose, wet, gray, silty fine SAND
	2-inch, 20-slot PVC well screen					
15		S-6		2 2 2		
-5		S-7	DS27060223-	2 2 2		
		S-8		3 4 5		Loose, wet, black, fine to medium SAND; trace silt
20						
-10						Bottom of Boring at 21' Coordinates N: 196835.06 E: 1271357.64
25						Set Prism screw ~ 15 ft BTOC
-15						

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon
- Ring Sampler

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: TDC
Approved by: JJS
Figure No. A-4

MONITORING WELL SOUTHPARK_WELLS.GPJ March 10, 2006

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100166	MW-29	1 of 1

Project Name: South Park Landfill
Location: Seattle, WA
Driller/Method: Cascade Drilling, LP / Direct Push Probe
Sampling Method: Continuous Core

Ground Surface Elev: 19.45' NAVD88
Depth to Water: 5.4' BGS (ATD)
Start/Finish Date: 1/14/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
0	Concrete seal, 0'-2'	S-1					Dense, moist, dark gray, slightly silty, sandy GRAVEL (GP-GM), occasional brick fragments.	0
							Dense, moist, brown, SAND (SP); medium sand.	
5	2-inch diameter schedule 40 PVC casing, 0'-20' ▽ 12/29/2010	S-2		0.0				5
	Hydrated bentonite chips, 2'-18'						Medium stiff, moist, dark brown SILT (ML); occasional wood fibers; glass pieces at 6'. Grades to light brown with frequent wood fibers.	
10		S-3		0.0			Grades to soft, dark gray, with black wood fragments.	10
							No wood, thin silt laminations.	
15		S-4		0.0			Dense, very moist, black SAND (SP); fine to medium sand.	15
		S-5		0.0			Dense, wet, dark gray, very silty SAND (SM); with occasional thin sandy silt interbeds.	
20	#8/12 sand filter pack, 18'-30'							20
	2-inch diameter schedule 40 PVC 20-slot prepacked screen, 20'-30'	S-6		0.0			Dense, wet, dark brown to black SAND (SP); with thick silty sand interbeds.	
25		S-7		0.0				25
							Dense, wet, dark brown to black, sandy SILT (ML).	
		S-8		0.0			Dense, wet, black SAND (SP); fine sand.	
30	PVC endcap Aluminum drive shoe							30
							Bottom of boring at 10' below ground surface. Soil vapors were measured using GEM 2000 gas analyzer, H2S meter, and PID: CH4: 0.2% CO2: 0.1% O2: 20.4% BAL: 79.5% H2S: 0.0 ppm PID: 0.0 ppm	
35								35

Sampler Type:
○ No Recovery
▌▌ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: DFR
Approved by: JJS
Figure No. B- 25

_ENV BORING LOG SOUTH PARK LANDFILL 100116.GPJ December 1, 2011

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100166	MW-30	1 of 1

Project Name: South Park Landfill
Location: Seattle, WA
Driller/Method: Cascade Drilling, / Hollow Stem Auger
Sampling Method: Dames & Moore

Ground Surface Elev: 17.60' NAVD88
Depth to Water: 10.8' BGS (ATD)
Start/Finish Date: 6/15/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
	Concrete seal, 0'-2'						Loose, slightly moist, brown, trace to slightly silty SAND (SP-SM); fine to medium sand, predominantly fine.	
	2-inch diameter schedule 40 PVC casing, 0'-8'							
	Hydrated bentonite chips, 2'-6'							
5		S-1		0.0	1 1 1			5
	#2/12 sand filter pack, 6'-13'							
		S-2		0.0	1 1 1		Loose, slightly moist, brown, slightly silty SAND (SP-SM); with frequent, thin SILT (ML) lamina.	
	2-inch diameter schedule 40 PVC 10-slot screen, 8'-13'							
10							Loose, wet, brown, slightly silty SAND (SP-SM); trace fine gravel.	10
	▽6/15/2011	S-3		0.0	1 1 1		Soft, wet, gray, clayey SILT (ML).	
							Loose, wet, black, slightly silty to silty SAND (SP-SM). Gravelly.	
	PVC endcap	S-4		0.0	2 1 1		Loose, wet, black SAND (SP) with 2" gray SILT (ML) pockets.	
15	Slough						Loose, wet, black SAND (SP); fine to medium sand.	15
		S-5		0.0	3 4 6			
							Bottom of boring at 16.5' below ground surface.	

Sampler Type:
- ○ No Recovery
- ◧ 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level

▽ Water Level (ATD)

Logged by: AET

Approved by: JJS

Figure No. B- 26

_ENV BORING LOG SOUTH PARK LANDFILL 100116.GPJ December 1, 2011

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100166	MW-31	1 of 1

Project Name: South Park Landfill
Location: Seattle, WA
Driller/Method: Cascade Drilling, / Hollow Stem Auger
Sampling Method: Dames & Moore

Ground Surface Elev: 17.58' NAVD88
Depth to Water: 11' BGS (ATD)
Start/Finish Date: 6/15/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
	Concrete seal, 0'-2'						Loose, slightly moist, brown, slightly silty SAND (SP-SM); fine sand.	
5	2-inch diameter schedule 40 PVC casing, 0'-18'	S-1		0.0	3 3 3			5
		S-2		0.0	3 3 4		Loose, slightly moist, dark gray SAND (SP); fine to medium sand.	
10	Hydrated bentonite chips, 2'-16' ▽6/15/2011	S-3		0.0	4 4 3		Wet.	10
15		S-4		0.0	3 5 8		Stiff, wet, gray SILT (ML); with wood debris. Medium dense, wet, dark gray to black SAND (SP); trace silt; fine to medium sand.	15
	#2/12 sand filter pack, 16'-26'							
20	2-inch diameter schedule 40 PVC 10-slot screen, 18'-23'	S-5		0.0	4 6 8			20
	PVC endcap							
25		S-6		0.0	5 9 9		Bottom of boring at 26' below ground surface.	25

Sampler Type:
- ◯ No Recovery
- ◧ 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: AET
Approved by: JJS
Figure No. B- 27

_ENV BORING LOG SOUTH PARK LANDFILL 100116.GPJ December 1, 2011

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100166	MW-32	1 of 1

Project Name: South Park Landfill
Location: Seattle, WA
Driller/Method: Cascade Drilling, / Hollow Stem Auger
Sampling Method: Dames & Moore

Ground Surface Elev: 17.51' NAVD88
Depth to Water: 10.90' bTOC
Start/Finish Date: 6/29/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
0	Concrete seal, 0'-2'						Very loose, moist, dark red-brown, slightly silty SAND (SP-SM); fine sand; glass shards, burnt woods debris, and other refuse present	0
	2-inch diameter schedule 40 PVC casing, 0'-20'	S-1	CH4: 0.1% CO2: 0.1% O2: 20.1%	0.0	2 2 2			
5	Well installed with 10.25" ID conductor casing installed to a depth of 11.5' bgs. A 1 ft thick bentonite seal was constructed from 10.5' to 11.5' bgs and hydrated for 1 hr before drilling to 24' bgs with 4.25" ID hollow stem augers.	S-2	CH4: 0.1% CO2: 0.1% O2: 19.1%	0.0	4 1 1			5
		S-3		0.0	2 5 5		Very loose, very moist, black SAND (SP); medium sand; no refuse present	
10	▽6/29/2011	S-4	CH4: 0.1% CO2: 0.1% O2: 20.0%	0.0	2 3 4		Medium stiff, wet, dark blue-gray SILT (ML)	10
		S-5		0.0	1 2 2			
15	Hydrated bentonite chips, 2'-17'	S-6		0.0	3 3 4			15
	#2/12 sand filter pack, 17'-24'						Medium dense, wet, dark gray to black SAND (SP); trace silt; fine to medium sand.	
20	2-inch diameter schedule 40 PVC 10-slot screen, 19'-24'							20
		S-7		0.0	10 12 13			
	PVC endcap						Bottom of boring at 24' below ground surface. Ecology Well ID Tag BHA-082	
25								25

Sampler Type:
- ◯ No Recovery
- ◧ 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: DFR
Approved by: JJS
Figure No. B- 28

_ENV BORING LOG SOUTH PARK LANDFILL 100116.GPJ December 1, 2011

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100166	MW-33	1 of 1

Project Name: South Park Landfill
Location: Seattle, WA
Driller/Method: Cascade Drilling, / Hollow Stem Auger
Sampling Method: Dames & Moore

Ground Surface Elev: 17.81' NAVD88
Depth to Water: 11.05' bTOC
Start/Finish Date: 6/29/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
0	Concrete seal, 0'-2'						Very loose, slightly moist, brown, medium SAND (SP)	0
	2-inch diameter schedule 40 PVC casing, 0'-20'	S-1	CH4: 0.1% CO2: 0.1% O2: 19.1%	0.0	2 2 4			
5	Well installed with 10.25" ID conductor casing installed to a depth of 11.5' bgs. A 1 ft thick bentonite seal was constructed from 10.5' to 11.5' bgs and hydrated for 1 hr before drilling to 24' bgs with 4.25" ID hollow stem augers.	S-2	CH4: 0.1% CO2: 0.1% O2: 20.0%	0.0	2 3 4		Very loose, moist, dark red-brown, slightly silty SAND (SP-SM); fine sand; glass shards, burnt woods debris, and other refuse present	5
		S-3		0.0	8 16 20		Very loose, very moist, black SAND (SP); medium sand; no refuse present	
10	▽6/29/2011	S-4	CH4: 0.1% CO2: 0.1% O2: 20.1%	0.0	4 3 2		Medium stiff, wet, dark blue-gray SILT (ML)	10
		S-5		0.0	4 5 6		No sample recovery due to rock in sampler	
15	Hydrated bentonite chips, 2'-18'							15
		S-6		0.0	2 3 4		Medium dense, wet, dark gray to black SAND (SP); trace silt; fine to medium sand.	
20	#2/12 sand filter pack, 18'-25' 2-inch diameter schedule 40 PVC 10-slot screen, 19'-25'							20
		S-7		0.0	10 12 12			
25	PVC endcap						Bottom of boring at 25' below ground surface. Ecology Well ID Tag BHA-083	25

Sampler Type:
- ◯ No Recovery
- ◧ 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level

▽ Water Level (ATD)

Logged by: DFR

Approved by: JJS

Figure No. B- 29

_ENV BORING LOG SOUTH PARK LANDFILL 100116.GPJ December 1, 2011

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.3
Groundwater Monitoring and Contingency Plan

Exhibit A.3.1
Sampling and Analysis Plan and Quality Assurance Project Plan

Attachment B
Groundwater Sampling Record Template

South Park Landfill

GROUNDWATER SAMPLE COLLECTION FORM

Well ID: _____ Date of Collection: _____ Field Personnel: _____

Purge Data

Well ID: _____ Secure: ☐ Yes ☐ No Well Condition/Damage Description: _____

_____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from top of well casing): _____ Well Casing Type/Diameter: _____

After 5 minutes of purging (from top of casing): _____ Screened Interval: _____

Sample intake depth: _____

Begin purge (time): _____

End purge (time): _____

Gallons purged: _____

Purge water disposal method: _____

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water	Vol. Purged	pH	DO	Conductivity	Turbidity	Temp	ORP	Comments

Sampling Data

Sample ID: _____ Location and Depth: _____

Date Collected (mo/dy/yr): _____ Time Collected: _____ ☐ AM ☐ PM Weather: _____

Sample: ☐ Filtered ☐ Unfiltered Other: _____

Sample Collected with: ☐ Bailer ☐ Pump Other: _____ Type: _____

Water Quality Instrument Data Collected with: _____

Sample Decon Procedure: Sample collected with (circle one): decontaminated all tubing; disposable and/or dedicated silicon and poly tubing Other: _____

Sample Description (Color, Turbidity, Odor, Other): _____

Types of Sample Containers: Quantity:

_____ _____

Duplicate Sample Collected: ☐ Yes ☐ No If yes, ID(s)

_____ _____

Additional Information/Comments

South Park Landfill

Landfill Post-Closure Operations, Maintenance, and Monitoring Plan

Attachment A.4
Annual Report Checklist

South Park Landfill

Annual Report Checklist

DUE TO ECOLOGY March 31 of each calendar year
(includes January 1 through December 31 of the previous year)

1. Landfill cap inspection and maintenance (per CMP)

☐ Cap inspection field form (annual) Date completed: _____
☐ Cap maintenance documentation
☐ No maintenance performed during this reported period

2. Documentation of non-routine subsurface work in accordance with MHP

☐ Completed during this reporting period
☐ Not completed during this reporting period

3. Quarterly LFG Perimeter Probe Monitoring in accordance with LFGMCP

Date Completed		Field Forms	Uploaded into Database
☐ Q1	_____	☐	☐
☐ Q2	_____	☐	☐
☐ Q3	_____	☐	☐
☐ Q4	_____	☐	☐

4. Quarterly Inspection of on-site building methane detectors and alarms

Date Completed

☐ Q1 _____
☐ Q2 _____
☐ Q3 _____
☐ Q4 _____

Off-site building monitoring conducted?

☐ Yes ☐ No

If yes provide location, date, and field documentation:

_____

_____

5. Quarterly groundwater monitoring in accordance with GMCP

Date Completed		Field Forms
☐ Q1	_____	☐
☐ Q2	_____	☐
☐ Q3	_____	☐
☐ Q4	_____	☐

_____ _____
Signature Date

South Park Landfill

Final Cleanup Action Plan

Appendix B
Environmental Covenants for South Park Landfill

South Park Landfill

Final Cleanup Action Plan

Appendix B
Environmental Covenants for
South Park Landfill

South Park Property Development Parcel

After Recording Return
Original Signed Covenant to:

Jerome Cruz
Toxics Cleanup Program
Department of Ecology
Northwest Regional Office
3190 - 160th Ave. SE
Bellevue, WA 98008-5452

Environmental Covenant

Grantor: South Park Property Development LLC
Grantee: State of Washington, Department of Ecology (hereafter "Ecology")
Brief Legal Description: Ptn. NW¼ S. 32, T. 24 N, R. 4 E.W.M.
Additional Legal Description on pages 8-10
Tax Parcel Nos.: 3224049005
Cross Reference: NONE

RECITALS

a. This document is an environmental (restrictive) covenant (hereafter "Covenant") executed pursuant to the Model Toxics Control Act ("MTCA"), chapter 70.105D RCW, and Uniform Environmental Covenants Act ("UECA"), chapter 64.70 RCW.

b. The Property that is the subject of this Covenant is part of a site commonly known as South Park Landfill (Facility Site ID # 2180). The Property is legally described in Exhibit A, and illustrated in Exhibit B, both of which are attached (hereafter "Property"). If there are differences between these two Exhibits, the legal description in Exhibit A shall prevail.

c. The Property is the subject of remedial action conducted under MTCA. This Covenant is required because residual contamination remains on the Property after completion of remedial actions. Specifically, the following principal contaminants remain on the Property:

Medium	Principal Contaminants Present[1]
Waste within the closed landfill	Aged municipal solid waste with soil. Arsenic and lead have been detected in soil.
Soil (landscaping above the landfill cap)	Various common urban hazardous substances, such as PAHs and metals, are present at concentrations above unrestricted land use cleanup levels (Methods A and B) but below industrial land use cleanup levels (Methods A and C).
Soil vapor	Landfill gas (Methane)
Groundwater	Vinyl Chloride, Iron, Manganese, Arsenic

d. It is the purpose of this Covenant to restrict certain activities and uses of the Property to protect human health and the environment and the integrity of remedial actions conducted at the site. Records describing the extent of residual contamination and remedial actions conducted are

[1] For a full description of the contaminants of concern at the South Park Landfill Site, see Exhibit A to the Consent Decree (King County Cause No XXXXX), Draft Cleanup Action Plan, in Table 4.2.

available through Ecology. This includes but is not limited to the following documents (hereafter the "Site Documents"):

- Cleanup Action Plan **<citation to be completed>,** including the Operations, Maintenance, and Monitoring Plan (OMMP) for South Park Landfill, which includes the following:
    - Attachment A.1: Landfill Cap Inspection and Maintenance Plan
    - Attachment A.2: Landfill Gas Monitoring and Contingency Plan
    - Attachment A.3: Groundwater Monitoring and Contingency Plan
    - Attachment A.4: Annual Report Checklist
- Consent Decree **<citation to be completed once entered by court>**
- RI/FS **<citation to be completed>**

e. This Covenant grants Ecology certain rights under UECA and as specified in this Covenant. As a Holder of this Covenant under UECA, Ecology has an interest in real property, however, this is not an ownership interest which equates to liability under MTCA or the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 *et seq*. The rights of Ecology as an "agency" under UECA, other than its' right as a holder, are not an interest in real property.

COVENANT

South Park Property Development LLC ("SPPD"), as Grantor and fee simple owner of the Property, hereby grants to the Washington State Department of Ecology, and its successors and assignees, the following covenants. Furthermore, it is the intent of the Grantor that such covenants shall supersede any prior interests SPPD has in the property and run with the land and be binding on all current and future owners of any portion of, or interest in, the Property.

Section 1. General Restrictions and Requirements.

The following general restrictions and requirements shall apply to the Property:

a. Interference with Remedial Action. The Grantor shall not engage in any activity on the Property that may adversely impact or interfere with the remedial action and any operation, maintenance, inspection or monitoring of that remedial action without prior written approval from Ecology.

b. Protection of Human Health and the Environment. The Grantor shall not engage in any activity on the Property that may threaten continued protection of human health or the environment without prior written approval from Ecology. This includes, but is not limited to, any activity that results in the release of residual contamination that was contained as a part of the remedial action or that exacerbates or creates a new exposure pathway to residual contamination remaining on the Property.

c. Continued Compliance Required. Grantor shall not convey any interest in any portion of the Property without providing for the continued adequate and complete operation, maintenance and monitoring of remedial actions and continued compliance with this Covenant.

d. Leases. Grantor shall restrict any lease for any portion of the Property to uses and activities consistent with this Covenant and notify all lessees of the restrictions on the use of the Property.

e. Preservation of Reference Monuments. Grantor shall make a good faith effort to preserve any reference monuments and boundary markers used to define the areal extent of coverage of this Covenant. Should a monument or marker be damaged or destroyed, Grantor shall have it replaced by a licensed professional surveyor within 30 days of discovery of the damage or destruction.

Section 2. Specific Prohibitions and Requirements.

In addition to the general restrictions in Section 1 of this Covenant, the following additional specific restrictions and requirements shall apply to the Property.

a. Land use. The remedial action for the Property is based on a cleanup designed for industrial property. As such, the Property shall be used in perpetuity only for industrial uses, as that term is defined in the rules promulgated under Chapter 70.105D RCW. Prohibited uses on the Property include but are not limited to residential uses, childcare facilities, K-12 public or private schools, parks, grazing of animals, growing of food crops, and non-industrial commercial uses.

b. Containment of soil/solid wastes. The remedial action for the Property is based on containing contaminated soil and landfill waste under a cap consisting of buildings, asphalt, concrete, soil layers with a visible barrier (non-paved areas), and soil with low permeability layer or an impermeable geomembrane at least 50 millimeters thick (stormwater conveyance and treatment facilities such as swales, ditches, or ponds). Exhibit C shows the extent and type of the cap on the Property. The primary purpose of this cap is to prevent direct contact with the contaminated soil and landfill wastes. The cap is an inherent element of the stormwater and landfill gas controls that are part of landfill closure. The following restrictions shall apply within the cap area illustrated in Exhibit C:

i. Any activity on the Property that will compromise the integrity of the cap including: drilling; digging; piercing the cap with sampling device, post, stake or similar device; grading; excavation; installation of underground utilities; removal of the cap; or, application of loads in excess of the cap load bearing capacity, is prohibited without prior written approval by Ecology. The Grantor shall report to Ecology within forty-eight (48) hours of the discovery of any damage to the cap. Unless an alternative plan has been approved by Ecology in writing, the Grantor shall promptly repair the damage and submit a report documenting this work to Ecology within thirty (30) days of completing the repairs.

ii. The Grantor shall not alter or remove the existing structures on the Property in any manner that would expose contaminated soil and landfill waste, result in a release to the environment of contaminants, or create a new exposure pathway, without prior written approval of Ecology.

iii. The Grantor covenants and agrees that it shall annually, or at other time as approved in writing by Ecology, inspect the cap and building floor or foundation and report within thirty (30) days of the inspection the condition of the cap and building floor or foundation and any changes to the cap and building floor and foundation that would impair their performance.

c. Stormwater facilities. To minimize the potential for mobilization of contaminants remaining in soil, landfill waste, and groundwater on the Property, no stormwater infiltration facilities or unlined ponds shall be constructed on the portion of the Property that overlies refuse as detailed in Exhibit D. All stormwater catch basins, conveyance systems, and other appurtenances installed on the Property to manage stormwater shall be of water-tight construction.

d. Landfill Gas Controls and Protections. The residual contamination on the Property includes biodegradable wastes/chemicals that may generate methane, a combustible gas. The following restrictions shall apply on the Property to minimize the potential for exposure to methane vapors:

i. Grantor shall equip all buildings on the Property with methane alarms operating 24 hours, 7 days per week. Grantor shall maintain the alarms in good working order, and will replace any alarm that fails within 7 days after discovery of the failure.

ii. No building or other enclosed structure shall be constructed on the Property unless approved by Ecology.

iii. Grantor shall ensure that any new building or other enclosed structure constructed on the Property will comply with all City Code requirements related to methane mitigation, and will contain, at a minimum, a sealed foundation and a gas venting system unless otherwise approved in writing by Ecology.

e. Landfill Gas Monitoring. Grantor shall monitor landfill gas on the Property. The following monitoring is required:

i. The Grantor will monitor indoor spaces using the methane alarms described in 2(d) above to ensure that concentrations of methane gas in (a) buildings overlying refuse illustrated in Exhibit B do not exceed 1.25 percent by volume, or 25 percent of the lower explosive limit (LEL), and (b) buildings outside the area of the Property overlying refuse illustrated in Exhibit B do not exceed 100 parts per million by volume.

ii. The Grantor will monitor performance of the landfill gas controls installed on the Property as part of 2(d) above;

iii. The Grantor shall promptly report to Ecology any exceedance of methane gas allowable limits, and shall take immediate, appropriate action to respond to such exceedances.

f. Groundwater use. The groundwater beneath the Property remains contaminated and shall not be extracted for any purpose other than temporary construction dewatering, investigation, monitoring or remediation. Drilling of a well for any water supply purpose is strictly prohibited. Groundwater extracted from the Property for any purpose shall be considered potentially contaminated and any discharge of this water shall be done in accordance with state and federal law.

g. Groundwater Monitoring. Groundwater monitoring wells are located on the Property to monitor the performance of the remedial action. The Grantor shall maintain clear access to these devices and protect them from damage. The Grantor shall report to Ecology within 14 days of the discovery of any damage to any monitoring device located on the Property. Unless Ecology approves of an alternative plan in writing, the Grantor shall arrange for the prompt repair of the damage and submission of a report documenting this work to Ecology within thirty (30) days of completing the repairs.

Section 3. Access.

a. The Grantor shall maintain clear access to all remedial action components necessary to construct, operate, inspect, monitor and maintain the remedial action.

b. The Grantor freely and voluntarily grants Ecology, its authorized representatives, and the Site Coordinator, upon reasonable notice, the right to enter the Property at reasonable times to evaluate the effectiveness of this Covenant and associated remedial actions, and enforce compliance with this Covenant and those actions, including the right to take samples, inspect any remedial actions conducted on the Property, and to inspect related records.

c. No right of access or use by a third party to any portion of the Property is conveyed by this instrument.

Section 4. Notice Requirements.

a. Conveyance of Any Interest. The Grantor, when conveying any interest in any part of the Property, including but not limited to title, easement, leases, and security or other interests, must:

i. Provide written notice to Ecology of the intended conveyance at least thirty (30) days in advance of the conveyance.

ii. Include in the conveying document a notice in substantially the following form, as well as a complete copy of this Covenant:

NOTICE: THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL COVENANT GRANTED TO THE WASHINGTON STATE DEPARTMENT OF ECOLOGY ON [DATE] AND RECORDED WITH THE KING COUNTY RECORDER'S OFFICE UNDER RECORDING NUMBER [RECORDING NUMBER]. USES AND ACTIVITIES ON THIS PROPERTY MUST COMPLY WITH THAT COVENANT, A COMPLETE COPY OF WHICH IS ATTACHED TO THIS DOCUMENT.

iii. Unless otherwise agreed to in writing by Ecology, provide Ecology with a complete copy of the executed document within thirty (30) days of the date of execution of such document.

b. Reporting Violations. Should the Grantor become aware of any violation of this Covenant, Grantor shall promptly report such violation in writing to Ecology.

c. Emergencies. For any emergency or significant change in site conditions due to Acts of Nature (for example, flood or fire) resulting in a violation of this Covenant, the Grantor is authorized to respond to such an event in accordance with state and federal law. The Grantor must notify Ecology in writing of the event and response actions must be planned or taken as soon as practical but no later than within 24 hours of the discovery of the event.

d. Notification procedure. Any required written notice, approval, reporting or other communication shall be personally delivered or sent by first class mail to the following persons. Any change in this contact information shall be submitted in writing to all parties to this Covenant. Upon mutual agreement of the parties to this Covenant, an alternative to personal delivery or first class mail, such as e-mail or other electronic means, may be used for these communications.

South Park Property Development, LLC Attn: Rob Howie 165 NE Juniper Street Suite 100 Issaquah, WA 98027 425-837-9720 rhowie@seaconllc.com	Environmental Covenants Coordinator Washington State Department of Ecology Toxics Cleanup Program P.O. Box 47600 Olympia, WA 98504 – 7600 (360) 407-6000 ToxicsCleanupProgramHQ@ecy.wa.gov

Section 5. Modification or Termination.

a. Grantor must provide written notice and obtain approval from Ecology at least sixty (60) days in advance of any proposed activity or use of the Property in a manner that is inconsistent with this Covenant. For any proposal that is inconsistent with this Covenant and permanently modifies an activity or use restriction at the site:

i. Ecology must issue a public notice and provide an opportunity for the public to comment on the proposal; and

ii. If Ecology approves of the proposal, the Covenant must be amended to reflect the change before the activity or use can proceed.

b. If the conditions at the site requiring a Covenant have changed or no longer exist, then the Grantor may submit a request to Ecology that this Covenant be amended or terminated. Any amendment or termination of this Covenant must follow the procedures in MTCA and UECA and any rules promulgated under these chapters.

Section 6. Enforcement and Construction.

a. This Covenant is being freely and voluntarily granted by the Grantor.

b. Within ten (10) days of execution of this Covenant, Grantor shall provide Ecology with an original signed Covenant and proof of recording and a copy of the Covenant and proof of recording to others required by RCW 64.70.070.

c. Ecology shall be entitled to enforce the terms of this Covenant by resort to specific performance or legal process. All remedies available in this Covenant shall be in addition to any and all remedies at law or in equity, including MTCA and UECA. Enforcement of the terms of this Covenant shall be at the discretion of Ecology, and any forbearance, delay or omission to exercise its rights under this Covenant in the event of a breach of any term of this Covenant is not a waiver by Ecology of that term or of any subsequent breach of that term, or any other term in this Covenant, or of any rights of Ecology under this Covenant.

d. The Grantor shall be responsible for all costs associated with implementation of this Covenant. Furthermore, the Grantor, upon request by Ecology, shall be obligated to pay for Ecology's costs to process a request for any modification or termination of this Covenant and any approval required by this Covenant.

e. This Covenant shall be liberally construed to meet the intent of MTCA and UECA.

f. The provisions of this Covenant shall be severable. If any provision in this Covenant or its application to any person or circumstance is held invalid, the remainder of this Covenant or its application to any person or circumstance is not affected and shall continue in full force and effect as though such void provision had not been contained herein.

g. A heading used at the beginning of any section or paragraph or exhibit of this Covenant may be used to aid in the interpretation of that section or paragraph or exhibit but does not override the specific requirements in that section or paragraph.

h. This Covenant shall not be considered or interpreted to diminish the governmental or police powers of the State of Washington or the City of Seattle.

The undersigned Grantor warrants he/she holds the title to the Property and has authority to execute this Covenant.

EXECUTED this _____ day of _____, 20___.

SOUTH PARK PROPERTY DEVELOPMENT LLC

_____

By: _____

Title: _____

REPRESENTATIVE ACKNOWLEDGEMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the _____ [TYPE OF AUTHORITY] of South Park Property Development LLC to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

_____
Notary Public in and for the State of Washington
Residing at _____
My appointment expires _____

Exhibit A

LEGAL DESCRIPTION

The Land is located in King County, Washington, and is legally described as follows:

Parcel A:

That portion of Government Lots 2 through 4, inclusive, and of the Southwest Quarter of the Northwest Quarter of Section 32, Township 24 North, Range 4 East, Willamette Meridian, in King County, Washington, described as follows:

Beginning at a point on the West line of George Holt's Donation Claim No. 51, as established by Superior Court Case No. 14450, which is 400 feet North of the Southwesterly corner thereof;

thence South along said West line 400 feet to the South line of said donation claim;

thence East along said South line to the West line of A. Hograve's Donation Claim No. 37;

thence South along the last described West line to the production West of the centerline of Sullivan Street;

thence West along said produced line to the East line of 1st Avenue South, as established by Ordinance No. 21498;

thence North along said East line 39.56 feet;

thence North 66°52'24" East 562.14 feet;

thence North 16°56'06" West 861.57 feet;

thence North 24°43'54" East 35.17 feet;

thence North 64°14'54" East 98 feet;

thence Easterly along a straight line to the Point of Beginning;

EXCEPT that portion thereof described as follows:

Beginning at the intersection of a line 794 feet West of and parallel with the West line of A. Hograve's Donation Claim No. 37 and the production West of the centerline of Sullivan Street;

thence West along said produced line to the East line of 1st Avenue South, as established by Ordinance No. 21498;

thence North along said East line 39.56 feet;

thence North 66°52'24" East 562.14 feet;

thence Southeasterly along a straight line to the Point of Beginning; and

EXCEPT those portions conveyed to the City of Seattle by deeds recorded under recording numbers 5947050 and 6240807; and

EXCEPT that portion lying Southwesterly of the Northeasterly line of Occidental Avenue South (Road No. 51); and

EXCEPT that portion thereof described as follows:

That portion of Government Lot 4, Section 32, Township 24 North, Range 4 East, Willamette Meridian, in King County, Washington, described as follows:

Beginning at a point on the West line of Geo. Holt Donation Claim No. 51 which is 516.36 feet South of the North line of Section 32, Township 24 North, Range 4 East, Willamette Meridian, in King County, Washington;

thence South 02°03'26" West along said line 400 feet;

thence North 89°53'36" East along the South line of said donation claim 73.16 feet;

thence South 00°35'49" West along a line parallel to and 794 feet West of the West line of A. Hograve Donation Claim No. 37, a distance of 350 feet;

thence Westerly to a concrete monument on the East line of Chas. Prentice tract;

thence North 16°56'06" West 705.57 feet;

thence North 24°43'54" East 35.17 feet;

thence North 64°14'54" East 98 feet;

thence Easterly to the Point of Beginning.

Parcel B:

That portion of Government Lot 4, Section 32, Township 24 North, Range 4 East, Willamette Meridian, in King County, Washington, described as follows:

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thence Westerly to a concrete monument on the East line of Chas. Prentice tract;

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thence North 24°43'54" East 35.17 feet;

thence North 64°14'54" East 98 feet;

thence Easterly to the Point of Beginning;

EXCEPT any portion thereof lying within Occidental Avenue; and

EXCEPT that portion conveyed to the City of Seattle by deed recorded under recording number 5947050.

Exhibit B

PROPERTY MAP

FLOYD | SNIDER
strategy • science • engineering
Aspect CONSULTING
HERRERA

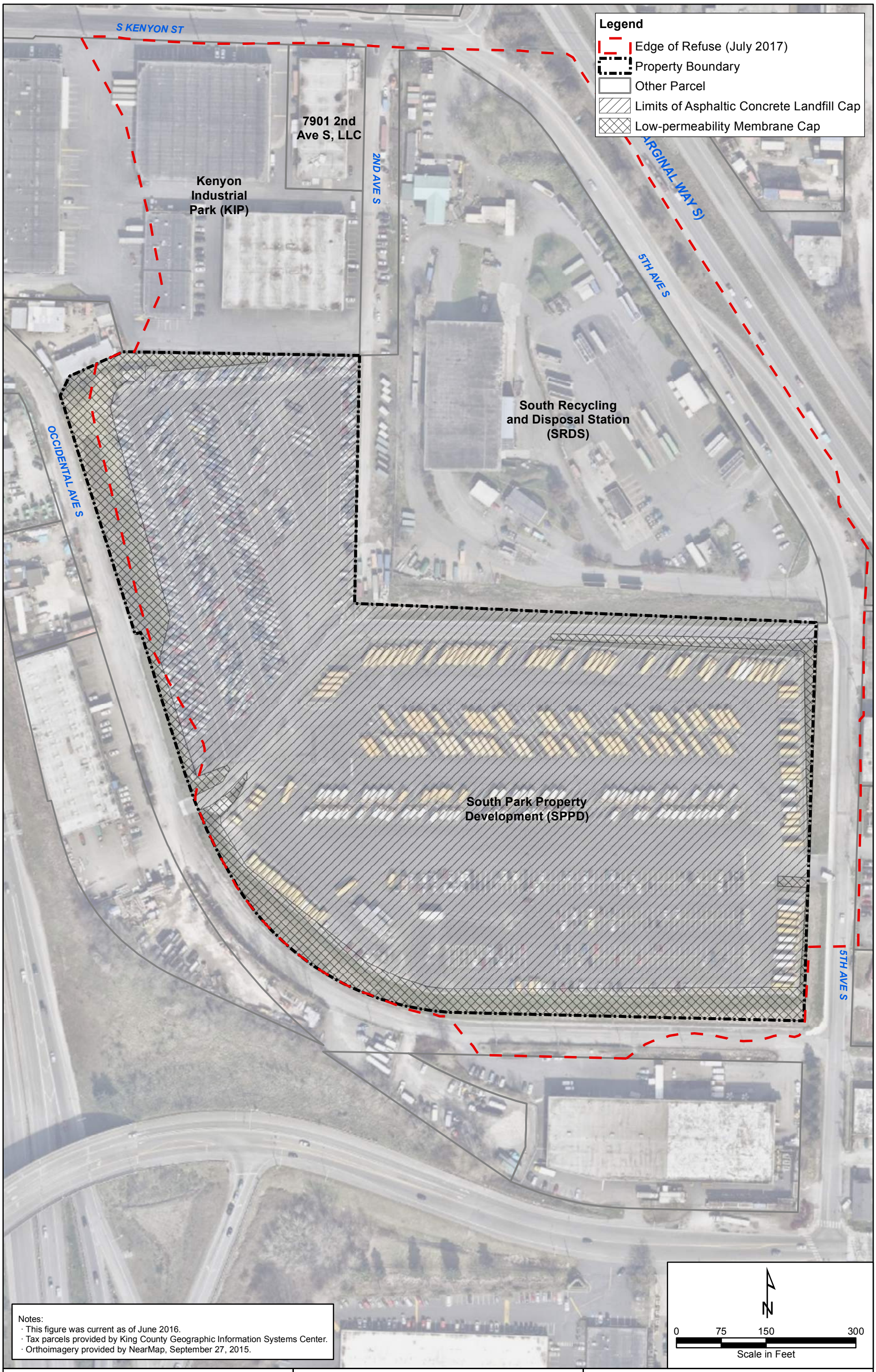
South Park Landfill
Seattle, Washington

Exhibit B
Property Boundary–SPPD Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\Exhibit B\Exhibit B Property Boundary - SPPD Parcel.mxd
2/12/2018

Exhibit C

LANDFILL CAP BOUNDARY



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strategy • science • engineering
Aspect CONSULTING
HERRERA

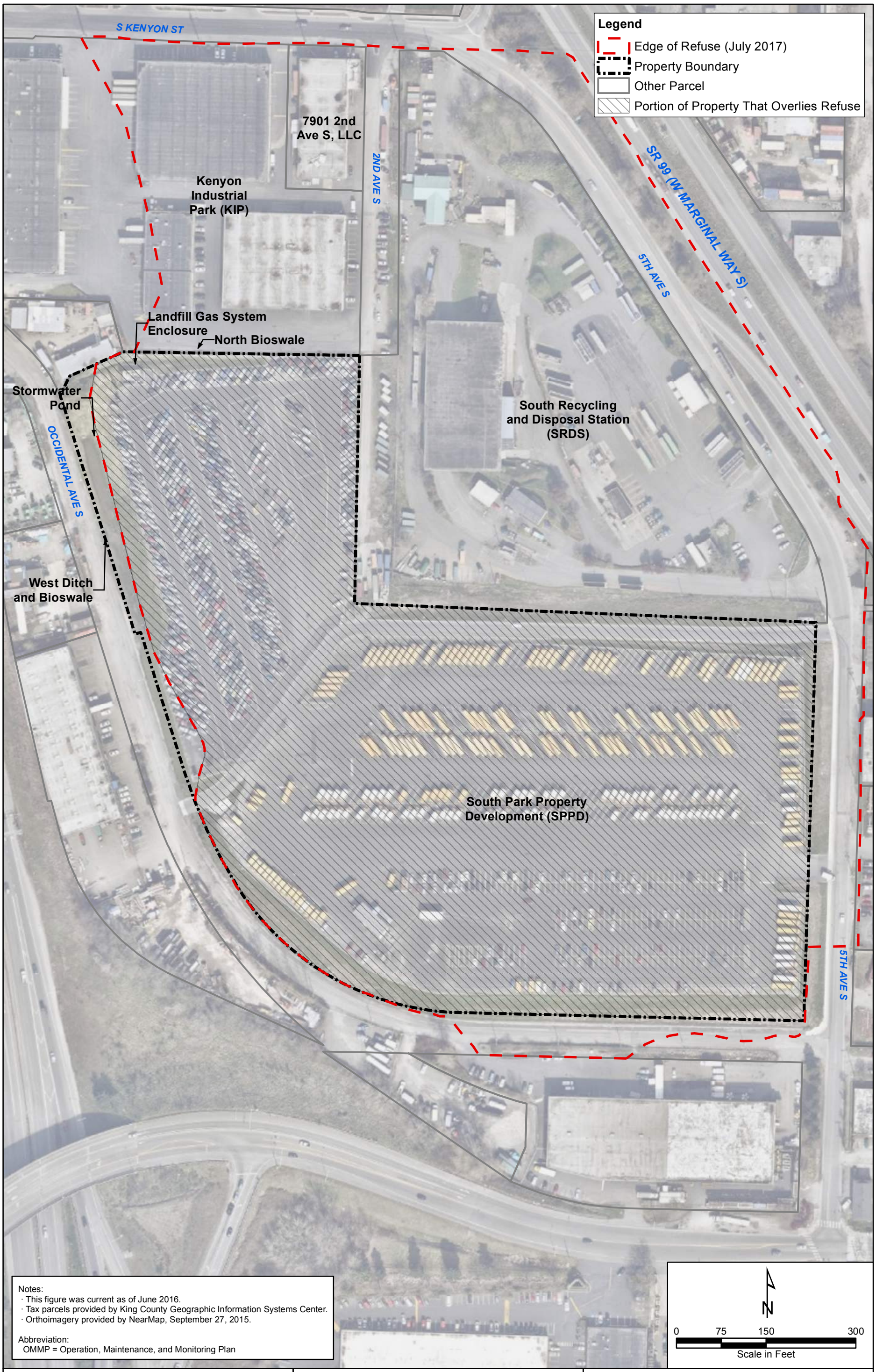
South Park Landfill
Seattle, Washington

Exhibit C
Landfill Cap Boundary–SPPD Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\Exhibit C\Exhibit C Landfill Cap Boundary - SPPD Parcel.mxd
2/12/2018

Exhibit D

PORTION OF THE PROPERTY THAT OVERLIES REFUSE



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Aspect CONSULTING
HERRERA

South Park Landfill
Seattle, Washington

Exhibit D
Portion of Property That Overlies Refuse–SPPD Parcel

I:\GIS\Projects\COS-SPARK\MXD\CAP\2017 CAP-FEB18\Exhibit D\Exhibit D Portion of Property That Overlies Refuse - SPPD Parcel.mxd
2/12/2018

South Park Landfill

Final Cleanup Action Plan

Appendix B
Environmental Covenants for
South Park Landfill

South Recycling and Disposal Station Parcel

After Recording Return
Original Signed Covenant to:

Jerome Cruz
Toxics Cleanup Program
Department of Ecology
Northwest Regional Office
3190 - 160th Ave. SE
Bellevue, WA 98008-5452

Environmental Covenant

Grantor: City of Seattle
Grantee: State of Washington, Department of Ecology (hereafter "Ecology")
Brief Legal Description: PTN OF GOV'T LOT 4 STR 32-24-04
Tax Parcel Nos.: 7328400005 and 3224049110
Cross Reference: NONE

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c. Stormwater facilities. To minimize the potential for mobilization of contaminants remaining in soil, waste materials, and groundwater on the Property, no stormwater infiltration facilities or unlined ponds shall be constructed on the portion of the Property that overlies refuse as detailed in Exhibit D. All stormwater catch basins, conveyance systems, and other appurtenances installed on the Property shall be of water-tight construction.

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e. Landfill Gas Monitoring. Grantor shall monitor landfill gas on the Property. The following monitoring is required:

i. The Grantor will monitor indoor spaces using the methane alarms in 2(d) above to ensure that concentrations of methane gas in (a) buildings overlying refuse illustrated in Exhibit B do not exceed 1.25 percent by volume, or 25 percent of the lower explosive limit (LEL), and (b) buildings outside the area of the Property overlying refuse illustrated in Exhibit B do not exceed 100 parts per million by volume.

ii. The Grantor will monitor performance of the landfill gas controls installed on the Property as part of 2(d) above;

iii. The Grantor shall promptly report to Ecology any exceedance of methane gas allowable limits, and shall take immediate, appropriate action to respond to such exceedances.

f. Groundwater use. The groundwater beneath the Property remains contaminated and shall not be extracted for any purpose other than temporary construction dewatering, investigation, monitoring or remediation. Drilling of a well for any water supply purpose is strictly prohibited. Groundwater extracted from the Property for any purpose shall be considered potentially contaminated and any discharge of this water shall be done in accordance with state and federal law.

g. Groundwater Monitoring. Groundwater monitoring wells are located on the Property to monitor the performance of the remedial action. The Grantor shall maintain clear access to these devices and protect them from damage. The Grantor shall report to Ecology within 14 calendar days of the discovery of any damage to any monitoring device located on the Property. Unless Ecology approves of an alternative plan in writing, the Grantor shall arrange for the prompt repair of the damage and submission of a report documenting this work to Ecology within thirty (30) days of completing the repairs.

Section 3. Access.

a. The Grantor shall maintain clear access to all remedial action components necessary to construct, operate, inspect, monitor and maintain the remedial action.

b. The Grantor freely and voluntarily grants Ecology, its authorized representatives, and the Site Coordinator, upon reasonable notice, the right to enter the Property at reasonable times to evaluate the effectiveness of this Covenant and associated remedial actions, and enforce compliance with this Covenant and those actions, including the right to take samples, inspect any remedial actions conducted on the Property, and to inspect related records.

c. No right of access or use by a third party to any portion of the Property is conveyed by this instrument.

Section 4. Notice Requirements.

a. Conveyance of Any Interest. The Grantor, when conveying any interest in any part of the property, including but not limited to title, easement, leases, and security or other interests, must:

i. Provide written notice to Ecology of the intended conveyance at least thirty (30) days in advance of the conveyance.

ii. Include in the conveying document a notice in substantially the following form, as well as a complete copy of this Covenant:

NOTICE: THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL COVENANT GRANTED TO THE WASHINGTON STATE DEPARTMENT OF ECOLOGY ON [DATE] AND RECORDED WITH THE KING COUNTY RECORDER'S OFFICE UNDER RECORDING NUMBER [RECORDING NUMBER]. USES AND ACTIVITIES ON THIS PROPERTY MUST COMPLY WITH THAT COVENANT, A COMPLETE COPY OF WHICH IS ATTACHED TO THIS DOCUMENT.

iii. Unless otherwise agreed to in writing by Ecology, provide Ecology with a complete copy of the executed document within thirty (30) days of the date of execution of such document.

b. Reporting Violations. Should the Grantor become aware of any violation of this Covenant, Grantor shall promptly report such violation in writing to Ecology.

c. Emergencies. For any emergency or significant change in site conditions due to Acts of Nature (for example, flood or fire) resulting in a violation of this Covenant, the Grantor is authorized to respond to such an event in accordance with state and federal law. The Grantor must notify Ecology in writing of the event and response actions planned or taken as soon as practical but no later than within 24 hours of the discovery of the event.

d. Notification procedure. Any required written notice, approval, reporting or other communication shall be personally delivered or sent by first class mail to the following persons. Any change in this contact information shall be submitted in writing to all parties to this Covenant. Upon mutual agreement of the parties to this Covenant, an alternative to personal delivery or first class mail, such as e-mail or other electronic means, may be used for these communications.

City of Seattle Seattle Public Utilities Attn: Jeff Neuner P.O. Box 34018 Seattle, WA 98124-4018 206-684-7693 Jeff.Neuner@seattle.gov	Environmental Covenants Coordinator Washington State Department of Ecology Toxics Cleanup Program P.O. Box 47600 Olympia, WA 98504 – 7600 (360) 407-6000 ToxicsCleanupProgramHQ@ecy.wa.gov

Section 5. Modification or Termination.

a. Grantor must provide written notice and obtain approval from Ecology at least sixty (60) days in advance of any proposed activity or use of the Property in a manner that is inconsistent with this Covenant. For any proposal that is inconsistent with this Covenant and permanently modifies an activity or use restriction at the site:

i. Ecology must issue a public notice and provide an opportunity for the public to comment on the proposal; and

ii. If Ecology approves of the proposal, the Covenant must be amended to reflect the change before the activity or use can proceed.

b. If the conditions at the site requiring a Covenant have changed or no longer exist, then the Grantor may submit a request to Ecology that this Covenant be amended or terminated. Any amendment or termination of this Covenant must follow the procedures in MTCA and UECA and any rules promulgated under these chapters.

Section 6. Enforcement and Construction.

a. This Covenant is being freely and voluntarily granted by the Grantor.

b. Within ten (10) days of execution of this Covenant, Grantor shall provide Ecology with an original signed Covenant and proof of recording and a copy of the Covenant and proof of recording to others required by RCW 64.70.070.

c. Ecology shall be entitled to enforce the terms of this Covenant by resort to specific performance or legal process. All remedies available in this Covenant shall be in addition to any and all remedies at law or in equity, including MTCA and UECA. Enforcement of the terms of this Covenant shall be at the discretion of Ecology, and any forbearance, delay or omission to exercise its rights under this Covenant in the event of a breach of any term of this Covenant is not a waiver by Ecology of that term or of any subsequent breach of that term, or any other term in this Covenant, or of any rights of Ecology under this Covenant.

d. The Grantor shall be responsible for all costs associated with implementation of this Covenant. Furthermore, the Grantor, upon request by Ecology, shall be obligated to pay for Ecology's costs to process a request for any modification or termination of this Covenant and any approval required by this Covenant.

e. This Covenant shall be liberally construed to meet the intent of MTCA and UECA.

f. The provisions of this Covenant shall be severable. If any provision in this Covenant or its application to any person or circumstance is held invalid, the remainder of this Covenant or its application to any person or circumstance is not affected and shall continue in full force and effect as though such void provision had not been contained herein.

g. A heading used at the beginning of any section or paragraph or exhibit of this Covenant may be used to aid in the interpretation of that section or paragraph or exhibit but does not override the specific requirements in that section or paragraph.

h. This Covenant shall not be considered or interpreted to diminish the governmental or police powers of the State of Washington or the City of Seattle.

The undersigned Grantor warrants he/she holds the title to the Property and has authority to execute this Covenant.

EXECUTED this _____ day of _____, 20___.

CITY OF SEATTLE

_____

by: _____

Title: _____

Exhibit A

LEGAL DESCRIPTION

The Land is located in King County, Washington, and is legally described as follows:

Parcel A:

Those portions of Blocks 6, 7, 17 and 18, First Addition to River Park, according to the Plat thereof recorded in Volume 8 of Plats, page 65, in King County, Washington, lying westerly and southwesterly of the westerly and southwesterly margin of that certain property conveyed by the State of Washington to the City of Seattle for road purposes by deed recorded under Recording No. 9012260159;

EXCEPT any portion thereof lying west of the west line of George Holt Donation Claim No. 51;

AND EXCEPT any portion thereof lying within 2nd Avenue South, conveyed to the City of Seattle by deed recorded under Recording No. 4192618;

AND EXCEPT any portion thereof lying within South Kenyon Street;

TOGETHER WITH vacated South Monroe, South Elmgrove and South Southern Streets adjoining, vacated pursuant to City of Seattle Ordinance No. 96804 and attaching thereto by operation of law.

Parcel B:

That portion of Government Lot 4, Section 32, Township 24 North, Range 4 East, W.M., in King County, Washington, described as follows:

A strip of land, 60 feet in width, lying between lines, the west line being 60 feet west of, as measured at right angles to and parallel with the following described east line:

Beginning on the north line of said Section 32, 264 feet east from the northwest corner thereof;

thence south 15031'06" east, 547.61 feet;

thence easterly to intersect a point on a line drawn south 02°03'26" west from a point on the north line of said section, 73.81 feet west of the west line of George Holt Donation Claim No. 51, said point being 516.36 feet south of said north line;

thence continuing easterly on said line to the west line of said Donation Claim and the TRUE POINT OF BEGINNING of east line description;

thence south along the west line of said Donation Claim to an intersection with a line distant 30 feet south of and parallel with the south line of Block 6, First Addition to River Park, according to the plat thereof recorded in Volume 8 of Plats, page 65, in King County, Washington, and the terminus of east line description.

Parcel C:

That portion of Government Lots 2 and 4, Section 32, Township 24 North, Range 4 East, W.M., in King County, Washington, described as follows:

A strip of land, 30 feet in width, lying between lines, the south line being 30 feet south of, as measured at right angles to and parallel with the following described north line:

Beginning at the intersection of the west line of George Holt Donation Claim No. 51, with the south line of Block 6, First Addition to River Park, according to the plat thereof recorded in Volume 8 of Plats, page 65, in King County, Washington;

thence easterly, along the south line of said Block 6, to the southeast corner of Lot 1, said Block 6, and the terminus of north line description;

EXCEPT that portion thereof, if any, lying within 5th Avenue South.

Exhibit B

PROPERTY MAP

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Aspect CONSULTING
HERRERA

South Park Landfill
Seattle, Washington

Exhibit B
Property Boundary–SRDS Parcel

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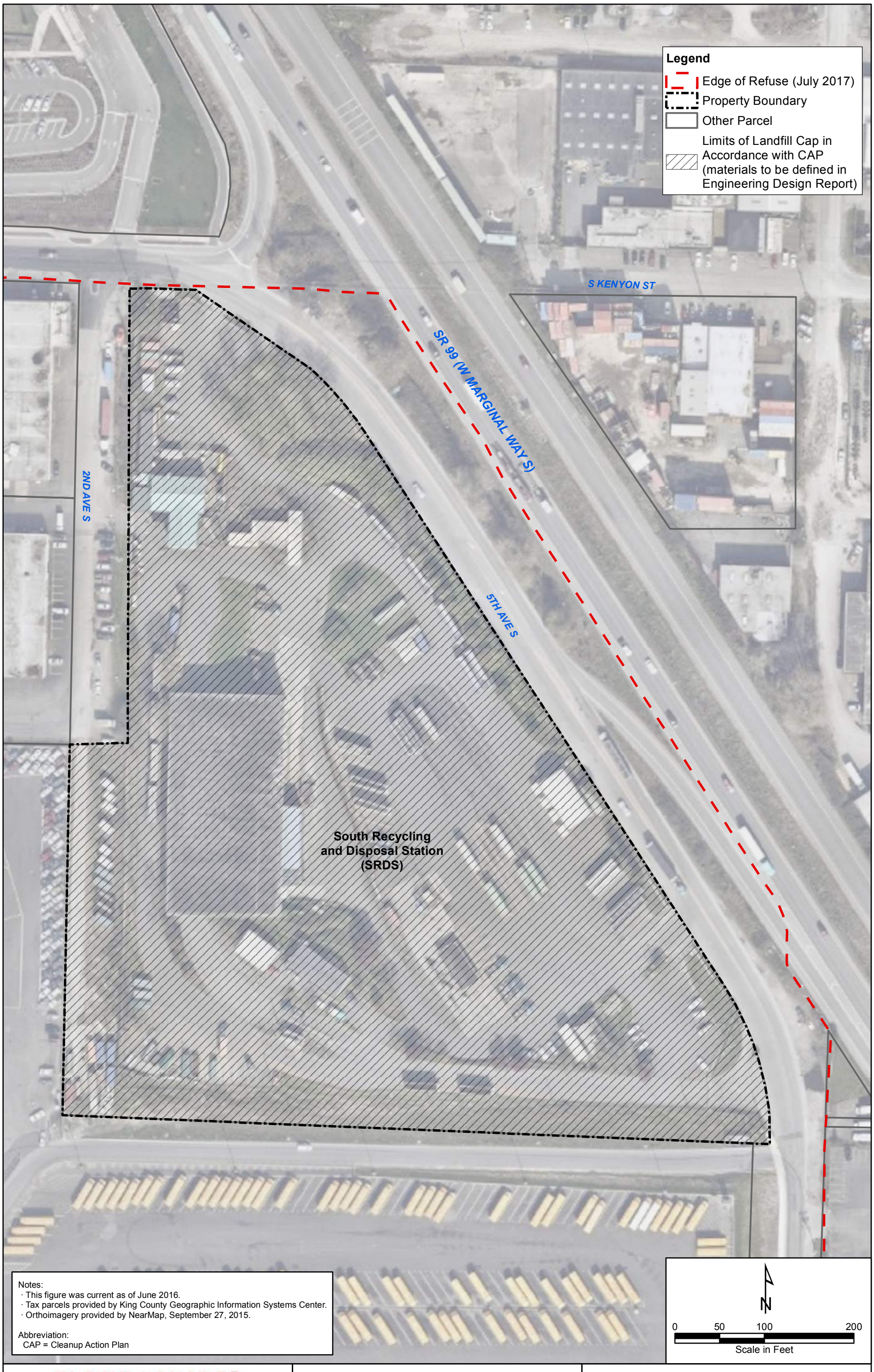
2/12/2018

Exhibit C

LANDFILL CAP BOUNDARY



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strategy ▪ science ▪ engineering
Aspect CONSULTING
HERRERA

South Park Landfill
Seattle, Washington

Exhibit C
Landfill Cap Boundary–SRDS Parcel

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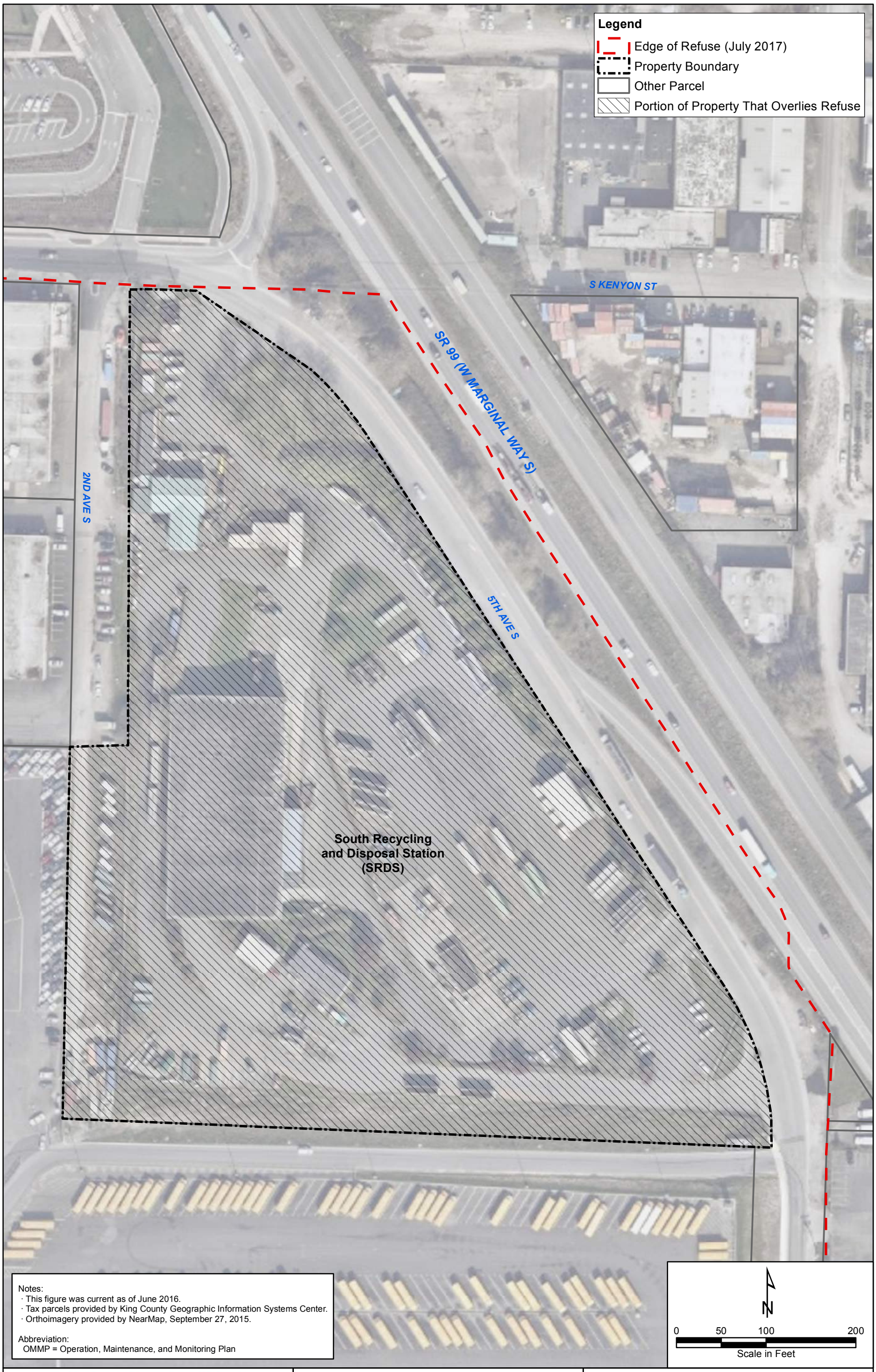
2/12/2018

Exhibit D

PORTION OF PROPERTY THAT OVERLIES REFUSE



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South Park Landfill
Seattle, Washington

Exhibit D
Portion of Property That Overlies Refuse–SRDS Parcel

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2/12/2018