CITY OF VANCOUVER

CITY CLERK'S DEPARTMENT
Access to Information & Privacy Division

File No.: 04-1000-20-2023-376

August 8, 2023

s.22(1)

Dear s.22(1)

Re: **Request for Access to Records under the Freedom of Information and Protection of Privacy Act (the "Act")**

I am responding to your request of June 23, 2023 under the ***Freedom of Information and Protection of Privacy Act (the Act)*** for:

> **Record of the report "Environmental Review at Everett Crowley Park (Former Kerr St Landfill)" (2014) prepared by SynergyAspen Environmental (report cited in "Everett Crowley Park: An assessment of current and future restoration efforts (https://sustain.ubc.ca/sites/default/files/2017-28_Everett%20Crowley%20Park%20Restoration%20Assessment_Campbell.pdf).**

All responsive records are attached.

Under section 52 of the Act, and within 30 business days of receipt of this letter, you may ask the Information & Privacy Commissioner to review any matter related to the City's response to your FOI request by writing to: Office of the Information & Privacy Commissioner, info@oipc.bc.ca or by phoning 250-387-5629.

If you request a review, please provide the Commissioner's office with: 1) the request number (#04-1000-20-2023-376); 2) a copy of this letter; 3) a copy of your original request; and 4) detailed reasons why you are seeking the review.

Yours truly,

[Signed by Cobi Falconer]

Cobi Falconer, MAS, MLIS, CIPP/C
Director, Access to Information & Privacy
cobi.falconer@vancouver.ca
453 W. 12th Avenue Vancouver BC V5Y 1V4

If you have any questions, please email us at foi@vancouver.ca and we will respond to you as soon as possible. Alternatively, you can call the FOI Case Manager at 604-871-6584.

Encl. (Response Package)

:ma

CITY OF VANCOUVER

ENVIRONMENTAL REVIEW AT EVERETT CROWLEY PARK

(FORMER KERR STREET LANDFILL)

Prepared For:

Real Estate and Facilities Management
City of Vancouver
453 W 12th Avenue
Vancouver, BC, V5Y 1V4
Attn: Amber Bongiovanni, B.Sc., EP
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October 22, 2014

City of Vancouver
Real Estate and Facilities
Management
453 W 12th Avenue
Vancouver, BC, V5Y 1V4

Attention: Amber Bongiovanni, B.Sc., EP
Contaminated Sites Specialist

Reference: **Environmental Review at Everett Crowley Park (Former Kerr Street Landfill)**

SynergyAspen Environmental Inc. (SynergyAspen) is pleased to provide the enclosed report in response to the request from the City of Vancouver for an Environmental Review of the former Kerr Street landfill, currently utilized as the Everett Crowley Park located at 8200 Kerr Street in Vancouver (Site).

The services requested comprised the review of 7 documents provided by the City of Vancouver and a Site visit focusing on the following four (4) areas:

1. Surface water management.
2. Groundwater flow and management.
3. Leachate management infrastructure.
4. Landfill gas.

Based on the document review and Site visit, SynergyAspen's prepared the enclosed report addressing the four areas above including a long term care plan.

SynergyAspen hopes that the enclosed report meets and/or exceeds the current needs of the City of Vancouver.

Best Regards,

Philip Lowery, P. Eng., CSAP
Project Manager
SynergyAspen Environmental Inc.

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ATTACHMENTS

I. Historical Aerial Photographs

II. Site Visit Photographs

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IV. UTM Coordinates for Site Features on Drawing VAN6044-14-002

1. Understanding

Based on the Scope of Work provided by the City of Vancouver (City) in the email of March 31, 2014, it is the understanding of SynergyAspen that the City is requesting an Environmental Review of the Everett Crowley Park, formerly the Kerr Street landfill, located at 8200 Kerr Street in Vancouver (Site). The Environmental Review is in response to a report prepared by Morrison Hersfield in March 2014 for Metro Vancouver and subsequent response letter from the City to Metro Vancouver dated March 6, 2014; the City letter stated that the City was in the process of addressing the areas of potential concern identified in the Morrison Hersfield report.

The purpose of the Environmental Review is to address the information gaps identified in the Morrison Hershfield report as not conforming to 'Best Practices Criteria' detailed below, to identify any potential environmental risks and provide plans to mitigate those risks and to layout an appropriate long term care plan for the future associated with the former landfill.

The scope of work completed by SynergyAspen comprised two (2) main tasks: 1) Review of seven (7) reports provided by the City, and 2) a Site visit, focusing on four (4) areas identified in the Morrison Hershfield report as not conforming to 'Best Practices Criteria':

1. Surface water management.
2. Groundwater flow and management.
3. Leachate management infrastructure.
4. Landfill gas.

The following sections in this report provide the results to the report review and site visit and recommendations for further work as part of the long term care plan.

2. Regulatory Context

The recent report prepared by Morrison Hershfield identified that there were no permits or approvals issued under the Environmental Management Act (or its predecessors) for the Site. Also, the Site was not identified on the Ministry of Environment (MOE) Site Registry. This was due primarily to the limited regulatory framework in place at the time of the Site's closure.

As part of the environmental review and preparation of the final report, the following regulations and criteria / guidelines were referenced to ensure that the current regulatory regime is considered:

- *Environmental Management Act (EMA),* S.B.C. 2003, c. 53;
- *Contaminated Sites Regulation (CSR),* B.C. Reg. 375/96, including Stage 9 amendments B.C. Reg. 4/2014 effective January 31, 2014;
- *Approved and Working Water Quality Guidelines,* BC Ministry of Environment;
- *Standards for End of the Pipe Water Based Discharges from the Pacific Place Site,* BC Ministry of Environment, November 27, 1991;
- *Landfill Gas Management Regulation (LGMR),* R/1243/2008/48, effective January 1, 2009;
- *Landfill Gas Management Facilities Design Guidelines,* prepared by Conestoga-Rovers & Associates (CRA) for the BC Ministry of Environment March 2010 pursuant to Section 7 of the LGMR;
- *Landfill Criteria for Municipal Solid Waste,* Last Revised June 1993;
- *Landfill Gas Generation Assessment Procedure Guidelines,* prepared by CRA for the Ministry of Environment prepared pursuant to Section 4 of the LGMR, August 2009*;*
- *Landfill Criteria for Municipal Solid Waste,* Draft Interim Second Edition, November 2013, and;
- *Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills, Ministry of the Environment.*

It should be noted that some of the '*Landfill*' documents referenced above apply to only operating landfills and after 2009. However, the following 'landfill' documents do have relevant sections that pertain to landfill closures and associated monitoring and maintenance plans:

- Section 7 and 10.3.4 of the *Landfill Criteria for Municipal Waste, Second Edition*;
- *Landfill Gas Generation Assessment Procedure Guideline*, and;
- Sections 3, 4, 5 and 6 of the *Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills.*

3. Environmental Review

3.1 Report Review

Based on the review of the reports provided by the City of Vancouver and listed below, the following is a summary of the history of the Site as a landfill as understood by SynergyAspen.

- Environment Canada 1980: Fraser River Estuary Study, Water Quality. Impact of Landfills. Prepared by J. Atwater, Environmental Protection Service, Environment Canada (30 pages);
- City of Vancouver Health Department, 1984. Kerr Road Landfill Site Report. Prepared by E. McLeod, December 16, 1985 and summarized some preliminary landfill gas investigations completed in 1981 (30 pages);
- The Evergreen Foundation, 1997: Everett Crowley Park: Paradise Reclaimed. A short booklet that summarizes some of the landfill and subsequent development history (16 pages);
- Vancouver Parks & Recreation, 2005: Memorandum from March 4, 2005 recommending implementation of the Everett Crowley Park Management Plan (13 pages);
- LEES + Associates Consulting Ltd, 2005. Everett Crowley Park Management Plan, March 7, 2005. The plan includes a preliminary assessment by Gartner Lee Limited of the landfill issues (138 pages);
- ALS Canada Ltd., 2012 & 2013: Water quality analysis results from the Kinross Ravine drain collected by City of Vancouver December 2012 and April 2013, and;
- Morrison Hershfield March 19, 2014: Closure Status Assessment Report – Kerr Road Landfill (Everett Crowley Park) (13 pages).

Attachment I include historical aerial photographs showing the current site boundaries and the location of the former Kinross creek ravine. These photographs were reviewed in conjunction with the above reports.

3.1.1 Landfill History

Informally, during the 1930's it was common practice to dump garbage into the Kinross Creek ravine, which eventually formed part of the overall Kerr Street disposal site area. Landfilling began formally at the Site in 1944 with the creation of the Kerr Street Dump and became the primary landfill for the City in 1946 and was used until 1966; total waste volume placed was estimated at 3.8 million m^3, with yearly quantities ranging from 230,000 m^3 in 1946, 295,000 m^3 in 1950 to an estimated 490,000 m^3 in 1956.

Filling of the ravine started on the western side, adjacent to Kerr Street, with mostly residential garbage. In 1946 Kinross Creek was diverted around the fill area by the installation of a steel culvert along the eastern side of the ravine. The creek was never that wide as it was reported through local stories that you could wade it or even leap it at any number of places. At the time the culvert ran under Marine Drive, through where is now Kinross Ravine Park, to the Fraser River. Based on quality concerns raised by the Ministry of Environment, including the potential toxicity based on a 96 hour LC50 assay, the drainage from the steel culvert installed in 1946 in Kinross Creek ravine was routed to the Metro Vancouver sanitary sewer in 1984. During this same time a PVC drain was installed on the north side of SE Marine Drive to collect a leachate seep emerging in the road ditch east of the current Kinross Ravine Park (refer to Site Visit section for details) and directed it to a sump and then to the Metro Vancouver sanitary sewer trunk line on Marine Way.

Both seepage waste (including septic tank pumping's) and municipal solid waste (MSW) were accepted over the operational life span of the landfill, with very little interim soil cover used. In the early 1950's oily wastes were prohibited and in 1956 septic tank waste were also banned. Also during the 1960's roofing companies were permitted to dispose of unused barrels of tar in the ravine. In 1988 some hikers discovered an area where a tarry substance was visible at surface. Environment Canada advised the City of Vancouver Parks Board to bury this area and so until 1996 the Parks Board staff covered the tarry area with soil from other areas of the City; there was no information available indicating where this area was.

After 1966, the Site was used for disposal of clean fill (reported to be heavy clay) and demolition debris, reportedly from building excavations, for the next 2-3 years with the majority of the fill placed in the area of the former ravine. Depth of the landfilling activities ranges from 49m in the central area of the former ravine to an average of less than 12m across the remainder of the Site. Closure of the landfill was completed with the placement of a 1.5m cap across the entire area of the former landfill. A visual sense of the depth of the former Kinross Creek Ravine at the south end is evident in the Kinross Ravine Park located between SE Marine Drive and Marine Way; north end of the park is approximately 16m in depth. The approximate maximum extent of the fill material placed on the former landfill, based on the aerial photos in Attachment I, is presented on Drawing VAN6044-14-003.

Following the completion of covering and filling, it appears that the site was abandoned and allowed to naturally re-vegetate. Over the period of 1967 to 1973 the site was reported to have settled one metre. In 1974 the Site was placed in the care and custody of the City Parks Board and in 1987 was designated as Everett Crowley Park.

3.1.2 Quarry History

As evident by the appended aerial photographs, from the 1930's through to the late 1960's a sand and gravel quarry operated primarily in the northeast portion of the current park and up-gradient of the former landfill. The sand and gravel was excavated below the water table and eventually formed an irregular shaped pit that was approximately 2 ha in area and 15-18m deep. When the quarry was eventually abandoned in circa early 1970's, groundwater and surface drainage filled the pit, creating what is now Avalon Pond and a small stream (previous landfill drainage ditch), which is now the new Kinross Creek.

3.1.3 Other Historical Activities

In the early 1970's the former landfill was a popular location for motocross riders from the City and surrounding areas. Many of the trails now present at the park were originated during that time. This activity continued until 1975 when they were banned from the site after it was put in the care of the Parks Board.

Another activity that changed the topography of the former landfill was hang gliding. In 1983 the BC Hang Gliding Association proposed to the Parks Board the construction of a temporary training facility. Construction began in 1983 with 2,000 truckloads of 'clean' fill from commercial excavations producing a rough hill, which is now known as Mount Everett. The facility opened in 1985, but was abandoned shortly thereafter due to the hill being too low and too close to trees.

3.1.4 Previous Analytical Results

Based on the review of the reports provided by the City, on the following pages is a compilation of the analysis completed at the Site since the closure of the landfill, including leachate and associated sludge, surface water and sediment from what is now Avalon Pond and vapours from unknown areas of the Site.

TABLE 1: Summary of Analytical Results for LEACHATE

Station	Kerr Street Landfill		Loadings	N of Marine Dr	Deep Culvert	Deep Culvert	N of Marine Dr	Kerr St. Dump	Kerr St. Dump Culvert - Discharge to Sanitary 2012-2013	Metro Vancouver Discharge - Sewer Use Bylaw	End of Pipe Discharges from Pacific Place - Ministry of Environment	Approved / Working Water Quality Guidelines - Ministry of Environment
Sample Name	Average	-	Fraser River	Sludge	Floating Scum	Flow	Pipe	Pond				
Date Collected	1978-1979	18-Jul-84	-	18-Jul-84	18-Jul-84	18-Jul-84	18-Jul-84	22-Jan-85				
Parameter	**Analytical Results**											
pH	7.9	7.3	-	7.5	7.9	7.3	8.1	7.6		5.5-10.5	6.5-8.5	
NFR	37	-	-	-	-	-	-	-				
COD*	116	130	116	11,060	1,415	130	265	-	30-50	53-84		
Conductivity (umhos/cm)	1,960	1,200	-	1,000	1,300	1,200	1,300	275				1400-4200
BETX									Non-detect	1		
Ammonia-Nitrogen	-	-	-	Non Detect	39.2	15.5	25.2	Nil	22.9		15.0	13-83
Nitrate-Nitrogen	-	-	-	171.5	68.8	5.1	2.6	<0.1				32.8, 10
Nitrite-Nitrogen	-	-	-	29.4	0.1	2.1	0.1	<0.01				0.1
Sulphate	7.5	-	7.5	-	-	-	-	75		1,500		128-429
Chloride	105	-	105	-	-	-	-	-				600
Total Phosphate	0.33	-	0.33	-	-	-	-	-				
Total Alkalinity	870	-	870	-	-	-	-	-				
Total Ammonia	-	-	58	-	-	-	-	-				
Aluminum	0.08	-	0.08	-	-	-	-	-		50	0.5	0.1
Arsenic	<0.15	-	-	-	-	-	-	-		1	0.1	0.005
Barium	0.57	-	0.57	-	-	-	-	-			1	5
Calcium	57	-	57	-	-	-	-	-				4
Cadmium	<0.015	Non Detect	-	Non Detect	Non Detect	Non Detect	Non Detect	<0.1		0.2	0.05	.00001-.00012
Cobalt	<0.02	Non Detect	-	-	-	-	-	-		5	0.1	0.11
Chromium	<0.02	Non Detect	-	1.3	Non Detect	Non Detect	Non Detect	<0.1		4	0.5	0.001
Copper	0.01	0.04	0.01	0.8	0.12	0.04	Non Detect	0.1		2	0.1	.003-.007
Iron	9.5	34.9	9.5	61,750	1,108	34.9	262.8	2.5	20-40	10		0.35-1.0
Mercury	<0.1	-	-	-	-	-	-	-		0.05	0.001	0.001
Magnesium	41	-	41	-	-	-	-	-				
Manganese	0.30	-	0.30	-	-	-	-	-		5		0.8-3.8
Molybdenum	<0.15	-	-	-	-	-	-	-		1	0.5	.05-2
Sodium	173	-	173	-	-	-	-	-				
Nickel	<0.08	Non Detect	-	Non Detect	Non Detect	Non Detect	Non Detect	<0.1		2	0.5	0.025-0.15
Lead	0.08	1.2	0.08	Non Detect	1.6	1.2	1.6	<0.1		1	0.1	.003-.1
Antimony	<0.08	-	-	-	-	-	-	-				0.02
Selenium	<0.15	-	-	-	-	-	-	-		1		0.002
Tin	<0.2	-	-	-	-	-	-	-			0.5	
Strontium	1.00	-	1.00	-	-	-	-	-				
Titanium	<0.009	-	-	-	-	-	-	-				2
Vanadium	<0.09	-	-	-	-	-	-	-				0.006
Zinc	0.01	0.01	0.4	490	0.4	0.1	0.4	0.1	0.015-0.029	3	0.2	0.01-0.03
Silicon	14.6	-	14.6	-	-	-	-	-				
Potassium	63	-	63	-	-	-	-	-				373-432

Footnotes:
All terms defined in the body of SynergyAspen's report.
All units reported in mg/L.
Standards units are total concentrations in mg/L
* COD values are based on typical effluent values from the Annacis Island Waste Water Treatment Plant
(<) Denotes concentration less than indicated detection limit or RPD less than indicated value.
(-) Denotes analysis not conducted.
(n/a) Denotes no applicable standard.

TABLE 2: Summary of Analytical Results for METALS in Sediment

Station	Kerr St. Dump	Working Water Quality Guidelines - Ministry of Environment	Sch 9 of the Contaminated Sites Regulation
Sample Name	Pond		
Date Collected	22-Jan-85		
Parameter	**Analytical Results**		
Cadmium	0.8	0.6	2.2
Copper	7.1	35.7	120
Iron	9,187	21,200	
Manganese	91.9	460	
Nickel	5.3	16	
Lead	9.7	35	57
Zinc	24.7	123	200

Footnotes:
All terms defined in the body of SynergyAspen's report.
All units reported in mg/kg.
* RPDs are not normally calculated where one or more concentrations are less than five times MDL.
(<) Denotes concentration less than indicated detection limit or RPD less than indicated value.
(-) Denotes analysis not conducted.
(n/a) Denotes no applicable standard.

NOTE: Sedimet from Pond

TABLE 3: Summary of Analytical Results for PHENOLS, PESTICIDES, & INSECTICIDES in Surface Water

Station	Kerr St. Dump
Sample Name	Pond
Date Collected	22-Jan-85
Parameter	**Analytical Results**
Chlorinated pesticdes	Not Detect
Carbanate Insecticides	Not Detect
Organophosphate	Not Detect
Phenols	Not Detect
PCBs	Not Detect

Footnotes:
All terms defined in the body of SynergyAspen's report.
All units reported in mg/L.
* RPDs are not normally calculated where one or more concentrations are less than five times MDL.
(<) Denotes concentration less than indicated detection limit or RPD less than indicated value.
(-) Denotes analysis not conducted.
(n/a) Denotes no applicable standard.

The values highlighted in red are concentrations that were identified in excess of the most stringent current standard, some of which are dependent on hardness and other variables. In addition, some of the exceedances are due to detection limits that at the time were higher than the current standards.

The only bioassay that was completed was in 1977; it revealed a result for a 96 hr. LC_{50} of 24% and a LT_{50} at 100% of 34 min. as compared to a current standard for a 96 hr. LC_{50} of 100% for discharge to a storm sewer and 50% to treatment. These standards are based on Pacific Place standards for a Special Waste facility. Additionally, the discharge permit for the Annacis Island Waste Water Treatment Plant specifies a minimum limit of 100% for a 96 hr. LC_{50}. These results in 1997 as well as the analytical results in the tables on the following page prompted the MOE to request the City to address the potential environmental risk posed by the former landfill leachate to the Fraser River. The City responded by re-directing the culvert discharge in 1984 to the sanitary as referenced in Section 3.1.1 above and illustrated in Drawing VAN6044-14-002.

A methane study was completed between January and March 1981 by E.H. Hanson (report was not available) during which time a combination of deep and shallow probes were used. The location of the deep probes was unknown; however the concentrations did not exceed 0.5% LEL methane. The shallow probes were reportedly installed in the north end of the Site where the Kinross Creek Ravine originated. A maximum concentration of 20% LEL methane was detected in this area. Concentrations of greater than 5% LEL in soil and/or greater than 25% LEL in structures on-site are indicative of potential hazardous conditions and warrant further assessment. A follow-up study completed in October 1981 found significant readings in soil off-Site, but no concentrations in adjacent structures or preferential pathways.

3.2 Site Visit

A site visit was completed on June 12, 2014 by SynergyAspen staff. City of Vancouver personnel was not available to accompany SynergyAspen during the Site visit. It should be noted that many areas of the Site, notably the south facing slope, were not accessible due to significant vegetation coverage (i.e. blackberries) and steep slopes. Despite the existence of the former landfill, there was limited visible evidence of environmental impacts to the Site, with significant presence of mature trees and other vegetation on Site.

During the Site visit the following was noted or observed:

1. Surface water bodies:

Primary surface water bodies at the Site include Avalon Pond and New Kinross Creek.

Avalon pond

- Water elevation was near surface with vegetation around its perimeter. A discharge point is located on the downstream side to the south, discharging to New Kinross Creek

New Kinross Creek

- At the discharge point from Avalon pond, minor iron staining was observed along the creek bank (photograph 9)
- Approximately 170 m downstream of Avalon pond, the creek was inspected and landfill garbage (concrete, old tubing, refuse) was visible along the exposed face of the western creek bank. No garbage

was visible on the eastern bank. No visible iron staining was observed (photographs 10-13) on either the east or west bank.

Former Kinross Creek (Currently Kinross Ravine Park)

- Downstream of Marine Drive, within the Park, there is standing stagnant surface water with significant iron staining and biofilm accumulation across its width; approximately 3 m maximum. The source of the water is suspected to be discharge from the former Kinross Creek [Photographs 15-17 and 39, 40) and/or possible leaking from the adjacent sanitary sewer system.

2. Groundwater Seeps

Groundwater seeps were not readily visible in the areas walked throughout the Site. However, several were observed along Marine Drive at four (4) locations. An intermittent swale was also observed along Marine Drive with standing water observed within. The seeps and swale (with water) locations are noted on Drawing VAN6044-14-002 and are as follows:

A: - a 2 m length of steel culvert (poor condition) was observed with stagnant water.

B: - an area of cattails and swale was observed east of former Kinross Creek Ravine.

C: - swale area was observed adjacent to bus stop within area of former Kinross Creek Ravine.

D: - an area of approximately 50 m in length adjacent to sidewalk on the north side of Marine Drive was observed including what appears to be an interception drain based on gravel at surface and a number of catch basins.

E: - A seep was noted on Matheson Crescent (Photographs 34 and 35) in close proximity to where New Kinross Creek discharges into a storm catchment drain (Photograph 36) and then likely into the City storm sewer system.

Seeps B to E were rust coloured indicating iron precipitate, typically common of leachate impacts.

The photos are provided in Attachment II, and locations of these photos are shown on Drawing VAN6044-14-002, as well as the City utilities.

3. Landfill Gas Venting

A number of potential gas venting areas in the eastern portion of the Site (presented on Drawing VAN6044-14-002) were observed. These areas were targeted based on the report review, anecdotal information, field visit and the park map located at the Kerr Street and the Matheson entrances. Of note:

- observed pockets of stressed (dry) grass (Photographs 30 and 32);
- observed dead tree (noticed by SynergyAspen to have been replaced during a second site visit on June 20, 2014) [Photograph 32]; and
- two larger re-vegetated areas by City personnel and/or Crowley Park volunteer association. The re-vegetated areas were specifically targeted as poor growing areas due to a "hot spot" in park, due to landfill gas venting. The two areas were re-vegetated with evergreen trees, shrubs and bark mulch was at ground surface. The areas were delineated by wood logs at the perimeter [Photographs 31 and 33].

4. Monitoring Well Condition

The monitoring well that was documented (observed and photographed) in the recent report prepared by Morrison Hershfield was located by SynergyAspen during a site visit conducted on June 30, 2014. However, the condition of the monitoring well could not be ascertained as the protective monument box was secured. The location of the monitoring well is presented on Drawing VAN6044-14-002 and in Photograph 38.

5. Minimal Soil Cover

Based on the interpretation of aerial photos and the Site visit it is suspect that the soil cover is primarily at its minimal thickness in the eastern portion of the Site where there was evidence of stressed vegetation (i.e. venting and re-vegetated areas), uneven terrain and 'garbage' at surface, along the bank of New Kinross Creek. These areas are depicted on Drawing VAN6044-14-003.

6. Stability of South Slope

The stability of the south slope of the Site was visibly assessed by Mr. Joel Pineau of Stantec on June 26, 2014. The details of the assessment are presented in section 4.3 below.

7. Site Access for Future Investigations

SynergyAspen inspected the park for accessibility for drilling monitoring wells for a long term monitoring and maintenance plan. The main paths within the park enable it to be fairly accessible throughout the park. Smaller paths laid by bark mulch are also accessible for a smaller or limited access drill rig. SynergyAspen recommends that monitoring wells be installed along the smaller paths such that they are less visible to the public.

Due to the nature of the infilling of the Site a sonic or ODEX type drill may be more preferred than a standard auger drill in order to minimize refusal on landfill debris and backfill material.

8. Current Leachate System

The only visible evidence of the current leachate system was the interception drain installed along the north side of the sidewalk at the intersection of Marine Drive and Kerr Street. It is unknown at this time as to when the drain was installed, its configuration, and where it discharges to. Significant iron fouling was observed within the storm sewer drains connected to the interception drain and also at surface in its vicinity.

The drain reportedly installed along the toe of the south slope of the Site north of Kinross Ravine Park was not visibly evident although there is a swale in the area. A number of manholes were located and are suspected to be associated with the system that was installed in 1984 to re-route the drain in the former ravine to the Metro Vancouver sanitary trunk line on Marine Way. Additionally, significant iron fouling was noted on standing water down-gradient of the former ravine and in the area of the sanitary line installed in 1984.

Further details are presented in Section 4.2 below.

4. Site Characteristics

4.1 Typical Landfill Contaminants

As a preface to describing the Site specific characteristics, this section provides a summary of the typical contaminants of a landfill and a range of concentrations. The following references were used:

- Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills, and;
- Landfill Gas Management Facilities Design Guidelines prepared by Conestoga-Rovers & Associates for the Ministry of Environment.

Landfill Leachate

There are virtually an endless number of parameters that could be analyzed to determine the constituents of leachate and their impact on surrounding water quality. However, it is more efficient and cost effective to choose a set of parameters which characterize the overall components within a landfill, are not subject to decomposition, and have measured values well above detection limits. The final selection of leachate parameters must be based on a comprehensive assessment of background water quality, the pure leachate quality (seeps and/or ravine culvert), as well as hydrogeologic influences.

The list presented in Table 4 below provides a summary of the typical landfill leachate characteristics:

TABLE 4: Typical Landfill Leachates

Constituent	Range (mg/L)
pH	5.3-8.5
COD	3,000-45,000
Chloride	100-3,000
Nitrite	5-40
Ammonia nitrogen	10-800
Sulphate	100-1,500
Cyanide	<0.10
BOD	2,000-30,000
TOC	1,500-20,000
TSS	200-1,000
Total Phosphorus	1-70
Hardness as $CaCO_3$	300-10,000
Calcium	200-3,000
Magnesium	50-1,500
Potassium	200-2,000
Sodium	200-2,000
Total Iron	50-600

Landfill Gas

Landfill Gas (LFG) is produced at landfill sites containing decomposable organic wastes. The major constituents of LFG are methane (CH_4) and carbon dioxide (CO_2), which are by-products of the biological decomposition of organic material. Trace concentrations of a variety of other compounds may also be present in LFG, including hydrogen sulphide, mercaptans, and volatile organic compounds, which can create nuisance odours, degrade air quality, and result in adverse health effects.

The proportions of $CH_4$and CO_2 vary over time and from landfill to landfill. LFG is typically described as consisting of approximately 30-60 % CH_4 and 20-50 % CO_2 with less than 2 % oxygen and less than 10 % nitrogen with other trace gas constituents making up the remainder. Some of the trace compounds present in LFG are attributed not to the biological decomposition process but to chemical products and reactions within the wastes.

Risk of explosion occurs when the concentration of methane in the air exceeds its lower explosive limit (LEL). The LEL of methane is approximately 5 % by volume in air, hence only a small proportion of LFG, which contains 50% by volume methane, is required to create an explosive condition. Another concern with methane is that it can act as an asphyxiant by displacement of air, producing a suffocation hazard, at a concentration in the order of 14%.

It is important to note that LFG generation occurs in an anaerobic (no oxygen) condition and thus any natural or artificial conditions that move the process to an aerobic condition will affect generation of LFG.

The first phase that a landfill will undergo, aerobic decomposition, occurs immediately after the waste has been placed, while oxygen is present within the waste. Aerobic decomposition produces carbon dioxide, water, and heat until such time as the oxygen present in the waste is consumed. The next stage is the anoxic, non-methanogenic phase where acidic compounds and hydrogen gas are formed and continued carbon dioxide generation. Substances produced during this stage as larger molecules are broken down to smaller chains include ammonia, carbon dioxide, hydrogen, water, and heat, all of which work to displace any residual oxygen and nitrogen that may reside in the waste. The third phase is the unsteady methanogenic phase; during this phase, the carbon dioxide generation begins to decline because waste decomposition moves from aerobic decomposition to anaerobic decomposition. Anaerobic decomposition produces heat and water, but unlike aerobic decomposition, it also produces methane.

During the fourth phase, methane is generated at a concentration between 40 and 70 % of total volume; in this stage, the processes responsible for the generation of methane are generally stable. Typically, the waste in most landfill sites will reach the stable methanogenic phase within less than two(2) years after the waste has been placed, although it should be noted that environmental conditions are also an important factor in this equation. Environments with high moisture and temperature, and where moisture is able to infiltrate readily into the waste, will show a generally shorter timeframe for reaching the stable methanogenic phase.

4.2 Site Specific Characteristics

Based on the findings of the environmental review, the following are the characteristics of the Site:

Currently there is only one monitoring well associated with the Site, located down-gradient within Kinross Ravine Park on the south side of Marine Drive. A minimum of three (3) monitoring wells are required to establish groundwater flow direction. For a complex site such as this one, where the hydrogeology will be influenced by the changing landscape over time, more than three (3) monitoring wells will be required.

However, based on the general topography of the area (refer to contours on Drawing VAN6044-14-004) and the presence of the former Kinross ravine, it is suspected that the ravine was a groundwater discharge point. Even though the ravine has been in-filled, it would still maintain its integral part of the groundwater flow regime at the Site. This is evident through the observed seeps at the down-gradient edge of the ravine.

Due to the lower level of New Kinross Creek at certain locations to the landfill area (eastern portion former landfill); it would also behave as a groundwater discharge point. The general groundwater flow would be to the south, and likely has some localized altered groundwater flow directions towards the former ravine and New Kinross Creek.

The leachate would also flow in a similar direction to the groundwater as evidenced by the seeps observed along the southern down-gradient perimeter at the base of the slope along Marine Drive. Based on field observations of the seeps, there are likely impacts to groundwater and surface water from the leachate.

Although there was no noticeably visible evidence, it appears that a sewer system was installed, based on City utility information, to capture the runoff and leachate from the landfill. However, based on the observations of the quality of the stagnant pond/water course within Kinross Ravine Park between Marine Drive and Marine Way, it is suspected that either i) not all leachate is being captured by the system, or ii) the sewer system installed in 1984 is leaking.

Additionally, the interception drain that was installed along Marine Drive would require re-evaluation due to the observed discharge of seeps onto the sidewalk area, despite the presence of the drain. Confirmation of the discharge of this drainage system would also need to be confirmed. There was an observed catch basin that the system was discharging too; it is unknown if this discharges into a combined sanitary/storm sewer system. The quality of the effluent discharge would need to be confirmed.

Though the analytical data available was limited, as mentioned in Section 3.1.4 there was concentrations between 1978 and 1985 that were in excess of the most stringent of the current standards. For those parameters that were identified as possible contaminants of concern in Tables 1 to 3, the concentrations were either below or within the typical leachate concentrations referenced above in Section 4.1.

There was evidence during the Site visit of various venting areas, based on the park entrance map and stressed vegetation and re-vegetated areas as documented in the attached photographs. There was however no visible evidence of any vapour management system(s) on Site. In addition, the reports reviewed documented the completion of a vapour assessment, though the location(s) is unknown but suspected to be at the north end of the former ravine adjacent to residences.

Considering the information provided above in Section 4.1, the former landfill is most likely in the fourth phase of LFG generation, where methane is the main LFG generated (between 40 and 70 % of total volume); in this stage, the processes responsible for the generation of methane are generally stable. Based on the most recent work in 1981 there were still concentrations of methane on-Site that could be a concern regarding explosive conditions. However, based on the time elapsed since the investigation, it is unlikely that methane concentrations have increased since methane generation is likely stable.

4.3 Slope Stability

SynergyAspen consulted with Mr. Joel Pineau of Stantec to provide a geotechnical assessment of the stability of the south facing slope adjacent to SE Marine Drive. A copy of the Stantec report is provided in Attachment III.

A summary of the report is as follows:

Stantec completed a Site inspection of the south-facing slope on June 26, 2014. The Site inspection consisted of traversing the park trails located along the crest of the south-facing slope and the toe of the slope along the north side of Marine Way and Marine Drive. In general, it was not possible to traverse the slope face due to the presence of thick blackberry bush cover.

During the Site inspection, no signs of slope instability were observed. The trails along the slope crest, no tension cracks or slumping and no escarpment faces were observed. In addition, no bulging was observed along the slope toe. In general, no surface water diversion or control measures were observed along the slope crest. A shallow ditch is located at the slope toe. Minimal seepage was observed in the toe ditch, approximately 300 m east of the intersection of Marine Way and Marine Drive. More significant seepage was observed approximately 100 m east of the intersection of Marine Way and Kerr Street. The seepage at this location is occurring from approximately 2 m above the base of the slope and some minimal soil erosion was observed.

5. Recommendations

SynergyAspen recommends a possible two (2) tier approach: (i) surface water assessment (seeps, pond and creek) and methane vapour survey in targeted areas (vents), and (ii) based on these results a long-term groundwater monitoring well and vapour well system can be developed.

Long Term Monitoring and Maintenance Plan

Surface Water and Seeps Monitoring

It is recommended to install up to five (5) surface water monitoring points to assess surface water quality at the Site. These may include:

- perimeter of Avalon Pond at observation point on west side
- discharge point from Avalon pond
- two stations along Kinross Creek, preferably in the area of noted 'garbage' and prior to discharge to the storm catchment
- stagnant water pond between Marine Drive and Marine Way in Kinross Ravine Park.

It is recommended to install seep sample ports at all seep locations (four) identified along Marine Drive and the one identified on Matheson Crescent.

The above sampling locations are presented on Drawing VAN6044-14-004.

Groundwater Monitoring System

It is recommended that two (2) types of monitoring wells be installed: (i) those for assessment of groundwater quality in and immediately adjacent of the former landfill and (ii) sentinel wells strategically placed between the landfill and potential receptors. The sentinel wells are 'triggers' for contingency plan implementation to mitigate adverse effects to receptors. Refer to Drawing VAN6044-14-004 for minimum proposed locations.

SynergyAspen recommends the following monitoring wells to be installed to establish a long term monitoring and maintenance plan:

Groundwater assessment wells:

- up to three (3) MWs within the main ravine where landfilling occurred
- up to three (3) on the east side of the ravine to establish groundwater flow regime between the former landfill area and New Kinross Creek and Avalon Pond
- up to two (2) on the west side of the ravine to establish groundwater flow regime
- up to four (4) along the down-gradient slope along Marine Drive to monitor the groundwater flow and quality along the down-gradient perimeter

Sentinel wells:

- up to two (2) in the lower area between Marine Drive and Marine Way to monitor further downgradient
- up to two (2) down-gradient of Marine Way to assess the extent of the groundwater plume and/or as a sentinel well; possible to utilize the current monitoring well identified during the Site visit once it is confirmed to be viable.

The drilling would also provide an indication of the landfill cover thickness at all drilled locations. Additional shallow boreholes could be advanced in other strategic locations to confirm the landfill cover thickness across a greater surface area of the Site.

It is recommended drilling be completed with a track mounted sonic drill rig or ODEX to minimize the likelihood of repeated occurrences of refusal on the unknown sub-surface materials (landfill and backfill material).

Effluent Discharge

It is understood that sampling of the effluent discharge into the sanitary sewer system may be completed by Metro Vancouver and/or the City as a condition of the 1984 installation of the connection to the sanitary trunk line. It is recommended that this discharge quality data be included as part of the long term maintenance monitoring data or if the sampling is not being conducted that it be included as part of the long term monitoring plan.

It is recommended that a better understanding of the interceptor drainage system along Marine Drive and the leachate collection system design be completed to confirm any other potential effluent discharge sampling points to be included in the long term monitoring plan may be required, (e.g. the Marine Drive interceptor drainage system storm catch basins).

Landfill Gas Monitoring

SynergyAspen recommends establishing a grid system in the areas of the Site identified during the Site visit as 'venting' areas. These locations are presented on Drawing VAN6044-14-004. The work would be completed by manually advancing drive point to measure the methane, O_2, CO_2 and temperature levels to determine where the highest LFG venting points are located; once these locations are established soil vapour monitoring wells would be installed and sampled as per the CSR Technical Guidance 4 ' Vapour Investigation and Remediation'. Samples would be analyzed for other potential contaminants of concern (i.e. VOCs) to determine if there are any other contaminants besides methane that need to be considered.

Detailed South Slope Assessment

Based on the attached Stantec report, the following scope of work was recommended to assess the south-facing slope of the Site:

- Complete six (6) boreholes and six (6) Cone Penetration Tests (CPTs) at the locations shown on Drawing No.1 in the attached report. The boreholes and CPTs should extend a minimum of 20 m below existing site grades, or until refusal into competent native soils.
- Install four (4) standpipe piezometers at the locations shown on Drawing No.1 in the attached report.

- Based on the types of materials identified in the boreholes, strengths interpreted from the CPTs and water levels observed in the piezometers, complete slope stability analyses for the three (3) proposed cross-sections using a 2-D slope stability software program for static and pseudo-static (seismic) conditions.

Some of the groundwater assessment well locations may serve as dual purpose and also be used for geotechnical purposes.

6. Professional Statement

SynergyAspen certifies that those who produced this report have demonstrable experience and are accustomed to completing the work, as described, for the nature of contamination at this Site. This certification was prepared in accordance with all requirements and regulations in the Environmental Management Act, S.B.C. 2003, c. 53, including amendments up to November 23, 2011.

Respectfully Submitted,
SYNERGYASPEN ENVIRONMENTAL

Philip Lowery, P.Eng., CSAP.
Project Manager

Michelle Uyeda, M.Sc., P.Eng., CSAP
Technical Services Manager

7. User Reliance and General Limitations

User Reliance

SynergyAspen Environmental Inc. (SynergyAspen) prepared this report for the sole use of the City of Vancouver (City). The City was privy to the establishment this project's scope and is aware of its terms and conditions.

Should the City submit this report to a regulatory authority, the regulatory authority may rely on the results within the context of the document's General Limitations for the purpose of determining whether the City is meeting (has met) its requirements concerning applicable environmental regulations.

As far as the nature of these investigative activities involves professional opinion, SynergyAspen offers no assurance that the results contained herein support a particular course of action. The investigative activities may have included the application of judgment to scientific principles; hence certain results of this work may be based on subjective interpretation. Professional opinions expressed herein are derived from the specifics currently available within the confines of the existing information, scope of work, budget, and schedule.

Third party reliance is subject to the scope of work agreed upon by SynergyAspen and the City and is only suitable within the limitations of the project/document. The activities detailed herein were performed for the City, and this document may not be appropriate for the purposes of a relying party. Application of this document for aims beyond those practically intended by the City and SynergyAspen is at the exclusive risk of the user. SynergyAspen does not accept legal responsibility for any damages toward any third party as a result of the application, use of, or any conclusion drawn based on this report.

General Limitations

The results, conclusions, and recommendations herein were developed according to the degree of care and skill generally exercised by contemporary environmental professionals within similar conditions and localities. The findings herein are somewhat reliant upon information provided by others. If any of the information is erroneous, amendments to the results, conclusions, and recommendations may be required.

The results, conclusions and recommendations SynergyAspen presents herein represent SynergyAspen's best professional judgement according to the site conditions and on available information during preparation of this report. They were determined explicitly for this Site and are somewhat reliant upon visual observation of the site, subsurface investigation at specific locations and depths, and select analysis of specific materials (as detailed herein).

While this assessment has attempted to identify all areas of potential environmental concern at the Site, it is possible that other areas of potential environmental concern may have escaped detection due to imprecise government records, undocumented historical environmental accidents, or other undocumented activities that resulted in contamination.

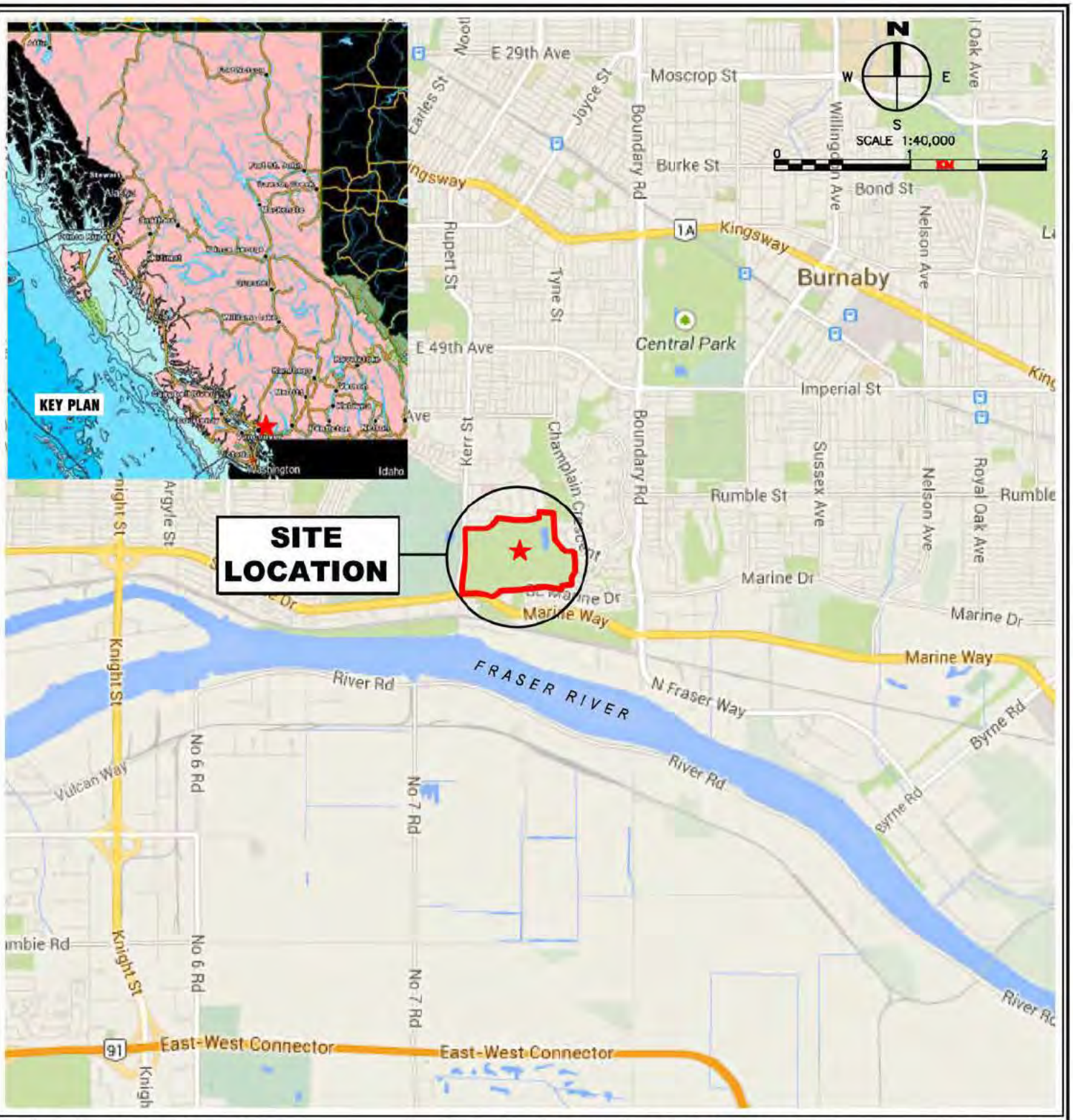
Drawings

VAN6044-14-001 – Site Location Plan

VAN6044-14-002 – Site Plan

VAN6044-14-003 – Area of Approximate Fill Material

VAN6044-14-004 – Long Term Monitoring Plan



CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-07-31	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	GOOGLE MAPS	2014-05-05	–

LEGEND

SUBJECT LOT

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

SITE LOCATION PLAN (49°12'32"N, 123°01'36"W)

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-07-31	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:40,000	DWG No: 001

PLOT: 20140806.1352

PHOTO INDEX

SITE FEATURE	DESCRIPTION	PHOTO REFERENCE
1	Redeveloped bark mulch area south of Mt. Everett - area of former Kinross Creek Ravine	Similar to Photos 31, 33
2	Parched area (brown grass) east of Mt. Everett - area of former Kinross Creek Ravine	Photo 30
3	Manfred's Meadow as per Park map	None
4	Butterfly Garden developed by Everett Crowley Park Committee	None
5	Location of former Kinross Creek Ravine at northern end of landfill	Photo 4
6	Avalon Pond viewing area (western edge of pond)	None
7	Steam Vents as per Park map: Location of dead tree, now replaced	Photo 32
8	Steam Vents as per Park map: Redeveloped bark mulch area (approx. 55 m long)	Photos 31, 33
9	Steam Vents as per Park map: Northern edge of former landfill (top of slope)	None
10	Steam Vents as per Park map: Parched area (brown grass) at eastern edge of former landfill	None
11	Edge of former landfill at top of slope to Kinross Creek	Photos 10 to 13
12	Bridge over Kinross Creek at discharge point of Avalon Pond	Photos 7 to 9
13	18 m north of bridge over Kinross Creek (near Matheson Crescent) prior to entering storm sewer	Photos 14, 36, 37
14	Steam Vent as per Park map: Parched area (brown grass)	None
15	Bark mulch area near park viewpoints	None
16	Everett Crowley park viewpoint #2 looking over area of former Kinross Creek Ravine	None
17	Seepage area onto sidewalk along Matheson Crescent (Seep E) just east of new Kinross Creek	Photos 34, 35
18	Cattails (Seep B)) at southern edge of park in area of former Kinross Creek Ravine, north of Marine Drive	Photos 19 and 20
19	Seepage area (Seep D) along sidewalk of Marine Drive near SW corner of park	Photos 25 to 29
20	Seepage hot spot of Site Feature 19	Photos 23 to 24
21	Top of slope (manhole covers) at location of former ravine, north of Kinross Ravine Park	None
22	Kinross Ravine Park between Marine Drive and Marine Way: Iron-stained stagnant ponded water	Photos 15 to 17, 39 to 40
23	Monitoring well in SW corner of Kinross Ravine Park near Marine Way	Photo 38
24	Path along suspected southern edge of landfill	Photo 3
25	Open area of blackberries at location of former ravine	Photos 5 to 6
26	Partially covered culvert in unofficial swale area (Seep A) near intersection of Marine Drive and Matheson Crescent	Photo 18
27	Iron staining from seeps (Seep C) adjacent to bus stop on Marine Drive at toe of south slope	Photos 21 and 22

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-07-31	0

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER VANMAP	2014-04-11	–
–	ORTHOPHOTO VANMAP	2013	–
–	–	–	–

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. BASE PLAN CREATED FROM MEASUREMENTS TAKEN IN THE FIELD. ALL LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
3. ORIGINAL DRAWING PAPER SIZE 17x11 INCHES

SCALE 1:5,000

0 50 METRES 250

LEGEND

- TRANS MOUNTAIN PIPELINE
- GVRD Trunk Mains
- HISTORICAL RAVINE (BASED ON 1938 AREAL PHOTO INTERPRETATION)
- FEATURES WITH UTM COORDINATES (SEE ATTACHMENT IV)
- FEATURES WITHOUT UTM COORDINATES

Sewer Manholes: Combined, Sanitary, Storm

Sewer Mains: Combined, Combined Siphon, Sanitary Force, Sanitary, Storm

SynergyAspen ENVIRONMENTAL

TITLE:

SITE PLAN

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION: 8200 Kerr Street Vancouver, BC

DATE: 2014-07-31

SCALE: 1:5,000

DWG No: 002

VAN6044-14

FILE: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-PJL

PLOT: 20141021.1546

N
W E
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SCALE 1:5,000

0 50 250
METRES

LEGEND

	APPROXIMATE MAXIMUM FILL MATERIAL LIMIT (>1.5m DEPTH)
	INFERRED SHALLOW SOIL COVER (<1.5m DEPTH)

NOTE:

APPROXIMATE DEPTH BASED ON HISTORICAL ANECDOTAL INFORMATION FROM REPORTS BY OTHERS PROVIDED BY CITY OF VANCOUVER.

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-07-31	0

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER VANMAP	2014-04-11	–
–	ORTHOPHOTO VANMAP	2013	–
–	–	–	–

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. BASE PLAN CREATED FROM MEASUREMENTS TAKEN IN THE FIELD. ALL LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
3. ORIGINAL DRAWING PAPER SIZE 17x11 INCHES

LEGEND

- TRANS MOUNTAIN PIPELINE
- GVRD Trunk Mains
- HISTORICAL RAVINE (BASED ON 1938 AREAL PHOTO INTERPRETATION)
- CONTOUR MAJOR (10m INTERVAL)
- CONTOUR MINOR (5m INTERVAL)

Sewer Manholes
- Combined
- Sanitary
- Storm

Sewer Mains
- Combined
- Combined Siphon
- Sanitary Force
- Sanitary
- Storm

SynergyAspen ENVIRONMENTAL

TITLE:

AREA OF APPROXIMATE FILL MATERIAL

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-07-31	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000	DWG No: 003

FILE: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-PJL

PLOT: 20141017.1127

N
W E
S

SCALE 1:5,000

0 50 250
METRES

LEGEND

MW	PROPOSED MONITORING WELL LOCATIONS
SW SP	PROPOSED SURFACE WATER/SEEP LOCATIONS
V	PROPOSED VAPOUR MONITORING LOCATIONS

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-07-31	0

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER VANMAP	2014-04-11	–
–	ORTHOPHOTO VANMAP	2013	–
–	–	–	–

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. BASE PLAN CREATED FROM MEASUREMENTS TAKEN IN THE FIELD. ALL LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
3. ORIGINAL DRAWING PAPER SIZE 17x11 INCHES

LEGEND

- TRANS MOUNTAIN PIPELINE
- GVRD Trunk Mains
- HISTORICAL RAVINE (BASED ON 1938 AREAL PHOTO INTERPRETATION)
- CONTOUR MAJOR (10m INTERVAL)
- CONTOUR MINOR (5m INTERVAL)

Sewer Manholes
- Combined
- Sanitary
- Storm

Sewer Mains
- Combined
- Combined Siphon
- Sanitary Force
- Sanitary
- Storm

SynergyAspen ENVIRONMENTAL

TITLE:

LONG TERM MONITORING PLAN

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-07-31	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000	DWG No: 004

FILE: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-PJL

APPENDIX I

Historical Aerial Photographs

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1938	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1938 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000 DWN: GIA CHK: PJL	DWG No: 001

PATH: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-002-

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1949	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1949 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000 2023-976	DWG No: 002

PATH: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-002-

20140806.1111

20140806.1113

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1954	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1954 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000 2008 GIA CHK'D PJL	DWG No: 003

PATH: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-002-

20140806.1253

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1963	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1963 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000	DWG No: 004

PATH: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-002-

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1969	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1969 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000 2008 GTAC Ortho	DWG No: 005

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20140806.1248

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DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1974	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1974 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000	DWG No: 006

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PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
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DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1979	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1979 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000	DWG No: 007

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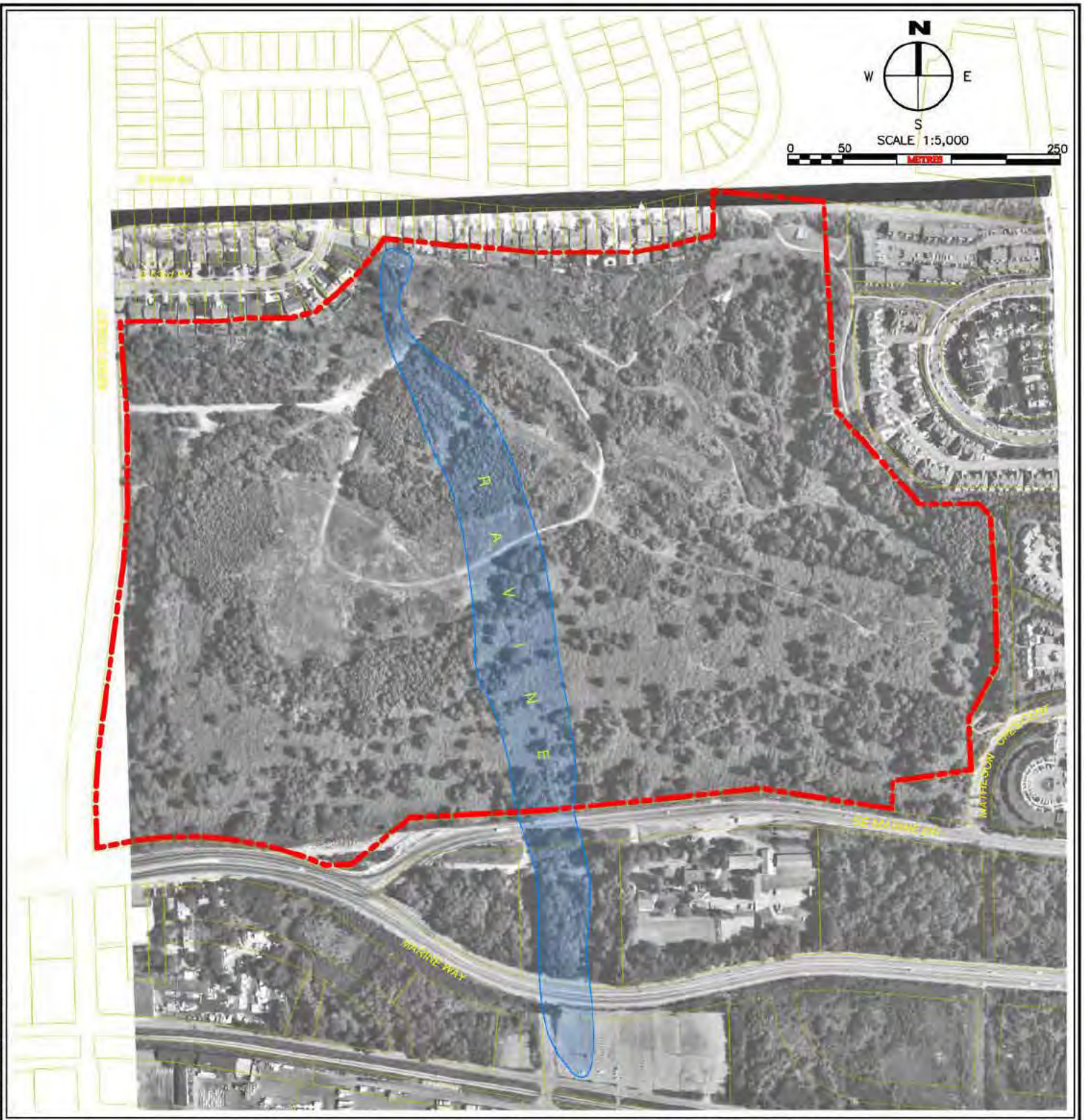
20140806.1238



CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	1986	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

1986 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000	DWG No: 008

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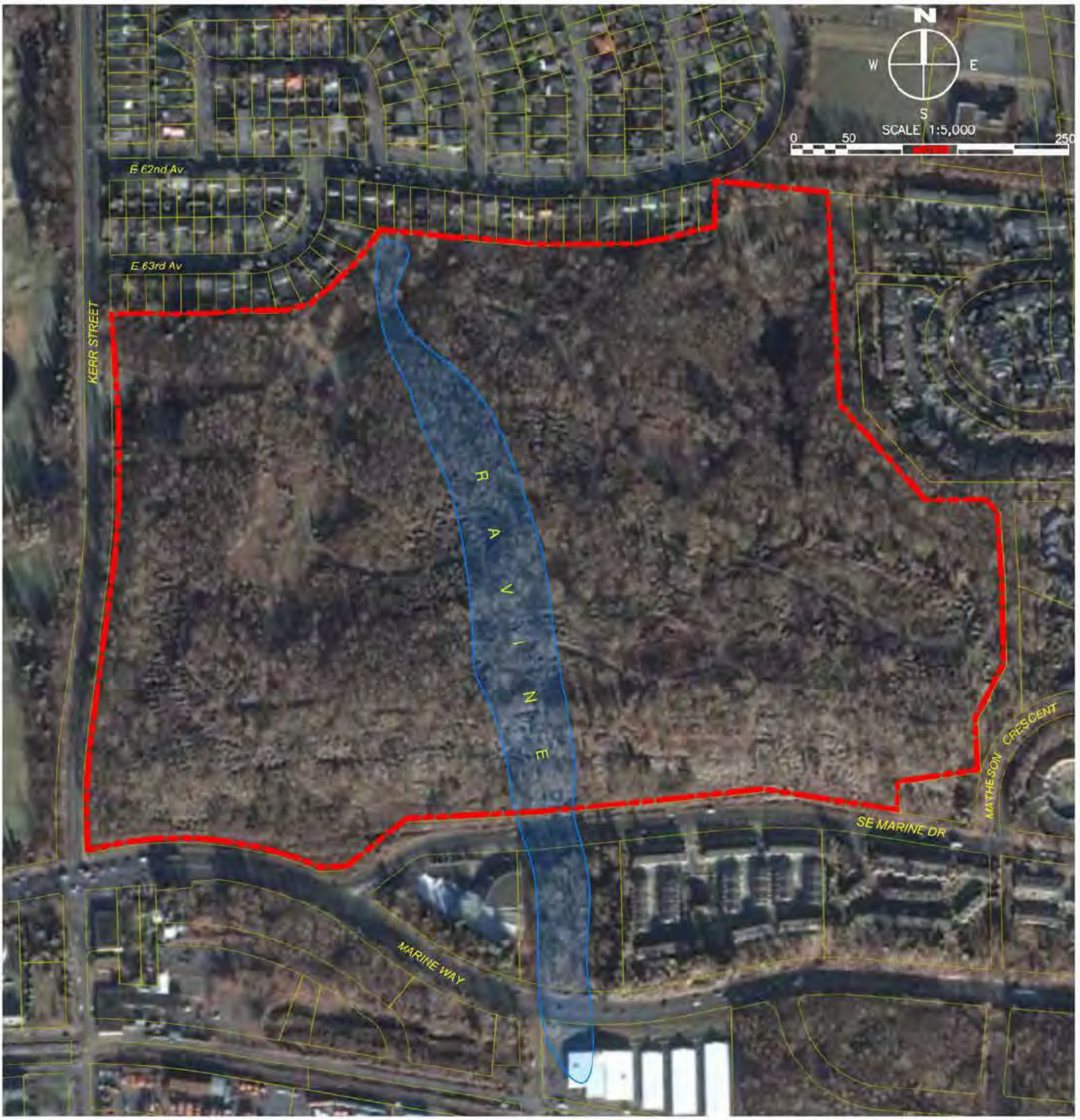

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
–	–	–	–	–

DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	2000	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

2000 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000 2008 GIA LOCATION	DWG No: 009

CHK	BY	REVISION DESCRIPTION	DATE	REV.
PJL	GIA	ISSUED TO CLIENT	2014-08-06	0
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DWG. NO.	REFERENCE DESCRIPTION	DATE	REV.
–	CITY OF VANCOUVER PUBLIC VANMAP	2014-04-11	–
–	AREAL PHOTOGRAPH	2013	–

LEGEND

SUBJECT LOT

HISTORICAL RAVINE

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. DATA COMPILED BY SYNAPSE: INTEGRATED ENVIRONMENTAL DATA MANAGEMENT SYSTEM
3. ORIGINAL DRAWING PAPER SIZE: 8.5x11 INCHES.

SynergyAspen ENVIRONMENTAL

TITLE:

2013 AREAL PHOTOGRAPH

CLIENT NAME: CITY OF VANCOUVER

SITE LOCATION:	DATE: 2014-08-06	VAN6044-14
8200 Kerr Street Vancouver, BC	SCALE: 1:5,000 2008 GTA Ortho	DWG No: 010

PATH: G:\SYNERGY\DRAFTING\30 DRAWINGS & SURVEYS\MISCELLANEOUS\VAN6044-14-RFP\VAN6044-002-

20140806.1147

APPENDIX II

Site Visit Photographs

PHOTO 1: Map of Park (June 12, 2014)

PHOTO 2: View of one of many cedar chip paths within the Park. (June 12, 2014)

PHOTO 3: Southern path, looking westward (embankment on south side). (June 12, 2014)

PHOTO 4: Cedar chip path in northwest corner near 62nd Ave residences, looking eastward. At location of northern part of former ravine. (June 12, 2014)

PHOTO 5: Open area in former ravine - large open blackberry patch; looking north. (June 12, 2014)

PHOTO 6: Lower trail crossing steep embankment; looking west. (June 12, 2014)

PHOTO 7: Avalon pond, looking north from foot bridge at south end. (June 12, 2014)

PHOTO 8: Looking downstream from foot bridge at southern discharge end of Avalon pond. (June 12, 2014)

PHOTO 9: Close-up of iron staining immediately downstream of foot bridge at discharge point from Avalon pond. (June 12, 2014)

PHOTO 10: New Kinross Creek bank about 100 m north of bridge looking down ravine to creek and culvert within creek. (June 12, 2014)

PHOTO 11: Panorama of New Kinross Creek bank about 100 m north of bridge. Exposed debris observed in creek bank (concrete, rubber, glass, shoe, garden hose etc). (June 12, 2014)

PHOTO 12: Close-up of debris of Photo 11 creek area. (June 12, 2014)

PHOTO 13: Close-up of debris Photo 11 creek area. (June 12, 2014)

PHOTO 14: Bridge crossing New Kinross Creek, looking southeast and downstream. (June 12, 2014)

PHOTO 15: Iron staining in stagnant ponding area between Marine Dr. and Marine Way (Kinross Ravine Park. (June 12, 2014)

PHOTO 16: Close-up of iron staining in Kinross Ravine Park. (June 12, 2014)

PHOTO 17: Iron staining in stagnant ponding area east side of Kinross Ravine Park. (June 12, 2014)

PHOTO 18: Observed culvert (approx. 15 ft long) partially covered in unofficial swale area (Seep A). Observed wetness and limited standing water around it. No iron staining observed. (June 12, 2014)

PHOTO 19: Cattails observed along Marine Drive in a discharge seep area from slope. (June 12, 2014)

PHOTO 20: Visible iron staining (Seep B) along Marine drive in small swale at toe of slope. (June 12, 2014)

PHOTO 21: Iron staining adjacent to bus stop from seeps (Seep C) along base of slope, along Marine drive. (June 12, 2014)

PHOTO 22: Close-up of iron staining Seep C. (June 12, 2014)

PHOTO 23: Iron staining in seep area (Seep D) along Marine Dr. onto sidewalk. (June 12, 2014)

PHOTO 24: Close-up of iron staining (Seep D) and one of 2 x 6"diameter capped PVC piping. (June 12, 2014)

PHOTO 25: Iron staining (Seep D) along Marine Dr. (June 12, 2014)

PHOTO 26: Iron staining (Seep D) along Marine Dr. onto sidewalk. (June 12, 2014)

PHOTO 27: Close-up of iron staining (Seep D), further up hill. (June 12, 2014)

PHOTO 28: Storm sewer catch basin adjacent to iron staining of Seep D. (June 12, 2014)

PHOTO 29: Close-up of storm sewer catch basin adjacent to iron staining of Seep D - observed staining discharging into the catch basin and observed within. (June 12, 2014)

PHOTO 30: Suspect heat venting area (note observed patch of dry grass). (June 12, 2014)

PHOTO 31: 2nd re-vegetation area. (June 12, 2014)

PHOTO 32: Across from 2nd re-vegetation area, to the north. Observed dead tree and only grass vegetation, no other trees. (June 12, 2014)

PHOTO 33: Stunted vegetation in suspect heat vent area (in a rehabilitation area) (June 12, 2014)

PHOTO 34: Seep onto sidewalk on Matheson Avenue. (June 30, 2014)

PHOTO 35: Seep onto sidewalk on Matheson Avenue (Close-up) (June 30, 2014)

PHOTO 36: Storm drain for outfall from New Kinross Creek. (June 30, 2014)

PHOTO 37: Location of storm drain in reference to footbridge over New Kinross Creek. (June 30, 2014)

PHOTO 38: Monitoring well in SW portion of Kinross Ravine Park. (June 30, 2014)

PHOTO 39: Iron-laden water along eastern side of Kinross Ravine Park. (June 30, 2014)

PHOTO 40: Termination of iron-laden water (wooden barricade and metallic grate). (June 30, 2014)

APPENDIX III

Stantec letter report - Proposed Scope of Work for Detailed Stability Assessment of the South-Facing Slope -Everett Crowley Park, Vancouver, BC

Stantec Consulting Ltd.
2400 - 4710 Kingsway, Burnaby BC V5H 4M2

July 10, 2014
File: 123311284

Attention: Phillip Lowery, P.Eng., CSAP
Synergy Aspen Environmental
1214 Austin Avenue
Coquitlam, BC, V3K 3P5

Dear Mr. Lowery,

Reference: Proposed Scope of Work for Detailed Stability Assessment of the South-Facing Slope - Everett Crowley Park, Vancouver, BC

INTRODUCTION

In accordance with our proposal dated April 16, 2014, Stantec Consulting Ltd. (Stantec) has completed a field inspection of the south-facing slope of Everett Crowley Park in order to provide a detailed scope of work to assess slope stability.

The site inspection of the south-facing slope and preparation of a proposed scope of work to assess slope stability is one component of a larger scope of work consisting of an overall environmental review of Everett Crowley Park completed by Synergy Aspen Environmental for the City of Vancouver.

SITE DESCRIPTION & HISTORY

Everett Crowley Park, hereafter referred to as 'the site', is located at 8200 Kerr Street in Vancouver, BC. The site is approximately 40 hectares in area and is bounded by Kerr Street to west, private property and Champlain Heights Park to the north, private property to the east and Marine Drive and Marine Way to south.

The northern area of the site generally slopes gently from the north to the south with an elevation change from approximately 72 to 58 m (geodetic) over a distance of approximately 450 m (i.e., an approximately 3% grade). The southern area of the site generally slopes moderately with an elevation change from 58 to 26 m (geodetic) over a distance of approximately 110 m (i.e., an approximately 30% grade). The toe of the south facing slope is generally set back from Marine Drive by 7 to 10 m, while the slope toe generally extends up to the sidewalk on the north side of Marine Way. A localized high point exists near the center of the park with a peak elevation of 80 m (geodetic).

The site is presently heavily vegetated with mature second growth deciduous trees and black berry bushes. A network of gravel and bark mulch walking trails traverse the northern area of the park extending south to the crest of the south-facing slope. A small asphalt paved parking lot is

located in the northwest quadrant of the park with access from Kerr Street. Avalon Pond is located in the northeast quadrant of the park.

Stantec understands that the site was previously used as a landfill for seepage waste, in addition to solid waste. It is understood that waste placement began in the previous Kinross Creek ravine as early as 1938 and the site became the primary landfill for the City of Vancouver in 1946. It is further understood that landfill at the site was placed until 1966 resulting in the complete infilling of Kinross Creek ravine. Stantec understands that the peak thickness of landfill waste to be 49 m in the area of the Kinross Creek ravine infill, while the average landfill thickness over the site to be approximately 12 m.

It understood that a soil cap of fine grained soils with an estimated thickness of 1.5 m was placed over the landfill materials subsequent to its closure. Following the placement of the soil cap material, it is understood that the site was abandoned and become naturally re-vegetated. In 1974, the City of Vancouver Park Board was assigned care and custody of the site.

A sand and gravel borrow pit was developed in the north east area of the site, concurrently with landfill placement in the 1960's. The borrow pit was excavated to a depth of 15 to 18 m below site grades and forms what is now Avalon Pond.

Additional work was completed on the site in the mid 1980's. In 1984, water from Kinross Creek ravine was re-routed to a sanitary sewer and a PVC drain installed along north side of Marine Drive to collect seeping water emerging at the toe of the landfill.

Pertinent site features and recent contours are shown on the attached Drawing No. 1.

SITE INSPECTION

Stantec completed a site inspection of the south-facing slope on June 26, 2014. The site inspection was completed by Joel Pineau P.Eng., and consisted of traversing the park trails located along the crest of the south-facing slope and the toe of the slope along the north side of Marine Way and Marine Drive. In general, it was not possible to traverse the slope face due to the presence of thick black berry bush cover.

During the site inspection, no signs of slope instability were observed. The trails along the slope crest, no tension cracks or slumping and no escarpment faces were observed. In addition, no bulging was observed along the slope toe. In general, no surface water diversion or control measures were observed along the slope crest. A shallow ditch is located at the slope toe.

Minimal seepage was observed in the toe ditch, approximately 300 m east of the intersection of Marine Way and Marine Drive. More significant seepage was observed approximately 100 m east of the intersection of Marine Way and Kerr Street. The seepage at this location is occurring from approximately 2 m above the base of the slope and some minimal soil erosion was observed. In

general, the vegetation cover at this location is minimal. Photos of the seepage are attached for reference.

PROPOSED SCOPE OF WORK

Stantec understands that no previous geotechnical assessment of the stability of the south-facing slope at the site has been completed to date. Although no indications of slope instability were observed during the site inspection, Stantec considers that a sub-surface investigation, installation of basic geotechnical instrumentation and stability analyses should be completed to assess the current state of stability of the slope.

Specifically, Stantec recommends the following scope of work to assess the stability of the south-facing slope at the site:

- Complete six (6) boreholes and six (6) Cone Penetration Tests (CPTs) at the locations shown on the attached Drawing No.1. The boreholes and CPTs should extend a minimum of 20 m below existing site grades, or until refusal into competent native soils.
- Install four (4) standpipe piezometers at the locations shown on the attached Drawing No.1.
- Based on the types of materials identified in the boreholes, strengths interpreted from the CPTs and water levels observed in the piezometers, complete slope stability analyses for the three proposed cross-sections using a 2-D slope stability software program for static and pseudo-static (seismic) conditions.

Results of the site investigation, laboratory work and slope stability analysis should be presented in a geotechnical report.

Reference: Environmental Review at Everett Crowley Park

CLOSURE

We trust this information meets your present requirements. Should you have any questions or require additional information, please call the undersigned.

Regards,

STANTEC CONSULTING LTD.

Joel Pineau, P.Eng
Geotechnical Engineer
Phone: 604-678-3078
Fax: 604-436-3752
joel.pineau@stantec.com

Wayne Quong, M.A.Sc., P.Eng
Senior Associate
Phone: 604-412-2990
Fax: 604-436-3752
wayne.quong@stantec.com

Attachments: Site Photos
Drawing No.1

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Photo 1: Seepage along south slope 100 m (approx.) east of Kerr St.

Photo 2: Seepage from 2 m above base of toe along south slope 100 m (approx.) east of Kerr St.

Stantec

Project Information

Project No.:	123311284
Scale:	1:5000
Date:	2014-07-04
Drawn by:	G. HUYNH
Checked by:	J. PINEAU

Project Location
EVERETT CROWLEY PARK
VANCOUVER, BC

Client/Project
SYNERGY ASPEN ENVIRONMENTAL

PROPOSED SCOPE OF WORK FOR DETAILED SLOPE STABILITY ASSESSMENT

Title
SITE PLAN

Dwg No.
1

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2014/07/10 3:39 PM By: Huynh, Gordon

ORIGINAL SHEET - ANSI A

APPENDIX IV

UTM Coordinates for Site Features on Drawing VAN6044-14-002

VAN6044 - GPS Features

Site Feature	Description	UTM Coordinates (N, E)
1	Redeveloped bark mulch area south of Mt. Everett - area of former Kinross Creek Ravine	5450851, 497185
2	Parched area (brown grass) east of Mt. Everett - area of former Kinross Creek Ravine	5450881, 497282
3	Manfred's Meadow as per Park map	5450952, 497438
4	Butterfly Garden developed by Everett Crowley Park Committee	5450964, 497475
5	Location of former Kinross Creek Ravine at northern end of landfill	5451062, 497350
6	Avalon Pond viewing area (western edge of pond)	5451019, 497546
7	Steam Vents as per Park map: Location of dead tree, now replaced	5450806, 497633
8	Steam Vents as per Park map: Redeveloped bark mulch area (approx. 55 m long)	5450800, 497610
9	Steam Vents as per Park map: Northern edge of former landfill (top of slope)	5450839, 497628
10	Steam Vents as per Park map: Parched area (brown grass) at eastern edge of former landfill	5450785, 497692
11	Edge of former landfill at top of slope to New Kinross Creek	5450821, 497723
12	Bridge over New Kinross Creek at discharge point of Avalon Pond	5450915, 497579
13	18 m north of bridge over New Kinross Creek (near Matheson Crescent) prior to entering storm sewer	5450755, 497784
14	Steam Vent as per Park map: Parched area (brown grass)	5450818, 497498
15	Bark mulch area near park viewpoints	5450764, 497471
16	Everett Crowley park viewpoint #2 looking over area of former Kinross Creek Ravine	5450721, 497249
17	Seepage area onto sidewalk along Matheson Crescent just east of new Kinross Creek	5450711, 497817
18	Cattails (Seep B)) at southern edge of park in area of former Kinross Creek Ravine, north of Marine Drive	From 5450634, 497490 to 5450637, 497513
19	Seepage area (Seep D) along sidewalk of Marine Drive near SW corner of park	From 5450616, 497004 to 5450611, 497063
20	Seepage hot spot of Site Feature 19	5450614, 497043
21	Top of slope (manhole covers) at location of former ravine, north of Kinross Ravine Park	5450600, 497379