THE WATERSHED COMPANY

SCIENCE & DESIGN

December 1, 2016

Susan Lauinger
City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, WA 98125

Re: Orcas Moon Property
Stream & Wetland Delineation & Buffer Modification 2nd Review
The Watershed Company Ref. No.: 160622.6

Dear Susan:

This letter presents the findings of an environmental review of the applicant's response to my previous review letter for the Orcas Moon property, dated September 2, 2016. The Orcas Moon LLC property is located between 20th Avenue and Forbes Creek Drive (Parcel numbers 389010-0050 and -0055). The following documents were reviewed for this study:

- *Orcas Moon Project – Response to City of Kirkland Third Party Review from the Watershed Company, 2 September 2019 (Talasaea Consultants, Inc., 20 October 2016)*
- *Site Reconnaissance – Wetland "A" (Associated Earth Sciences Inc., October 13, 2016)*

On November 18, 2016, I attended a site meeting with you, John Burkhalter of City of Kirkland Public Works, the applicant and his consultant team, including David Teesdale of Talasaea and Jeffrey Laub of Associated Earth Sciences. The purpose of the site meeting was to verify the classification of Wetland A. Stormwater drainage conditions around Wetland A were also reviewed in the field by the meeting attendees.

Findings

I discussed differences in the City of Kirkland wetland field data form, which are summarized in my September 2, 2016 letter, with Senior Wetland Ecologist David Teesdale of Talasaea. Mr. Teesdale agreed that a forested class is present in Wetland A. He did not disagree with any of my answers to questions on the wetland classification form. The Type 2 classification of Wetland A was confirmed in the field.

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The Talasaea letter states that, "Since Wetland A is likely the direct result of frontage improvements on 20th Avenue E, it does not meet the requirements as a regulated feature as defined in §90.30.21 of the Kirkland Municipal Code." As documented in the Associated Earth Sciences letter, drainage from the road discharges upslope of Wetland A. However, Wetland A exhibits high groundwater and is a headwater wetland of a perennial stream. These conditions are indicative of sustained groundwater support and would typically not be present in a system artificially supported wholly by stormwater flows. Given this condition, our impression is that Wetland A is within Kirkland's jurisdictional authority. Wetland conditions are undisputedly present in the area delineated as Wetland A and, regardless of regulatory authority at the local level, would be federally jurisdictional.

The majority of my comments and recommendations for updates to the Orcas Moon stream and wetland delineation study were not addressed in this resubmittal. The applicant's wetland consultant indicated that work was in-progress and field review of additional critical areas at the north end of the site was not necessary on the day of our field meeting.

The applicant did not provide any responses to comments on the previously reviewed buffer modification plan. Those comments/recommendations are repeated below for completeness.

Recommendations

Specifically, the following study corrections are recommended:

Stream & Wetland Delineation Study

- Update Wetland A classification and buffer width; it is a Type 2 wetland with a 75 foot buffer.
- Delineate and survey the ordinary high water mark, left and right banks, of all onsite streams.
- Include the ditched stream along Forbes Creek Drive in the delineation and survey map, including buffer width.
- Update the classification and buffer of Stream 5 to match previously recorded information and current site observations (Class C stream, 35 foot buffer).
- Review the portion of Stream 2 shown as piped. Based on field observations, an open channel is present below the pipe; delineate and survey open stream channel ordinary high water mark.
- Review open channel originating from a culvert at the north end of the property and flagged as 'Stream 3.' It is not shown on the provided survey. Delineate and survey open stream channel ordinary high water mark.
- Delineate, classify and survey the wetland area identified at the north end of the property, west of Stream 5.

- Update the critical areas overview map to include all relevant stream and wetland survey data and document all associated on-site buffer and building setback encumbrances.

Buffer Modification Plan

- Update the Critical Areas Report to reflect the delineation study revisions noted above.
- Revise the Critical Areas Report to address the KZC 90.100(2)(b) requirements.
- Provide a mitigation plan that meets the content requirements in KZC 90.55(4).
- Show fencing details on the mitigation plan per KZC 90.50 and KZC 90.95.
- Revise the proposed buffer averaging approach to rectify functional losses due to steep slopes and existing non-native vegetation.
- Recommend salvaging some trees within the building footprint for large woody debris placement in buffer areas.
- Provide a bond quantity worksheet

I recommend that the City accept the Talasaea report once the corrections listed above are implemented. Please call if you have any questions or if I can provide you with any additional information.

Sincerely,

Nell Lund, PWS
Senior Ecologist

Enclosures

THE WATERSHED COMPANY

SCIENCE & DESIGN

July 21, 2017

Susan Lauinger
City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, WA 98125

Re: Orcas Moon Property
Stream & Wetland Delineation & Buffer Modification - 3rd Review
The Watershed Company Ref. No.: 160622.6

Dear Susan:

This letter presents the findings of an environmental review of the applicant's response to my previous review letter for the Orcas Moon property, dated December 1, 2016. I visited the site on July 6, 2017 as part of this review. The Orcas Moon LLC property is located between 20th Avenue and Forbes Creek Drive (Parcel numbers 389010-0050 and -0055). The following documents were reviewed for this study:

- *Critical Areas Report and Buffer Averaging Plan, Orcas Moon Cottages, Kirkland, WA. (Talasaea Consultants, Inc., Revised 31 May 2017)*
- *Orcas Moon Cottages Preliminary Plat / IDP (The Blueline Group, 5/31/17)*
- *Orcas Moon Cottages Preliminary Plat Map (Axis Survey & Mapping, 5/30/17)*
- *Critical Areas Mitigation Plan, Orcas Moon Cottages, Kirkland, WA (Talasaea Consultants, Inc., 5/31/17)*

This project is vested to the old Kirkland Zoning Code, Chapter 90 – Drainage Basins, which was in-effect prior to March 2017.

Findings

Site Observations, Non-permitted Stream Improvements

As I shared with you following my July 6th site visit, recently installed trash racks were observed on the culverts in streams 2, 3 and 4. Additionally, hay bales and straw wattles were placed in the stream channels above the modified culverts (see Photos 1 and 2 below). Per the email documentation you forwarded to me, the property owner has reviewed these improvements with Elizabeth Torrey of the Washington Department of

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Fish and Wildlife (WDFW) and received two options for mitigating these non-permitted in-stream activities. The owner, indicated he'd like to proceed with WDFW option 1:

> "*Remove the trash racks, straw wattles, and straw bales with an HPA permit. Potential mitigation for installing these structures without a permit could be walking up the three streams and removing any trash and debris you encounter.*"

Stream and Wetland Delineation Study

The majority of my recommendations for the stream and wetland study were addressed in the submitted revised critical areas report. Wetland A has now been correctly identified as a Type 2 wetland with a 75-foot standard buffer width. The ordinary high water mark of the onsite streams was flagged and surveyed. Stream 5 is now mapped as a Class 3 stream with a 35-foot standard buffer width.

A portion of Stream 4, which is ditched along Forbes Creek Drive, is now mapped and buffered on the mitigation plan set. I concur with the delineated extent of Stream 4. Ditched stream flow ends as depicted by Talasaea and is ultimately conveyed north under Forbes Creek Drive.

The following recommendations from my December 1, 2016 letter have not been fully addressed and require further response:

- Stream 2 - The current submittal does not address the noted erosion in the piped segment of Stream 2. The noted erosion likely formed around and below the culvert due to storm events, blocked or undersized culvert, or a combination of those factors. This assumption is bolstered by the statement in Elizabeth Torrey's email dated 7/19/17 that, "*the reason why the trash racks seemed appropriate is because all three of those culverts are drastically undersized and cannot handle the volume of the stream systems, with the water, sediment, and leafy/woody debris trying to pass through.*" The stream flow path should be protected by either designating the scoured bed/bank below the culvert as stream, or resizing the culvert to handle the existing seasonal variations in flow. Alternatively, the piped stream segment could be daylighted as part of the mitigation strategy. This could also potentially limit future erosion liability for the owner.

- Stream 3 – The open channel of Stream 3 at the north end of the property is shown as a single line (centerline) from the culvert to its confluence with ditched Stream 4. I measured the open stream channel at 18-inches wide. The ordinary high watermark (OHWM) for this short stream segment can be mapped by off-setting the OHWM 9-inches from either side of the centerline. As reported, Stream 3 is a class B stream with a 60-foot buffer. The buffer is not shown on this stream segment.

- The newly delineated boundary of Wetland D does not include my data point, taken during the first site review in August 2016. That data point, DP-1, is approximately 20 feet from Talasaea flag D-2 at a bearing of 200 degrees. DP-1 is enclosed with this letter for your reference. Regarding the wetland rating, I concur with the reported Type 3 rating for Wetland D. Although I scored it slightly differently, I agree the points total is well below the 22 points required for a Type 2 rating.

Additionally, the 10-foot building setback should be shown on the existing conditions map utilized to assess site plan impacts (KZC 90.45.2).

Buffer Modification Plan

Before the buffer modification plan can be fully assessed, the existing conditions plan and associated proposed site plan impacts and mitigation overview needs to be updated to address the stream and wetland delineation study comments above.

In general, the buffer averaging approach is well laid out. Proposed buffer addition areas are outside of the designated steep slope areas, which is appropriate when applying a 1:1 loss to gain ratio.

As stated in my September 2016 letter, per Ecology guidance, "*…standard buffer widths presume an intact native plant community. Although the proposed buffer addition areas are forest, patches of understory are dominated by non-native blackberry vines. To ensure buffer functions and values are maintained, the revised mitigation plan must consider steep slopes and the existing vegetative condition.*" The CAR states in Section 6.3.2, paragraph 3 (bold emphasis added), "*The proposed buffer addition areas* ***may*** *be enhanced through the removal of non-native species (i.e. Himalayan blackberry, etc.) and replanted with a variety of native trees and shrubs after physical removal of blackberry.*" I concur that such enhancement would maintain or improve buffer functions and values in light of the proposed buffer modification. However, the provided mitigation plan is a concept level plan, which does not specify enhancement planting. Additionally, temporary impacts and associated restoration are mentioned in CAR text, but not shown on the plan.

This concept-level mitigation plan is missing several details needed to evaluate for compliance under Chapter 90, which are described in CAR Appendix C, including quantifying temporary impacts, a planting plan for restoration and enhancement areas, large woody debris quantity/placement, temporary irrigation, and fencing and signage.

Mitigation goals, objectives and performance standards provided in Appendix C are appropriate with the exception of performance standard C1 for invasive plant species. A ten percent maximum threshold is recommended for noxious weed cover within the

buffer addition areas. This standard has been consistently applied to past Kirkland mitigation projects and has been shown to be achievable.

A bond quantity worksheet was not provided with this submittal.

The CAR states in Section 6.1, paragraph 2 that, the development plan will provide three open space areas and "*…an approximately 22,158 SF area located in the northeast corner of the Site will be dedicated as an NGPA.*" The proposed NGPA is shown on mitigation plan sheet W1.1. The open space areas are not shown on the plan, so perhaps the open space areas overlap with remaining critical areas. It is unclear why all onsite critical areas and buffers would not be placed in an NGPA.

Recommendations

Specifically, the following revisions are recommended:

Stream & Wetland Delineation Study

1. Review stream conditions below the culvert on Stream 2 and revise the stream delineation or culvert condition as needed to protect stream flow. Alternatively, this stream segment could be daylighted as part of the mitigation strategy.

2. Show the OHWM of Stream 3 at the north end of the property and buffer the open channel with the standard 60-foot buffer width.

3. Show the 10-foot building setback line per KZC 90.45.2.

4. Review and revise the boundary of Wetland D per comments above.

Buffer Modification Plan

- Update the Critical Areas Report and associated plans to reflect the delineation study revisions noted above.
- Identify temporary impacts associated with clearing limits and construction assess. Prepare a restoration planting plan or typical revegetation layout.
- Show enhancement areas on the mitigation plan set and prepare an enhancement planting plan or typical revegetation layout.
- Show approximate placement of bird/bat boxes and salvaged woody debris on the mitigation plan.
- Address temporary irrigation
- Show placement and spacing of fencing and signage required per KZC 90.50.
- Clearly identify proposed designated Open Space and NGPA areas onsite.
- Provide a bond quantity worksheet (BQWS) following the King County form.

The City should require an updated CAR and complete mitigation plan to properly evaluate and document compliance with Chapter 90 and complete this review. Please call if you have any questions or if I can provide you with any additional information.

Sincerely,

Nell Lund, PWS
Senior Ecologist

Enclosures

1. Wetland determination data form, DP-1
2. Sketch of in-stream improvements, provided by the applicant, Robert Londo, dated 7/17/17
3. Email chain between the applicant and WDFW, dated July 20, 2017

Photo 1. One of the installed trash racks (Photograph taken 7/6/17)

Photo 2. Trash rack with straw bales in upstream channel. (Photograph taken 7/6/17)

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WETLAND DETERMINATION DATA FORM

Western Mountains, Valleys, and Coast Supplement to the 1987 COE Wetlands Delineation Manual

ATTACHMENT 26

DP- 1

Project Site:	**Parcels 389010-0050 and -0055**	Sampling Date:	**8/25/2016**
Applicant/Owner:	**Orcas Moon LLC**	Sampling Point:	DP- **1**
Investigator:	**N. Lund**	City/County:	**Kirkland / King County**
Sect., Township, Range:	S **32** T **26** R **5**	State:	**WA**
Landform (hillslope, terrace, etc): **hillslope**	Slope (%): **<5%**	Local relief (concave, convex, none): **concave**	
Subregion (LRR): **A**	Lat:	Long:	Datum:
Soil Map Unit Name: **KpB (Kitsap silt loam)**		NWI classification: **None**	

Are climatic/hydrologic conditions on the site typical for this time of year? ☒ Yes ☐ No (If no, explain in remarks.)

Are "Normal Circumstances" present on the site? ☒ Yes ☐ No

Are Vegetation☐, Soil ☐, or Hydrology ☐ significantly disturbed?

Are Vegetation☐, Soil ☐, or Hydrology ☐ naturally problematic (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampling Point within a Wetland?** Yes ☒ No ☐
Hydric Soils Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5m diam.)	Absolute % Cover	Dominant Species?	Indicator Status
1. ***Alnus rubra***	**30**	**Y**	**FAC**
2. ***Salix lucida spp. lasiandra***	**15**	**Y**	**FACW**
3.			
4.			
	45	= Total Cover	
Sapling/Shrub Stratum (Plot size: 3m diam.)			
1. ***Crataegus douglasii***	**50**	**Y**	**FAC**
2. ***Cornus sericea***	**50**	**Y**	**FACW**
3. ***Rubus spectabilis***	**10**	**N**	**FAC**
4.			
5.			
	110	= Total Cover	
Herb Stratum (Plot size: 1m diam.)			
1. ***Athyrium filix-femina***	**5**	**Y**	**FAC**
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum:			

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC:	**5**	(A)
Total Number of Dominant Species Across All Strata:	**5**	(B)
Percent of Dominant Species that are OBL, FACW, or FAC:	**100**	(A/B)

Prevalence Index Worksheet

Total % Cover of		Multiply by
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B / A =

Hydrophytic Vegetation Indicators

- ☒ Dominance test is > 50%
- ☐ Prevalence test is ≤ 3.0 *
- ☐ Morphological Adaptations * (provide supporting data in remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants *
- ☐ Problematic Hydrophytic Vegetation * (explain)

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:

SOIL **Sampling Point – DP- 1**

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	**2.5Y 3/1**	**100**					**Sandy loam**	
8-14	**10YR 3/2**	**95**	**10YR 3/6**	**5**	**C**	**M**	**Sandy loam**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Loc: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☒ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ☐ 2cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (explain in remarks)
- ☐

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric soil present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply):

- ☐ Surface water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (**except MLRA 1, 2, 4A & 4B**) (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (explain in remarks)

Secondary Indicators (2 or more required):

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A & 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks

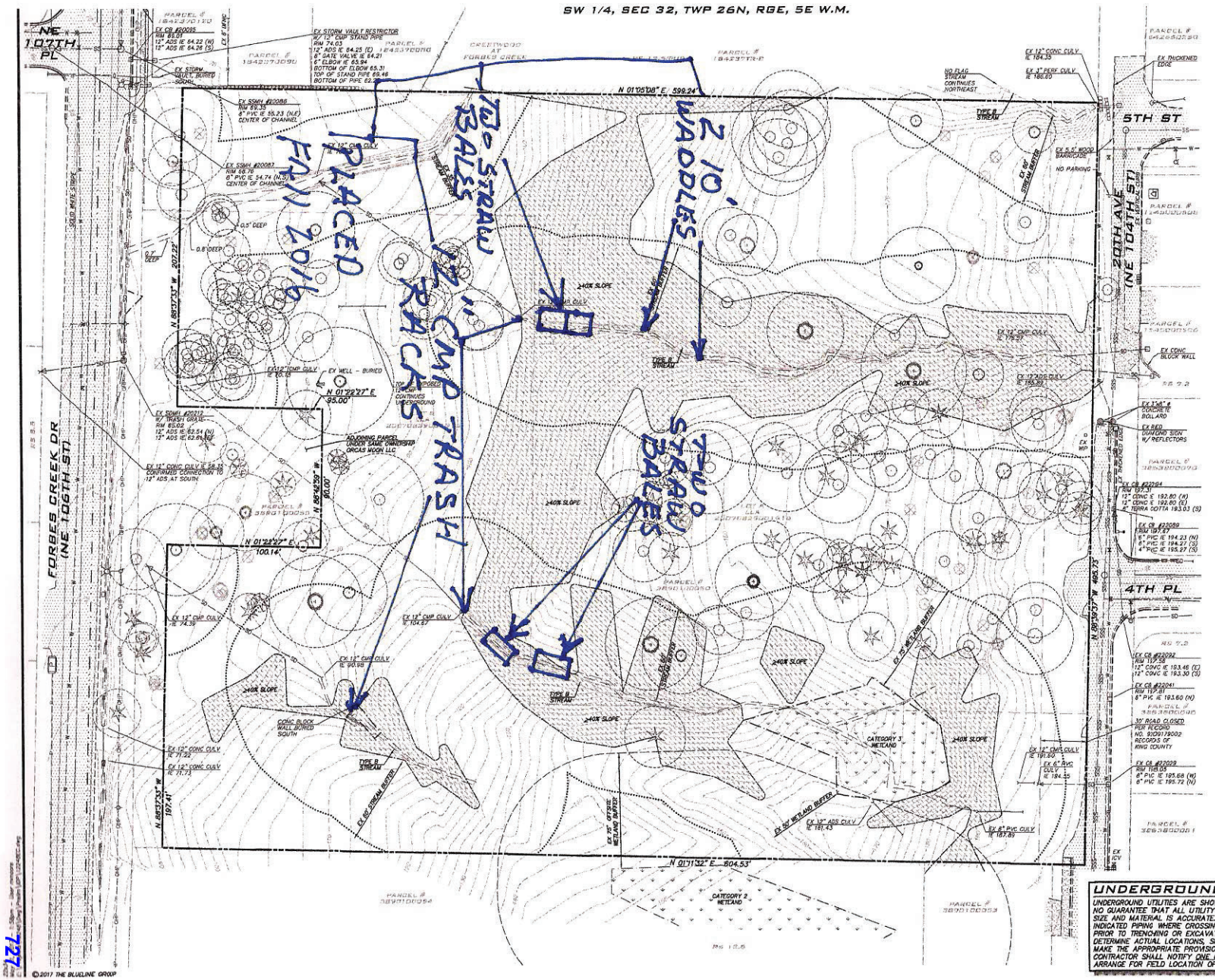
Field Observations

Surface Water Present?	Yes ☐	No ☒	Depth (in):
Water Table Present?	Yes ☐	No ☒	Depth (in):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (in):

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **Dry summer season, soil moist, not saturated.**
Secondary indicators present.



UNDERGROUND UTILITY NOTE

UNDERGROUND UTILITIES ARE SHOWN IN THE APPROXIMATE LOCATION. THERE IS NO GUARANTEE THAT ALL UTILITY LINES ARE SHOWN, OR THAT THE LOCATION, SIZE AND MATERIAL IS ACCURATE. THE CONTRACTOR SHALL UNCOVER ALL INDICATED PIPING WHERE CROSSING, INTERFERENCES, OR CONNECTIONS OCCUR PRIOR TO TRENCHING OR EXCAVATION FOR ANY PIPE OR STRUCTURES, TO DETERMINE ACTUAL LOCATIONS, SIZE AND MATERIAL. THE CONTRACTOR SHALL MAKE THE APPROPRIATE PROVISION FOR PROTECTION OF SAID FACILITIES. THE CONTRACTOR SHALL NOTIFY ONE CALL AT 8-1-1 (WASHINGTON811.COM) AND ARRANGE FOR FIELD LOCATION OF EXISTING FACILITIES BEFORE CONSTRUCTION.

BLUELINE

SCALE: AS NOTED
PROJECT MANAGER: TODD A. OBERG, PE
PROJECT ENGINEER: TODD A. OBERG, PE
DESIGNER: TIM HO
ISSUE DATE: 5/31/2017

REVISIONS			
NO	DATE	BY	
1	6/6/17	WC	REVISIONS PER CITY REVIEW

EXISTING CONDITIONS
ORCAS MOON COTTAGES
PRELIMINARY PLAT / IDP
PARCEL #3890100050
CITY OF KIRKLAND WASHINGTON

6/31/17

JOB NUMBER 12-244
SHEET NAME EC-01
SHT 2 OF 20

ATTACHMENT 2

Nell Lund

From: Susan Lauinger <SLauinger@kirklandwa.gov>
Sent: Thursday, July 20, 2017 8:06 AM
To: Hugh Mortensen; Nell Lund
Subject: FW: Orcas Moon Critical Areas Report

FYI on the hay bales, wattles and trash racks.

Susan Lauinger
Associate Planner
Planning and Building Department
123 5th Ave
Kirkland, WA 98033
425-587-3252
slauinger@kirklandwa.gov

From: Robert P. Londo [mailto:rl@londotiberio.com]
Sent: Thursday, July 20, 2017 7:40 AM
To: 'Torrey, Elizabeth M (DFW)' <Elizabeth.Torrey@dfw.wa.gov>
Cc: Susan Lauinger <SLauinger@kirklandwa.gov>
Subject: RE: Orcas Moon Critical Areas Report

Hi Elizabeth,

Thank you for the rapid response!

I would like to proceed with option one and remove the trash racks, straw bales, straw wattles and associated mitigation. Additionally, a HPA application will be forthcoming to allow such work and also permit/permission from the City of Kirkland. It is my intent to perform the work ASAP while stream flows are minimal and be in compliance with regulations.

Best,

Robert Londo

From: Torrey, Elizabeth M (DFW) [mailto:Elizabeth.Torrey@dfw.wa.gov]
Sent: Wednesday, July 19, 2017 5:11 PM
To: Robert P. Londo <rl@londotiberio.com>
Subject: RE: Orcas Moon Critical Areas Report

Hello,

Thanks for having me out today. I was able to talk to my supervisor when I got back to the office. He confirmed many of the thoughts I had on site. Given the nature of the watercourses (regulated, but non fish-bearing), the situation could go either way, see below. Of course, WDFW's preferred option is to remove the trash racks. However, I could write a

permit that defensibly justifies keeping the trash racks, with appropriate management and mitigation. The two options are:

1. Remove the trash racks, straw wattles, and straw bales with an HPA permit. Potential mitigation for installing these structures without a permit could be walking up the three streams and removing any trash and debris you encounter.

OR:

2. Remove the straw wattles and bales, but keep the trash racks. An HPA permit will be necessary, as this course of action will require a management plan to ensure that the trash racks are kept free and clear of debris, and maintained at the correct time of year. One of the provisions of that HPA will be that a new HPA must be applied for every 5 years, for the life of those structures, to ensure that they are maintained and not left to clog. Also, woody material that is over 4" diameter or more will not be permitted to leave the system - i.e. you can throw leaves, small branches, etc. up on the bank, but larger woody material must be placed back in the stream, either up or downstream. Additionally, a mitigation planting plan will be necessary to offset the impact of having the trash racks in the watercourse. You and I talked about this a bit – a planting plan could incorporate removal of invasive species and planting of appropriate native ones, including spirea, etc. in the riparian area. This could also benefit erosion control measures, as many types of plants will lock in the soil.

So, there are two options. It is your choice which you would like to go with. Again, the reason why the trash racks seemed appropriate is because all three of those culverts are drastically undersized and cannot handle the volume of the stream systems, with the water, sediment, and leafy/woody debris trying to pass through. That's just something to keep in mind for the future, regardless of the route you take.

Please let me know if you would like more information or would like to talk more about this.

Thanks,

Elizabeth Torrey
Fish & Wildlife Biologist
Washington Department of Fish & Wildlife
Region 4 – Issaquah Field Office
(425) 313-5681 office
(425) 628-0490 cell

From: Robert P. Londo [mailto:rl@londotiberio.com]
Sent: Wednesday, July 19, 2017 4:20 PM
To: Torrey, Elizabeth M (DFW) <Elizabeth.Torrey@dfw.wa.gov>
Subject: Orcas Moon Critical Areas Report

Hi Elizabeth,

Thank you for meeting me today at our Orcas Moon site.
I look forward to your reply for our next course of action. Per our discussion I have enclosed the Critical Areas report and Buffer Averaging report from Talasaea.

Should you have any questions I may be reached via cell @ 206-550-5560 or rl@londotiberio.com

Best,

Robert Londo

THE WATERSHED COMPANY

SCIENCE & DESIGN

January 2, 2018

Susan Lauinger
City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, WA 98125

Re: Orcas Moon Property
Stream & Wetland Delineation & Buffer Modification – 4th Review
The Watershed Company Ref. No.: 160622.6

Dear Susan:

This letter presents the findings of an environmental review of the applicant's response to my previous review letter for the Orcas Moon property, dated July 21, 2017. The Orcas Moon LLC property is located between 20th Avenue and Forbes Creek Drive (Parcel numbers 389010-0050 and -0055). The following documents were reviewed for this study:

- *Orcas Moon – Preliminary Plat* (Comment Response Letter)*(The Blueline Group, November 21, 2017)*
- *Critical Areas Report and Buffer Averaging Plan, Orcas Moon Cottages, Kirkland, WA. (Talasaea Consultants, Inc., 21 July 2016, Revised 9 November 2017)*
- *Orcas Moon Cottages Preliminary Plat / IDP (The Blueline Group, 5/31/17)*
- *Critical Areas Mitigation Bond Quantity Worksheet, Orcas Moon Cottages (Prepared by Talasaea Consultants, Inc., 11-9-2017)*

I also referenced my prior lot line adjustment review for this project, particularly regarding the boundary of Wetland D (*Orcas Moon Property – Environmental Review, Lot Line Adjustment, dated September 21, 2017*).

This project is vested to the old Kirkland Zoning Code, Chapter 90 – Drainage Basins, which was in-effect prior to March 2017.

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Findings

Stream & Wetland Delineation Study

The revised boundary of Wetland D now includes my data point at the southern-most edge of the wetland. Since this wetland is surrounded by streams to the east and west, this revision now captures the most encumbering buffer line on-site.

Regarding Stream 2, it should be noted that a culvert maintenance plan is proposed in lieu of other alternatives, such as daylighting. The applicant proposes to retain existing culverts and reinstalling trash racks on culverts for Streams 2, 3 and 4. As Fish and Wildlife Biologist Elizabeth Torrey at WDFW noted in her July 19, 2017 email for this project:

> "Again, the reason why the trash racks seemed appropriate is because all three of those culverts are drastically undersized and cannot handle the volume of the stream systems, with the water, sediment, and leafy/woody debris trying to pass through."

The applicant's engineer provided an analysis of drainage capacity for the existing culverts (CAR, Appendix C) and states they are adequate for a 100-year storm event. However, it is unclear if this analysis was for unobstructed pipes or if bedload and debris passage was included. Observed sediment deposition, and in the case of Stream 2 downstream erosion, indicates these culverts are not presently functioning well. From a biological perspective, the streams, most notably Stream 2, would benefit from daylighting and in-channel enhancement to better manage flows and sediment transport. Not only would the interaction between the forest and the stream improve but removal would eliminate the risk the pipes plug and the streams cut new channels.

KZC 90.120, states in part (bold emphasis added), "*…The Planning Official may permit* ***or require*** *the applicant or property owner to restore and maintain a stream and/or its buffer by removing material detrimental to the stream and its surrounding area such as debris, sediment, or vegetation…*" If the City allows the existing culverts to remain, then a culvert maintenance plan would require review and approval from City of Kirkland for compliance with KZC 90.115 and 90.145. A Hydraulic Project Approval (HPA) would be required from WDFW for trash rack installation.

Stream and wetland delineation study comments were generally addressed in this submittal.

Critical Areas Report (CAR) & Buffer Averaging Plan

The submittal addressed each recommendation, however, the following items will need clarification in the final report and mitigation plan.

Temporary impacts are included on the mitigation plan set. Although temporary impacts to proposed buffer replacement areas are not identified on sheet W1.1, sheets W2.0 and 3.0 show those areas will also be restored. The plan does not identify any tree losses within the utility installation areas.

The pedestrian walkway trail shown between Streams 2 and 3 on the plan set extends down a steep slope and overlaps with proposed buffer replacement. Where it crosses the proposed buffer replacement area, the trail square footage must be subtracted from the buffer gain area. The civil plan (Sheet CV-01) indicates the trail will have a gravel surface. Additionally, trail placement needs to be adjusted to avoid and minimize Stream 2 buffer impacts. A portion of the trail is shown within the buffer, behind Native Growth Protection Easement (NGPE) fencing.

A utility easement is proposed within the buffer of Stream 2. This limits the vegetation to a shrub and groundcover plant community. The applicant should relocate that easement to the west, between Lots 13 and 14, outside of standard buffer widths or provide an analysis demonstrating why that is not feasible (see KZC 90.20.4).

The conceptual planting legend indicates planting density will be based on King County critical area mitigation guidelines at a reduced percentage where in-fill planting is proposed. However, the approximate number of plants for each area does not match the KC guidelines, which applies a multiplier of 0.12 for trees, 0.28 for shrubs, and 0.063 for groundcover plants (note these factors are based on triangular spacing). For example, approximately 280 plants are proposed in the light green hatched areas, 29,150 SF total. Planting in an area of this size at 30% of the standard densities would require 901 plants.

Section 6.1 describes three open spaces, a dedicated NGPE, and states a portion of the NGPE meets the city's stormwater drainage manual requirements. However, sheet W1.1 Site Development Key Map just shows one area, approximately 4.4-acres, as a designated NGPE. The three open space areas must be within the NGPE, but they are not identified separately.

Trash rack installation on existing culverts is proposed for Streams 2, 3 and 4 (sheet W2.0). As noted above, this requires review and approval by the city (pursuant to KZC 90.115) and WDFW. The Blueline Group provided a conveyance design analysis in Appendix C of the Critical Areas Report. They conclude that the existing culverts provide more capacity than required for a 100 year storm event.

Section 8.6.2, performance standard C1 sets the invasive plant threshold at less than 20 percent cover throughout the added buffer area. Per King County critical area mitigation guidelines and consistent with past Kirkland projects, non-native and invasive plants may only comprise up to 10 percent cover in a stratum.

The bond quantity worksheet (BQWS) is missing a few items. Installation costs should include decompaction and soil amendments as shown on sheet (W2.0). The BQWS and plan sheet W1.1 propose approximately 100-foot spacing for critical area signs. A denser placement of 50-feet apart would be more effective adjacent to the two development tracts. The BQWS calculates 8 annual maintenance and monitoring cycles. According to the proposed schedule in Section 8.1 of the CAR the site would require 10 maintenance visits (spring and summer each year) and five annual monitoring visits plus an as-built study.

Recommendations

Review recommendations are as follows:

- Culvert modifications: City surface water engineer should review the proposed trash racks for existing culverts on Streams 2, 3 and 4 and the associated drainage analysis in Appendix C of the CAR. The City should also review WDFW project comments (Elizabeth Torrey email, dated 7/19/2017) and consider downstream flooding issues to determine if some or all of these streams should be daylighted pursuant to KZC 90.120. If the City allows the proposed trash racks, then the applicant should detail proposed culvert maintenance so it can be reviewed for code compliance.
- Pedestrian walkway:
    - The proposed walkway is within a proposed buffer replacement area. The trail footprint must be subtracted from the buffer replacement calculation. Since the plan shows a net buffer gain of 4,764 square feet, this recalculation will not alter the mitigation approach.
    - The proposed walkway should be placed outside of the modified buffer at all points. Currently, the trail is shown within the buffer southeast of Lot 15. Alternatively, the pedestrian path may be placed between Lots 13 and 14, further outside of stream buffers.
    - To minimize buffer impacts, a woodchip trail surface may be used in place of gravel as the gradient allows. Note the use of woodchips would not completely eliminate impacts.
- Utility easement within the Stream 2 buffer: Require the applicant to review lower impact placement alternatives, such as relocation to the west between Lots 13 and 14.
- Plant quantities: Proposed plant quantities do not meet the stated King County density guidelines, even when adjusting for in-fill planting. The applicant should revise proposed plant quantities and provide a clear description of how they are calculated.
- Performance Standard C1 should be revised to set the invasive plant threshold in proposed mitigation areas at no more than ten percent.

- Recommend 50-foot spacing for critical area signs around the development tracts for better visibility. (100-foot spacing is shown on the current plan.)
- Update the BQWS to include items noted above and capture changes to plant quantities.

Please call if you have any questions or if I can provide you with any additional information.

Sincerely,

Nell Lund, PWS
Senior Ecologist

Enclosure: Email chain, including comments from Elizabeth Torrey of WDFW, dated July 19, 2017

Reference:

Critical Areas Mitigation Guidelines (King County DPER, 11/10/2012)

Nell Lund

From: Susan Lauinger <SLauinger@kirklandwa.gov>
Sent: Thursday, July 20, 2017 8:06 AM
To: Hugh Mortensen; Nell Lund
Subject: FW: Orcas Moon Critical Areas Report

FYI on the hay bales, wattles and trash racks.

Susan Lauinger
Associate Planner
Planning and Building Department
123 5th Ave
Kirkland, WA 98033
425-587-3252
slauinger@kirklandwa.gov

From: Robert P. Londo [mailto:rl@londotiberio.com]
Sent: Thursday, July 20, 2017 7:40 AM
To: 'Torrey, Elizabeth M (DFW)' <Elizabeth.Torrey@dfw.wa.gov>
Cc: Susan Lauinger <SLauinger@kirklandwa.gov>
Subject: RE: Orcas Moon Critical Areas Report

Hi Elizabeth,

Thank you for the rapid response!

I would like to proceed with option one and remove the trash racks, straw bales, straw wattles and associated mitigation. Additionally, a HPA application will be forthcoming to allow such work and also permit/permission from the City of Kirkland. It is my intent to perform the work ASAP while stream flows are minimal and be in compliance with regulations.

Best,

Robert Londo

From: Torrey, Elizabeth M (DFW) [mailto:Elizabeth.Torrey@dfw.wa.gov]
Sent: Wednesday, July 19, 2017 5:11 PM
To: Robert P. Londo <rl@londotiberio.com>
Subject: RE: Orcas Moon Critical Areas Report

Hello,

Thanks for having me out today. I was able to talk to my supervisor when I got back to the office. He confirmed many of the thoughts I had on site. Given the nature of the watercourses (regulated, but non fish-bearing), the situation could go either way, see below. Of course, WDFW's preferred option is to remove the trash racks. However, I could write a

permit that defensibly justifies keeping the trash racks, with appropriate management and mitigation. The two options are:

1. Remove the trash racks, straw wattles, and straw bales with an HPA permit. Potential mitigation for installing these structures without a permit could be walking up the three streams and removing any trash and debris you encounter.

OR:

2. Remove the straw wattles and bales, but keep the trash racks. An HPA permit will be necessary, as this course of action will require a management plan to ensure that the trash racks are kept free and clear of debris, and maintained at the correct time of year. One of the provisions of that HPA will be that a new HPA must be applied for every 5 years, for the life of those structures, to ensure that they are maintained and not left to clog. Also, woody material that is over 4" diameter or more will not be permitted to leave the system - i.e. you can throw leaves, small branches, etc. up on the bank, but larger woody material must be placed back in the stream, either up or downstream. Additionally, a mitigation planting plan will be necessary to offset the impact of having the trash racks in the watercourse. You and I talked about this a bit – a planting plan could incorporate removal of invasive species and planting of appropriate native ones, including spirea, etc. in the riparian area. This could also benefit erosion control measures, as many types of plants will lock in the soil.

So, there are two options. It is your choice which you would like to go with. Again, the reason why the trash racks seemed appropriate is because all three of those culverts are drastically undersized and cannot handle the volume of the stream systems, with the water, sediment, and leafy/woody debris trying to pass through. That's just something to keep in mind for the future, regardless of the route you take.

Please let me know if you would like more information or would like to talk more about this.

Thanks,

Elizabeth Torrey
Fish & Wildlife Biologist
Washington Department of Fish & Wildlife
Region 4 – Issaquah Field Office
(425) 313-5681 office
(425) 628-0490 cell

From: Robert P. Londo [mailto:rl@londotiberio.com]
Sent: Wednesday, July 19, 2017 4:20 PM
To: Torrey, Elizabeth M (DFW) <Elizabeth.Torrey@dfw.wa.gov>
Subject: Orcas Moon Critical Areas Report

Hi Elizabeth,

Thank you for meeting me today at our Orcas Moon site.
I look forward to your reply for our next course of action. Per our discussion I have enclosed the Critical Areas report and Buffer Averaging report from Talasaea.

Should you have any questions I may be reached via cell @ 206-550-5560 or rl@londotiberio.com

Best,

Robert Londo

THE WATERSHED COMPANY

SCIENCE & DESIGN

August 22, 2018

Susan Lauinger
City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, WA 98125

Re: Orcas Moon Property
Stream & Wetland Delineation & Buffer Modification – 5th Review
The Watershed Company Ref. No.: 160622.6

Dear Susan:

This letter presents the findings of an environmental review of the applicant's response to my previous review letter for the Orcas Moon property, dated January 2018 and discussions between you and the applicant. The Orcas Moon LLC property is located between 20th Avenue and Forbes Creek Drive (Parcel numbers 389010-0050 and -0055). The following documents were reviewed for this study:

- July 23, 2018, *Orcas Moon – Preliminary Plat / IDP Plan set* (Prepared by The Blueline Group)
- July 20, 2018, *Critical Areas Report and Buffer Enhancement Plan, Orcas Moon Cottages, Kirkland, WA.* (CAR)(Prepared by Talasaea Consultants, Inc.)

I also referenced my prior review for this project. This project is vested to the old Kirkland Zoning Code, Chapter 90 – Drainage Basins, which was in-effect prior to March 2017.

Findings

The applicant made several changes to their site plan. Most notably one cottage was removed, now 15 cottages are proposed; buffer reduction with enhancement is proposed instead of buffer averaging; and the public path through the site has been removed from the design. Additionally, the CAR states that, "Stream 2 will be daylighted in the future after the development of this project."

750 Sixth Street South | Kirkland, WA 98033
p 425.822.5242 | f 425.827.8136 | watershedco.com

Existing Conditions

I assume it is not the applicant's intent to revisit wetland and stream delineation and classification findings covered in prior peer reviews. Some typos in the current CAR and plan set contradict both the provided documentation and prior review conclusions.

As documented in my December 1, 2016 review letter following a November site meeting with Mr. Teesdale, Wetland A contains a forested class and it is a Type 2 wetland with a 75-foot standard buffer. The CAR executive summary states that all on-site wetlands are Type 3; this is incorrect. Wetland A is mislabeled as a Type 3 on plan sheet 2. The correct, 75-foot standard buffer appears to be applied in the current plan set. This documentation discrepancy causes confusion and must be corrected in the CAR and the plan set.

Streams / Daylighting Potential

No additional analysis of the existing culverts, drainage capacity, and proposed trash rack installation was provided. The plan notes that Stream 2 will daylighted at a future date and not as part of this project. Construction of an open channel for Stream 2 down to its confluence with Stream 5 will cross a proposed utility line. To successfully daylight the stream and install the utilities, some preliminary plans with cross-section details showing how the stream will not conflict with he utility line are recommended.

Mitigation Planning

Wetland/stream buffer reduction with enhancement is proposed at a 1.01:1 mitigation to impact ratio according to the CAR and associated conceptual mitigation plan.

Sheet 3 of The Blueline Group plan set hatches buffer reduction areas and labels the hatch, 'buffer reduction with enhancement.' However, as the Talasaea plan shows, enhancement will be placed within the retained buffer; it is not synonymous with the buffer reduction area. The hatch should be relabeled to avoid confusion. Also, the title on sheet 3 is still, 'buffer averaging plan;' it needs to be updated. The Blueline Group may want to show the proposed buffer reduction on sheet 3, then reference the Talasaea W-sheets for mitigation.

Per the steep slope enhancement detail on sheet W2.0, placed logs will be secured to existing trees and stumps. Looking at the tree retention plan (sheet TR-01), there do not appear to be stumps or trees available in all the proposed steep slope enhancement areas. An anchoring method for areas lacking native anchors should be established.

Please note, in our experience it is possible to clear blackberry vines from steep slopes and reestablished native vegetation with the use of a temporary soil stabilizer, such as jute mat. However, the proposed steep slope enhancement approach also appears to be a suitable option.

Performance standards A1 and B1 refer to 'added buffer area.' Buffer reduction is proposed, not buffer addition. Recommend replacing the word added with the word enhanced.

A minimum of 12 pieces of large woody debris are specified in performance standard B1. However, the mitigation plan shows a total of 34 logs and rootwads in the buffer enhancement area. The proposed performance standard should more closely align with the mitigation plan. As Talasaea notes, the project will provide many salvage trees for this purpose (see sheet TR-02).

Performance standard C1 sets a 20 percent invasive plant cover threshold for enhancement areas. As stated in my January 2, 2018 letter, the invasive plant threshold in proposed mitigation areas should be set at no more than ten percent for consistency with King County mitigation guidelines and City practices.

Bond Quantity

An updated bond quantity worksheet was not provided with this submittal.

Recommendations

Review recommendations are as follows:

- Recommend having the City surface water engineer review the proposed culvert modifications, particularly the drainage capacity calculations provided with the prior submittal. (No new information was provided in this submittal.)
- Performance Standard B1 should be revised to increase the benchmark for large woody debris to more closely resemble the habitat feature plan (Sheet W2.0).
- Performance Standard C1 should be revised to set the invasive plant threshold in proposed mitigation areas at no more than ten percent.
- Recommend 50-foot spacing for critical area signs around the development tracts for better visibility. (100-foot spacing is shown on the current plan.)
- Note: The BQWS calculates details not shown on the conceptual mitigation plan provided. A more detailed plan set would be needed to verify BQWS entries.

Please call if you have any questions or if I can provide you with any additional information.

Sincerely,

Nell Lund, PWS
Senior Ecologist

THE WATERSHED COMPANY

SCIENCE & DESIGN

December 11, 2018

Susan Lauinger
City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, WA 98125

Re: Orcas Moon Property
Stream & Wetland Delineation & Buffer Modification – 6th Review
The Watershed Company Ref. No.: 160622.6

Dear Susan:

This letter presents the findings of an environmental review of the applicant's response to my previous review letter for the Orcas Moon property, dated August 22, 2018 and discussions between you and the applicant. The Orcas Moon LLC property is located between 20th Avenue and Forbes Creek Drive (Parcel numbers 389010-0050 and -0055). The following documents were reviewed for this study:

- November 2, 2018, *Orcas Moon Project, Response to City of Kirkland's Comment Letter.* (Prepared by Talasaea)
- November 2, 2018, *Orcas Moon Cottages/Subdivision SUB16-02267.* (Prepared by Blueline)
- October 31, 2018, *Critical Areas Report and Buffer Enhancement Plan, Orcas Moon Cottages, Kirkland, WA.* (CAR)(Prepared by Talasaea Consultants, Inc.)
- October 31, 2018, *Orcas Moon Cottages, Preliminary Plat / IDP.* (Prepared by Blueline)

I also referenced my prior reviews for this project and your letter to the applicant titled, *Orcas Moon Cottages/Subdivision SUB16-02267 Additional Information Needed*, dated September 21, 2018.

This project is vested to the old Kirkland Zoning Code, Chapter 90 – Drainage Basins, which was in-effect prior to March 2017.

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Findings & Recommendations

Talasaea and Blueline Group addressed all the comments I issued for this project on August 22, 2018.

Streams

According to the applicant's consultants, the potential to daylight Stream 2 was further analyzed and rejected; the pipe diameter will be increased instead. This should resolve any potential conflicts with the proposed stormwater line. The Talasaea comment response letter describes some geotechnical engineering challenges associated with daylighting Stream 2. The Talasaea report also quotes Casey Costello of WDFW as saying, "that daylighting Steam 2 would not provide any improvements to habitat or water quality." (This statement has not been independently verified with WDFW.) Although The Watershed Company does not agree that there is no functional lift opportunity here, stream daylighting is not required for the current design under the vested code (Pers. Comm. with Associate Planner, Susan Lauinger). Temporary impacts associated with pipe installation are documented in the CAR and accounted for in the proposed mitigation plan.

The project also proposes a headwall at the inlet of the pipe for Stream 3. As noted in the CAR, Section 6.2, the headwall is a small permanent buffer impact and it is accounted for in the proposed buffer enhancement mitigation.

As noted in CAR, Section 5.2, in-stream work will require Hydraulic Project Approval from the Washington State Department of Fish and Wildlife.

Performance Standards

Performance Standard B1 was updated in the CAR, but not on plan sheet W4.0. The updated standard for a minimum of 20 pieces of large woody debris needs to be copied to W4.0.

Mitigation Plan Notes

Update the maintenance and monitoring schedule on sheet W4.0, Table 1 to show performance monitoring visits in spring and fall of every monitoring year in compliance with KZC 90.55.4.

Bond Quantity Worksheet

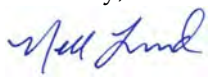
The bond quantity worksheet provided on sheet W4.0 is missing a few details.

- Temporary irrigation is calculated at 0.5-acre, but the 27,909 SF enhancement area is 0.64-acres.
- Labor and materials for jute matting and associated staple anchors are not included in the bond estimate.

- Silt fencing will be needed during construction; it is not included in the bond estimate. Silt fencing may be in the civil engineer's bond estimate. It should be bonded once for the project.
- Maintenance & Monitoring:
    - The maintenance plan specifies a spring and fall maintenance visit each year, recommend increasing that line item from 5 to 10 to reflect the cumulative number of annual visits.
    - The monitoring plan specifies an as-built inspection, spring and fall monitoring in years 1 and 2, and fall monitoring in years 3, 4 and 5. However, KZC 90.55.4 requires at least two site visits per year. Therefore, recommend increasing that line item from 5 to 11 to reflect the cumulative number of annual visits.

Please call if you have any questions or if I can provide you with any additional information.

Sincerely,



Nell Lund, PWS
Senior Ecologist

NATURAL GREENBELT PROTECTIVE EASEMENT

Grantor: _____, owner of the hereinafter described real property, hereby grants to

Grantee: The City of Kirkland, a municipal corporation.

A natural greenbelt protective easement over and across the following described real property to wit ("Easement Area"):

No tree trimming, tree topping, tree cutting, tree removal, shrub or brush-cutting or removal of native vegetation, application of pesticides, herbicides, or fertilizers; construction; clearing; or alteration activities shall occur within the Easement Area without prior written approval from the City of Kirkland. Application for such written approval to be made to the Kirkland Department of Planning and Community Development who may require inspection of the premises before issuance of the written approval and following completion of the activities. Any person conducting or authorizing such activity in violation of this paragraph or the terms of any written approval issued pursuant hereto, shall be subject to the enforcement provisions of Chapter 1.12, Kirkland Municipal Code. In such event, the Kirkland Department of Planning and Community Development may also require within the immediate vicinity of any damaged or fallen vegetation, restoration of the affected area by planting replacement trees and other vegetation as required in applicable sections of the Kirkland Zoning Code. The Department also may require that the damaged or fallen vegetation be removed.

It is the responsibility of the property owner to maintain critical areas and their buffers by removing non-native, invasive, and noxious plants in a manner that will not harm critical areas or their buffers and in accordance with Kirkland Zoning Code requirements for trees and other vegetation within critical areas and critical area buffers.

The City shall have a license to enter the Easement Area (and the property if necessary for access to the Easement Area) for the purpose of monitoring compliance with the terms of this easement.

Development outside of this Natural Greenbelt Protective Easement may be limited by codified standards, permit conditions, or movement of the critical area.

Each of the undersigned owners agree to defend, pay, and save harmless the City of Kirkland, its officers, agents, and employees from any and all claims of every nature whatsoever, real or imaginary, which may be made against the City, its officers, agents, or employees for any damage to property or injury to any person arising out of the existence of said Natural Greenbelt Protective Easement over said owner's property or the actions of the undersigned owners in carrying out the responsibilities under this agreement, including all costs and expenses, and recover attorney's fees as may be incurred by the City of Kirkland in defense thereof; excepting therefrom only such claims as may arise solely out of the negligence of the City of Kirkland, its officers, agents, or employees.

This easement is given to satisfy a condition of the development permit approved by the City of Kirkland under Kirkland File/Permit No. _____, for construction of _____ upon the following described real property:

This easement shall be binding upon the parties hereto, their successors and assigns, and shall run with the land.

DATED at Kirkland, Washington, this _____ day of _____, _____.

(Sign in blue ink)

(***Individuals Only***)

OWNER(S) OF REAL PROPERTY (INCLUDING SPOUSE)

_____

_____

_____

(***Individuals Only***)

STATE OF WASHINGTON)
) SS.
County of King)

On this _____ day of _____, _____, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared _____and _____to me known to be the individual(s) described herein and who executed the Public Ingress and Egress Easement and acknowledged that _____ signed the same as _____ free and voluntary act and deed, for the uses and purposes therein mentioned.

WITNESS my hand and official seal hereto affixed the day and year first above written.

_____
Notary's Signature

_____
Print Notary's Name
Notary Public in and for the State of Washington,
Residing at: _____
My commission expires: _____

(***Partnerships Only***)

OWNER(S) OF REAL PROPERTY

_____
(Name of Partnership or Joint Venture)

_____
By General Partner

_____
By General Partner

_____
By General Partner

(***Partnerships Only***)

STATE OF WASHINGTON)
) SS.
County of King)

On this _____ day of _____, _____, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared _____and _____ to me, known to be general partners of _____, the partnership that executed the Public Ingress and Egress Easement and acknowledged the said instrument to be the free and voluntary act and deed of each personally and of said partnership, for the uses and purposes therein set forth, and on oath stated that they were authorized to sign said instrument.

WITNESS my hand and official seal hereto affixed the day and year first above written.

_____
Notary's Signature

_____
Print Notary's Name
Notary Public in and for the State of Washington, Residing at: _____
My commission expires: _____

(Corporations Only)

OWNER(S) OF REAL PROPERTY

_____
(Name of Corporation)

_____
By President

_____
By Secretary

(***Corporations Only***)

STATE OF WASHINGTON)
) SS.
County of King)

On this _____ day of _____, _____, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared _____and _____ to me, known to be the President and Secretary, respectively, of _____, the corporation that executed the Public Ingress and Egress Easement and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein set forth, and on oath stated that they were authorized to sign said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal hereto affixed the day and year first above written.

_____
Notary's Signature

_____
Print Notary's Name
Notary Public in and for the State of Washington, Residing at: _____
My commission expires: _____

associated
earth sciences
incorporated

Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report

LONDO FORBES CREEK

Kirkland, Washington

Prepared For:

ORCAS MOON, LLC

Project No. KE160384A
July 28, 2016

Associated Earth Sciences, Inc.
911 5th Avenue
Kirkland, WA 98033
P (425) 827 7701
F (425) 827 5424

associated
earth sciences
incorporated

July 28, 2016
Project No. KE160384A

Orcas Moon, LLC
P.O. Box 2710
Redmond, Washington 98073

Attention: Mr. Robert Londo

Subject: Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report
Londo Forbes Creek
20th Avenue and 4th Place
Kirkland, Washington

Dear Mr. Londo:

We are pleased to present copies of the above-referenced report. This report summarizes the results of our subsurface exploration, geologic hazard, and geotechnical engineering studies and offers recommendations for the design and development of the proposed project. At the time of this report, site grading, structural plans, and construction methods have not been finalized and the recommendations presented herein are preliminary.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Bruce L. Blyton, P.E.
Senior Principal Engineer

BLB/pc – KE160384A2 – Projects\20160384\KE\WP

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND GEOTECHNICAL ENGINEERING REPORT

LONDO FORBES CREEK

Kirkland, Washington

Prepared for:
Orcas Moon, LLC
P.O. Box 2710
Redmond, Washington 98073

Prepared by:
Associated Earth Sciences, Inc.
911 5th Avenue
Kirkland, Washington 98033
425-827-7701
Fax: 425-827-5424

July 28, 2016
Project No. KE160384A

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of our subsurface exploration, geologic hazard, and geotechnical engineering study for the Londo Forbes Creek project, located near the intersection of 20th Avenue and 4th Place in Kirkland, Washington (Figure 1). The approximate locations of explorations referenced for this study are shown on the "Site and Exploration Plan," Figure 2. Interpretive exploration logs are included in the Appendix. At the time of this report, site grading, structural plans, and construction methods have not been finalized and the recommendations presented herein are preliminary. As the nature, design, and locations of the site improvements and lots are planned, the conclusions and recommendations contained in this report should be reviewed and modified, or verified, as necessary.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be utilized in design and construction of the site improvements and residences at the above-referenced site. Our study included a review of available geologic literature and exploration logs, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow ground water conditions. A geologic hazards assessment and a geotechnical engineering study were also completed to determine suitable geologic hazard mitigation techniques, the type of suitable foundations, allowable foundation soil bearing pressures, anticipated foundation settlements, erosion considerations, drainage considerations, and construction recommendations. This report summarizes our fieldwork and offers geologic hazard mitigation and development recommendations based on our present understanding of the project.

1.2 Authorization

Written authorization to proceed with this study was granted by Mr. Robert Londo of Orcas Moon, LLC. Our study was accomplished in general accordance with our scope of work letter dated July 21, 2016. This report has been prepared for the exclusive use of Orcas Moon, LLC and its agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made. It must be understood that no recommendations or engineering design can yield a guarantee of stable slopes. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

2.0 PROJECT AND SITE DESCRIPTION

This report was completed with an understanding of the project based on our discussions with you, and review of a "Cottage Plan" and associated cross sections, prepared by Blueline and dated July 12, 2016. We understand that you are currently planning 16 single-family cottage residences, with associated grading, access, and utilities, at the subject site. Rockeries, ranging up to approximately 10 feet in exposed height, are planned to face fills placed for roadways and building pads.

The property was situated north of the intersection of 20th Avenue and 4th Place in Kirkland, Washington (King County Parcel Nos. 3890100050 and 3890100055). The approximately 7-acre property generally slopes down to the north and is situated on the south flank of the Forbes Creek valley. The total elevation change across the property was on the order of 120 feet. Incised depressions on the slope appeared to serve as collectors of surface runoff above and for the upper third of the subject property. Locally, the depressions contained slopes on the order of 40 to 50 percent. We were informed that three sections of corrugated metal pipe were laid in the incised depressions and extend down the slope with water exiting the pipes near Forbes Creek Drive. It is our understanding that the pipe was installed to carry runoff water from 20th Avenue to the south of the site.

The property is accessed via a roughly graded road entering from Forbes Creek Drive along the northern property boundary. The site contains remnants of a demolished house and pump house. The site contains a moderate growth of native vegetation consisting of maple and evergreen trees, blackberry bushes, ferns, and short grass. While on-site, we did not observe bowed trees or similar conditions that would indicate creep or downslope movement of the existing slope. The only significant erosion features we observed were along the previously mentioned incised depressions running north-south on the face of the slope.

3.0 SUBSURFACE EXPLORATION

Our previous field study, completed in 2005, included excavating 10 exploration pits to gain information about the site. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in the Appendix. The depths indicated on the logs where conditions changed may represent gradational variations between sediment types. Our explorations were approximately located in the field by measuring from known site features.

The conclusions and recommendations presented in this report are based on the subsurface explorations completed for this study. The number, locations, and depths of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory

work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes.

3.1 Exploration Pits

Exploration pits were excavated with a trackhoe. The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by a geotechnical engineer from our firm. All exploration pits were backfilled immediately after examination and logging. Selected samples were then transported to our laboratory for further visual classification and testing, as necessary.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the subject site were inferred from the field explorations referenced for this study, visual reconnaissance of the site, and review of applicable geologic literature. The approximate locations of the explorations are shown on Figure 2. As shown on the field logs, the exploration pits generally encountered medium dense sand with varying amounts of silt and gravel or stiff to hard silts. Minor amounts of fill may occur at some locations, particularly those in the northern portion of the site, adjacent to the roadway, or within utility trenches across the property and in the vicinity of previous structures. The following section presents more detailed subsurface information.

4.1 Stratigraphy

Topsoil

Topsoil consisting of loose, moist, dark brown, silty sand was encountered in most of the explorations. The topsoil ranged in thickness from about 0.5 to 1.5 feet. This material is unsuitable for structure or pavement support.

Fill

We observed fill soils covering buried, approximately 12-inch–diameter, corrugated pipes laid along the steep site slopes. The pipes appeared to be between 1.5 and 2 feet below existing site grades at the locations we observed. Fill may also be encountered around utilities and

foundation areas associated with the demolished structure. This material is unsuitable for structure or pavement support.

Recessional Outwash

Sediments encountered below the topsoil layer consisted of medium dense, fine to medium sand with varying quantities of silt. We interpret these sediments to be representative of recessional outwash. The recessional outwash consists of sediments that were deposited by meltwater streams that emanated from the retreating glacial ice during the latter portion of the Vashon Stade of the Fraser Glaciation ending approximately 12,500 years ago. Where glacial sediments are exposed at the ground surface throughout the Puget Sound region, the upper several feet of these sediments typically become weathered. The recessional outwash sediments generally extended about 4 to 5 feet below existing grades, but in exploration pit EP-1, extended to the bottom of the exploration at 16 feet. When properly prepared, the recessional outwash will be suitable for the support of foundations.

Advance Outwash

An advance outwash deposit consisting of medium dense to very dense sand containing variable amounts of disseminated silt, interbeds of clayey silt, and few amounts of scattered gravel was encountered below the topsoil and recessional deposits. The advance outwash deposit was generally encountered between 4 to 6 feet below existing grades in exploration pits EP-6 and EP-9, or approximately the middle third of the slope. The advance outwash was deposited ahead of the advancing Vashon-age glacial ice sheet in meltwater streams and subsequently overridden by several thousand feet of ice. Consequently, these materials are medium dense to very dense, possess high shear strength, and have low compressibility characteristics. The advance outwash deposit is suitable for direct foundation support.

Transitional Beds

A hard, clayey silt and silty clay deposit containing trace amounts of fine sand interpreted to be transitional beds was generally encountered in the upper portions (south end) of the property. The glaciolacustrine clayey silt and silty clay was deposited in freshwater lakes or slow-moving rivers far ahead of the advancing Vashon-age glacial ice sheet and was also overridden by several thousand feet of ice. These materials are hard, have low compressibility characteristics, and are relatively impermeable. The transitional beds are considered suitable for support of shallow foundations with proper preparation. The transitional beds are typically highly moisture-sensitive and susceptible to disturbance when wet. Care should be taken not to disturb planned load-bearing surfaces that are composed of the transitional beds during periods of wet site or weather conditions.

4.2 Hydrology

Ground water seepage was only encountered in exploration pit EP-5 at the time of our field study in June 2005. It should be noted that fluctuations in the level of the ground water may occur due to the time of the year, variations in the amount of precipitation, and changes in site development. Seepage may also occur at random depths and locations in unsupervised or non-uniform fills.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on review of the City of Kirkland maps of environmentally critical areas. The subject site is classified as a high landslide hazard area with a potential for severe erosion hazards when devegetated.

5.0 LANDSLIDE HAZARDS AND MITIGATION

Our explorations encountered medium dense to dense, glacially consolidated sediments on the slopes at relatively shallow depths. In our opinion, the aforementioned slope geometry, drainage/ground water, and geologic conditions present a relatively low to moderate landslide hazard risk for the site. No springs or seeps were observed at the time of our visit and the site did not exhibit obvious indications of past or present slope instability. Landslide hazards can be mitigated by implementing the following measures:

1. Control storm water crossing the site.

2. Proper grading, compaction, and benching of subgrade soils

3. Permanent slopes in cut and structural fill must be limited to 2H:1V (Horizontal:Vertical). In areas where it is not feasible to construct a 2H:1V slope, engineered walls should be constructed.

4. Limit site clearing only to areas to be developed.

The basemap used for Figure 2 includes shaded areas indicating slopes across the subject site greater than 40 percent in grade. This basemap also shows stream and wetland areas, delineated by others, along with associated buffers. Based on our explorations, it is our opinion that the wetland/stream buffers also provide a suitable setback from significant site slopes for the proposed improvements, provided the recommendations in this report are followed.

6.0 SEISMIC HAZARDS AND MITIGATIONS

Earthquakes occur regularly in the Puget Lowland. Most of these events are small and are not felt by humans. However, large earthquakes do occur, as evidenced by the 2001, 6.8-magnitude event; the 1965, 6.5-magnitude event; and the 1949, 7.2-magnitude event. The 1949 earthquake appears to have been the largest in this region during recorded history and

was centered in the Olympia area. Evaluation of earthquake return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides, 3) liquefaction, and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

6.1 Surficial Ground Rupture

The nearest known fault traces to the project site are the South Whidbey Island-Lake Alice Fault located approximately 4 miles to the north, and the Seattle Fault located approximately 5 miles to the south. Recent studies of both the Seattle Fault and the South Whidbey Island-Lake Alice Fault indicate that they are active faults capable of generating surface ruptures. The recognition of these faults is relatively new, and data pertaining to them are limited, with the studies still ongoing. According to the U.S. Geological Society (USGS) studies, the recurrence interval of movements along these faults is unknown, but is speculated to be on the order of 1,100 years. Due to the distance from the site to the known fault zones, and due to the long recurrence interval that is suspected for these fault systems, the risk for damage to the project during the expected life of the structures due to surface faulting is expected to be low, in our opinion.

6.2 Seismically Induced Landslides

It is our opinion that the risk of damage to the proposed structures by seismically induced landsliding is low due to the presence of medium dense to very dense compacted soils observed at depth beneath the surface of the site.

6.3 Liquefaction

Liquefaction is a temporary loss in soil shear strength that can occur when loose granular soils below the ground water table are exposed to cyclic accelerations, such as those that occur during earthquakes. The observed site soils were relatively dense and unsaturated and are not expected to be prone to liquefaction. A detailed liquefaction hazard analysis was not performed as part of this study, and none is warranted, in our opinion.

6.4 Seismic Site Class

In our opinion the subsurface conditions at the site are consistent with seismic Site Class D in accordance with the 2012 *International Building Code* (IBC), and the publication ASCE 7 referenced therein, the most recent version of which is ASCE 7-10.

7.0 EROSION HAZARDS AND MITIGATION

The on-site sediments contain a high percentage of silt and fine sand and are sensitive to erosion. In order to control erosion and reduce the amount of sediment transport off the site during construction, the following recommendations should be followed.

1. Construction activity should be scheduled or phased as much as possible to reduce the amount of earthwork activity that is performed during the winter months.

2. The winter performance of a site is dependent on a well-conceived plan for control of site erosion and storm water runoff. The project temporary erosion and sediment control (TESC) plan should include ground-cover measures, access roads, and staging areas. The contractor must implement and maintain the required measures. A site maintenance plan should be in place in the event storm water turbidity measurements are greater than the Washington State Department of Ecology (Ecology) standards.

3. TESC measures for a given area to be graded or otherwise worked should be installed soon after ground clearing. The recommended sequence of construction within a given area after clearing would be to install sediment traps and/or ponds and establish perimeter flow control prior to starting mass grading.

4. During the wetter months of the year, or when large storm events are predicted during the summer months, each work area should be stabilized so that if showers occur, the work area can receive the rainfall without excessive erosion or sediment transport. The required measures for an area to be "buttoned-up" will depend on the time of year and the duration the area will be left un-worked. During the winter months, areas that are to be left un-worked for more than 2 days should be mulched or covered with plastic. During the summer months, stabilization will usually consist of seal-rolling the subgrade. Such measures will aid in the contractor's ability to get back into a work area after a storm event. The stabilization process also includes establishing temporary storm water conveyance channels through work areas to route runoff to the approved treatment facilities.

5. All disturbed areas should be revegetated as soon as possible. If it is outside of the growing season, the disturbed areas should be covered with mulch, as recommended in the erosion control plan. Straw mulch provides a cost-effective cover measure and can be made wind-resistant with the application of a tackifier after it is placed.

6. Surface runoff and discharge should be controlled during and following development. Uncontrolled discharge may promote erosion and sediment transport.

7. Soils that are to be reused around the site should be stored in such a manner as to reduce erosion from the stockpile. Protective measures may include, but are not limited to, covering with plastic sheeting, the use of low stockpiles in flat areas, or the use of silt fences around pile perimeters.

8. On-site erosion control inspections and turbidity monitoring (when required) should be performed in accordance with Ecology requirements. Weekly and monthly reporting to Ecology should be performed on a regularly scheduled basis. Temporary and permanent erosion control and drainage measures should be adjusted and maintained, as necessary, for the duration of project construction.

It is our opinion that with the proper implementation of the TESC plans and by field-adjusting appropriate mitigation elements (best management practices [BMPs]) throughout construction, as recommended by the erosion control inspector, the potential adverse impacts from erosion hazards on the project may be mitigated.

III. DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

Our explorations indicate that, from a geotechnical standpoint, the subject site is suitable for the proposed development provided the recommendations contained herein are properly followed. The bearing stratum is relatively shallow and spread-footing foundations may be utilized. We understand that the distribution of foundations loads of the proposed residences will be typical; concentrated loads on the order of 2 kips per lineal foot of foundation can be expected. Consequently, the native dense outwash soils, hard transitional bed silts, or structural fills bearing on the native soils are capable of providing suitable building support.

9.0 SITE PREPARATION

Site preparation of planned building, road, and structural fill areas should include removal of all trees, brush, debris and any other deleterious material. Additionally, the upper organic topsoil should be removed and the remaining roots grubbed. Areas where loose surficial soils exist due to grubbing operations should be considered as fill to the depth of disturbance and treated as subsequently recommended for structural fill placement.

Loose topsoil should be stripped down to the underlying, medium dense to dense outwash soils and hard transitional bed silts. Since the density of the soil is variable, random soft pockets may exist and the depth and extent of stripping can best be determined in the field by the geotechnical engineer or his representative. We recommend that road areas be proof-rolled with a loaded dump truck to identify soft spots; soft areas should be overexcavated and backfilled with structural fill.

9.1 Temporary Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, we anticipate that temporary, unsupported cut slopes in the unsaturated, medium dense recessional outwash soils and stiff silts can be made at a maximum slope of 1.5H:1V, and in the unsaturated native advance outwash sands and gravels and the very stiff to hard silts at 1H:1V. As is typical with earthwork operations, some sloughing and raveling may occur and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

9.2 Moisture-Sensitive Soils

The on-site soils contain a high percentage of fine-grained material which makes them moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be removed and the area brought to grade with structural fill. Consideration should be given to protecting access and staging areas with an appropriate section of crushed rock or asphalt treated base (ATB).

If crushed rock is considered for the access and staging areas, it should be underlain by engineering stabilization fabric to reduce the potential of fine-grained materials pumping up through the rock and turning the area to mud. The fabric will also aid in supporting construction equipment, thus reducing the amount of crushed rock required. We recommend that at least 10 inches of rock be placed over the fabric; however, due to the variable nature of the near-surface soils and differences in wheel loads, this thickness may have to be adjusted by the contractor in the field.

10.0 STRUCTURAL FILL

Due to the slopes on the site, structural fill will be necessary to establish desired grades. All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

10.1 Subgrade Keying and Benching

If fill is to be placed on slopes steeper than 5H:1V, the base of the fill should be tied to firm, stable subsoil by appropriate keying and benching, which would be established in the field to suit the particular soil conditions at the time of grading. The keyway will act as a shear key to embed the toe of the new fill into the hillside. Generally, the keyway for hillside fills should be at least 8 feet wide and cut into the lower, dense sand or stiff silt. Level benches would then be cut horizontally across the hill following the contours of the slope. No specific width is required for the benches, although they are usually a few feet wider than the dozer being used to cut them. All fills proposed over a slope should be reviewed by our office prior to construction.

We recommend that AESI observe exposed subgrades prior to fill placement. Should wet subgrade conditions be present, we recommend that the wet subgrade areas for fills planned along the slopes be equipped with subfill drains. Subfill drains may consist of a 1- to 2-foot-thick section of free-draining aggregate placed below the fill and covered with a geotextile

fabric. The aggregate should be compacted to 95 percent of the modified Proctor maximum density using *American Society for Testing and Materials* (ASTM):D 1557 as the standard or to a firm and unyielding condition as determined by the geotechnical engineer or his representative. The subfill drains will allow hydrostatic forces, if present, to disperse.

10.2 Fill Subgrade Preparation

After overexcavation/stripping has been performed to the satisfaction of the geotechnical engineer/engineering geologist, the upper 12 inches of exposed ground should be recompacted to 90 percent of the modified Proctor maximum density using ASTM:D 1557 as the standard or to a firm and unyielding condition as determined by the geotechnical engineer or his representative. If the subgrade contains too much moisture, adequate recompaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

10.3 Structural Fill Placement and Compaction

After the recompacted ground is tested and approved or a free-draining rock course is laid, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 10-inch loose lifts with each lift being compacted to at least 95 percent of the modified Proctor maximum density using ASTM:D 1557 as the standard. In the case of roadway and utility trench filling, the backfill should be placed and compacted in accordance with current local or county codes and standards. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the location of the perimeter footings or roadway edge before sloping down at an angle of 2H:1V.

10.4 Moisture-Sensitive Fill Materials

Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. The on-site soils generally contained significant amounts of silt and are considered moisture-sensitive. In addition, construction equipment traversing the site when the soils are wet can cause considerable disturbance. Due to the sloping, potentially wet conditions at the subject site, and the proposed structures, road ways, utilities, and rockeries planned for these slope conditions, a select import material consisting of a clean,

free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction. We recommend that imported structural fill conform to Washington State Department of Transportation (WSDOT) Specification 9-03.14(1) (gravel borrow) or similar as determined by the geotechnical engineer.

10.5 Structural Fill Testing

The contractor should note that any proposed fill soils must be evaluated by Associated Earth Sciences, Inc. (AESI) prior to their use in fills. This would require that we have a sample of the material 48 hours in advance of filling activities to perform a Proctor test and determine its field compaction standard. A representative from our firm should inspect the stripped subgrade and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid the owner in developing a suitable monitoring and testing frequency.

11.0 FOUNDATIONS

Spread footings may be used for building support when founded on medium dense recessional outwash soils, dense to very dense advance outwash soils, stiff to hard transitional beds, or structural fill placed as previously discussed. We recommend that an allowable bearing pressure of 2,000 pounds per square foot (psf) be utilized for design purposes, including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading. Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection. However, all footings must penetrate to the prescribed bearing stratum and no footing should be founded in or above loose, organic, or existing fill soils.

It should be noted that the area bounded by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area which has not been compacted to at least 95 percent of ASTM:D 1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edge of steps or cuts in the bearing soils.

Anticipated settlement of footings founded on medium dense to very dense outwash soils, stiff to hard transitional bed silts, or approved structural fill should be on the order of 1 inch. However, disturbed soil not removed from footing excavations prior to footing placement

could result in increased settlements. All footing areas should be inspected by AESI prior to placing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. Such inspections may be required by the City of Kirkland. Perimeter footing drains should be provided as discussed under the section on "Drainage Considerations."

12.0 LATERAL WALL PRESSURES

All backfill behind walls or around foundations should be placed following our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed using an equivalent fluid equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid of 50 pcf. Walls that retain sloping backfill at a maximum angle of 2H:1V should be designed for 55 pcf for yielding conditions and 75 pcf for restrained conditions. If parking areas are adjacent to walls, a surcharge equivalent to 2 feet of soil should be added to the wall height in determining lateral design forces. Undrained walls/structures must be designed for combined soil and hydrostatic pressures (85 pcf for yielding walls, 100 pcf for unyielding walls with horizontal backfill) and for buoyant/uplift forces.

In accordance with the 2012 IBC, retaining wall design should include seismic design parameters. Based on the site soils and assumed wall backfill materials, we recommend a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. A rectangular pressure distribution of 4H and 8H psf (where H is the height of the wall in feet) should be included in design for "active" and "at-rest" loading conditions, respectively. The resultant of the rectangular seismic surcharge should be applied at the midpoint of the walls.

12.1 Wall Backfill

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of either the on-site glacial sediments, or imported sand and gravel compacted to 92 percent of ASTM:D 1557. A higher degree of compaction is not recommended, as this will increase the pressure acting on the walls. A lower compaction may result in unacceptable settlement behind the walls. Thus, the compaction level is critical and must be tested by our firm during placement. The recommended compaction of 92 percent of ASTM:D 1557 applies to any structural fill placed behind the wall within a distance equal to the wall height and up to the elevation of the top of the wall. Structural fill used to construct slopes behind retaining walls should be compacted to at least 95 percent of ASTM:D 1557 if the fill is placed above the elevation of the top of the wall. Surcharges from adjacent footings, heavy construction equipment, or sloping ground must be added to the above-recommended lateral pressures.

Footing drains should be provided for all retaining walls, as discussed under the "Drainage Considerations" section of this report.

12.2 Wall Drainage

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum, 1-foot-wide blanket drain for the full wall height (excluding the uppermost 1 foot of backfill) using imported washed gravel against the walls. The wall drain material must be hydraulically connected to the footing drain pipe. Wall foundation drains are discussed in Section 15.0 of this report.

12.3 Passive Resistance and Friction Factor

Lateral loads can be resisted by friction between the foundation and the natural, medium dense to very dense sediments or supporting structural fill soils, or by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with compacted structural fill to achieve the passive resistance provided below. We recommend the following allowable design parameters.

- Passive equivalent fluid = 250 pcf
- Coefficient of friction = 0.30

13.0 ROCKERIES

Rockeries may be used to prevent erosion of slopes; however, they are not engineered structures and should not be used in place of retaining walls. Buildings and roads should be set back from rockeries so that a 1H:1V line extending up from the rear base of the rockery does not intersect the footing or pavement. Rockery construction quality depends largely on the skill of the builder. Although rockeries are commonly used, they should be considered a long-term maintenance item. Care must be exercised in selecting a rock source since some of the material presently being supplied is soft and disintegrates in a relatively short period of time. Samples of rock can be tested by AESI prior to their use in rockeries.

It is our understanding that rockery walls will be used as a facing for geogrid-reinforced fill slopes. The following notes present rockery design and construction considerations. A typical rockery detail for geogrid-reinforced slopes (Figure 3) is included in this report. In addition, the contractor should confirm that the proposed configuration conforms to current City of Kirkland specifications.

A) The base of the rockery should be started by excavating a trench to a minimum depth of 12 inches below subgrade into firm, undisturbed ground. If loose, soft, or disturbed materials exist at the base rock location, they should be removed and replaced with free-draining sand and gravel or crushed rock. This backfill material should be compacted to a minimum of 90 percent of ASTM:D-1557. The gradation of the sand and gravel should be such that not more than 5 percent by weight should be finer than the No. 200 sieve, based on the minus No. 4 sieve.

B) The base rock should have a minimum width (perpendicular to the line of the rockery) of 40 percent of the height of the rockery. All rocks should also meet the following weight requirements:

Height of Rockery	Minimum Weight of Rock
Above 5 feet	200/6,000 pounds, graded, top/bottom rocks
5 feet or less	200/2,000 pounds, graded, top/bottom rocks

C) The rock material should all be as nearly rectangular as possible. No stone should be used which does not extend through the wall. The rock material should be hard, sound, durable, and free from weathered portions, seams, cracks, or other defects. The rock density should be a minimum of 160 pcf.

D) Rock selection and placement should be such that there will be minimum voids and, in the exposed face of the wall, no open voids over 8 inches across in any direction. The rocks should be placed in a manner such that the longitudinal axis of the rock will be at right angles or perpendicular to the rockery face. Each rock should be placed so as to lock into two rocks in the lower tier. After setting each rock course, all voids between the rocks should be chinked on the back with quarry rock to eliminate any void sufficient to pass a 2-inch-square probe. The rockery should be limited to 8 feet in height.

E) A drain consisting of rigid, perforated, polyvinyl chloride (PVC) pipe enclosed in a 12-inch-wide pea gravel trench should be placed behind the lower course of rock to remove water and prevent the buildup of hydrostatic pressure behind the wall. The remainder of the wall backfill should consist of quarry spalls with a maximum size of 4 inches and a minimum size of 2 inches. This material should be placed to a 12-inch-minimum thickness between the entire wall and the cut material. The backfill material should be placed in lifts to an elevation approximately 6 inches below the top of each course of rocks as they are placed until the uppermost course is placed. Any backfill material falling onto the

bearing surface of a rock course should be removed before the setting of the next course.

F) Any asphalt paving should be sloped to drain away from the rockery. In addition, the areas above rockeries should be planted with grass as soon as possible after rockery construction to reduce erosion.

14.0 FLOOR SUPPORT

Slab-on-grade floors may be constructed either directly on the medium dense to very dense natural sediments, or on structural fill placed over these materials. Areas of the slab subgrade that are disturbed (loosened) during construction should be recompacted to an unyielding condition prior to placing the pea gravel, as described below.

If moisture intrusion through slab-on-grade floors is to be limited, the floors should be constructed atop a capillary break consisting of a minimum thickness of 4 inches of washed pea gravel. The pea gravel should be overlain by a 10-mil (minimum thickness) plastic vapor retarder.

15.0 DRAINAGE CONSIDERATIONS

The underlying, glacially compacted soils are relatively impermeable and water will tend to perch atop this stratum. Additionally, traffic across these soils when they are damp or wet will result in disturbance of the otherwise firm stratum. Therefore, prior to site work and construction, the contractor should be prepared to provide temporary drainage and subgrade protection, as necessary.

All retaining and perimeter footing walls should be provided with a drain at the footing elevation. The drains should consist of rigid, perforated, PVC pipe surrounded by washed pea gravel. The level of the perforations in the pipe should be set approximately 2 inches below the bottom of the footing, and the drains should be constructed with sufficient gradient to allow gravity discharge away from the buildings. All retaining walls should be lined with a minimum, 12-inch-thick, washed gravel blanket provided to within 1 foot of finish grade, and which ties into the footing drain. Roof and surface runoff should not discharge into the footing drain system, but should be handled by a separate, rigid, tightline drain.

Exterior grades adjacent to walls should be sloped downward away from the structures to achieve surface drainage. Final exterior grades should promote free and positive drainage away from the buildings at all times. Water must not be allowed to pond or to collect adjacent to foundations or within the immediate building areas. It is recommended that a gradient of at least 3 percent for a minimum distance of 10 feet from the building perimeters be provided, except in paved locations. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structures. Additionally, pavement subgrades should be crowned to provide drainage toward catch basins and pavement edges. Crawl space areas should be provided with drains at low points to prevent water from accumulating.

16.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

At the time of this report, site grading, structural plans, and construction methods have not been finalized and the recommendations presented herein are preliminary. We are available to provide additional geotechnical consultation as the project design develops and possibly changes from that upon which this report is based. We recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, our earthwork and foundation recommendations may be properly interpreted and implemented in the design. This plan review is not included in the current scope of work and budget.

We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundations depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of this current scope of work. If these services are desired, please let us know and we will prepare a cost proposal.

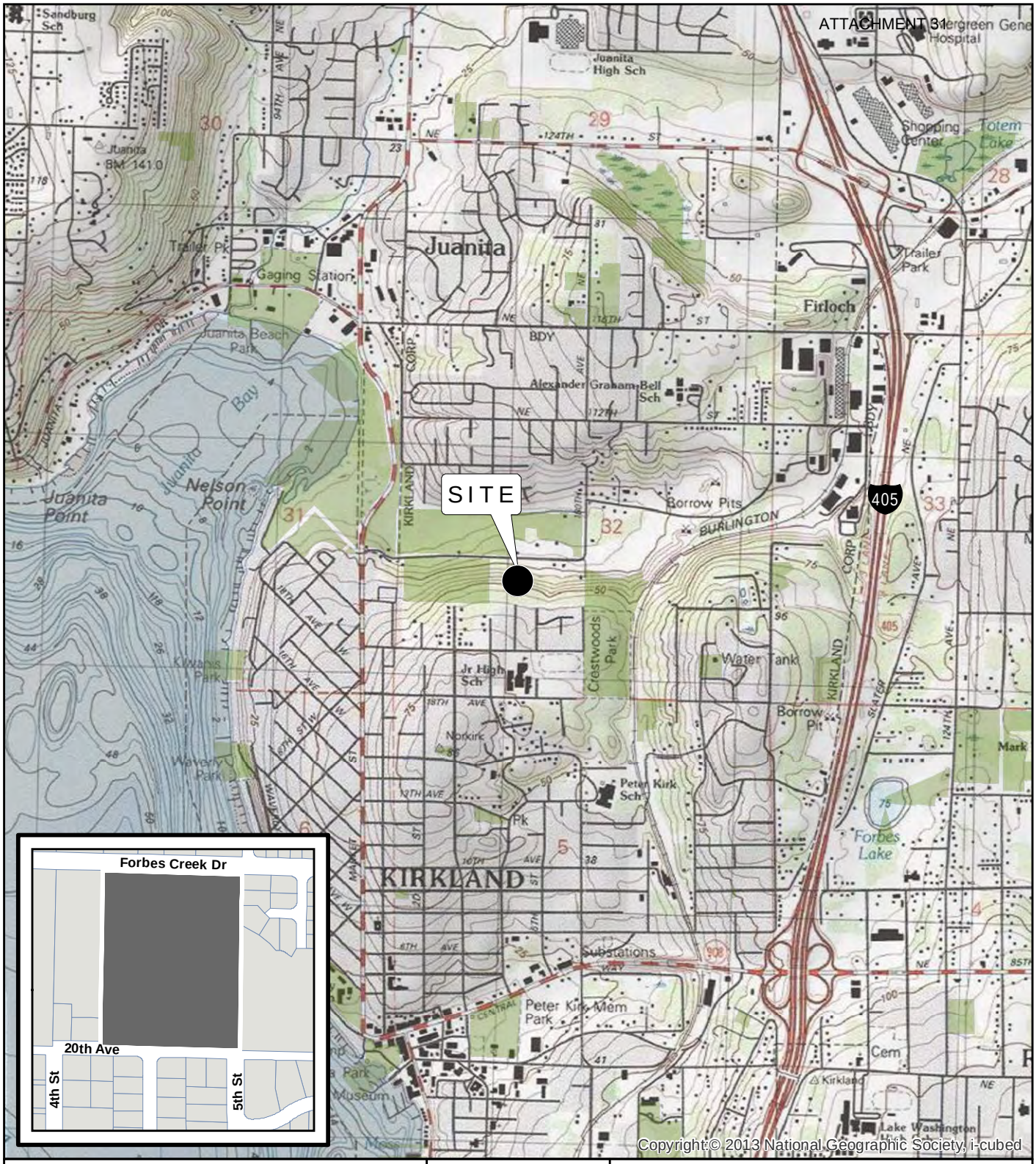
We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Jeffrey P. Laub, L.G., L.E.G.
Senior Project Engineering Geologist

Bruce L. Blyton, P.E.
Senior Principal Engineer

Attachments:	Figure 1:	Vicinity Map
	Figure 2:	Site and Exploration Plan
	Figure 3:	Geogrid-Reinforced Rockery Detail
	Appendix:	Exploration Logs



DATA SOURCES / REFERENCES:
USGS: 24K SERIES TOPOGRPAHIC MAPS
KING CO: STREETS, PARCELS 2015

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

N

0 1000 2000
FEET

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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VICINITY MAP

LONDO FORBES CREEK
KIRKLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
KE160384A	7/16	1

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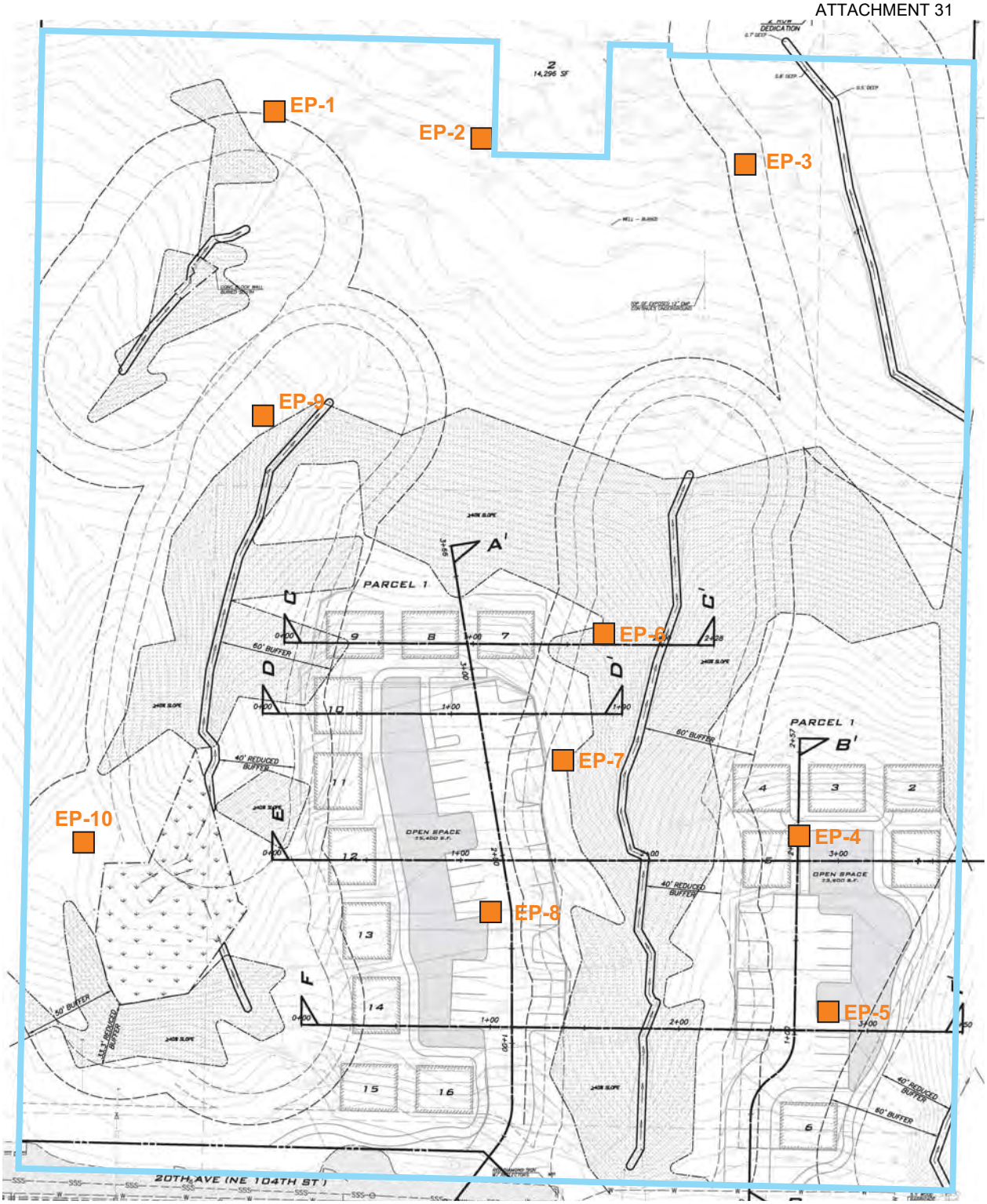

LEGEND:

SITE BOUNDARY

EP EXPLORATION PIT

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.
BASE MAP REFERENCE: BLUELINE; FORBES CREEK PROPERTY COTTAGE PLAN; DATED 7/12/2016

N

0 40 80

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NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

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SITE AND EXPLORATION PLAN

LONDO FORBES CREEK
KIRKLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
KE160384A	7/16	2

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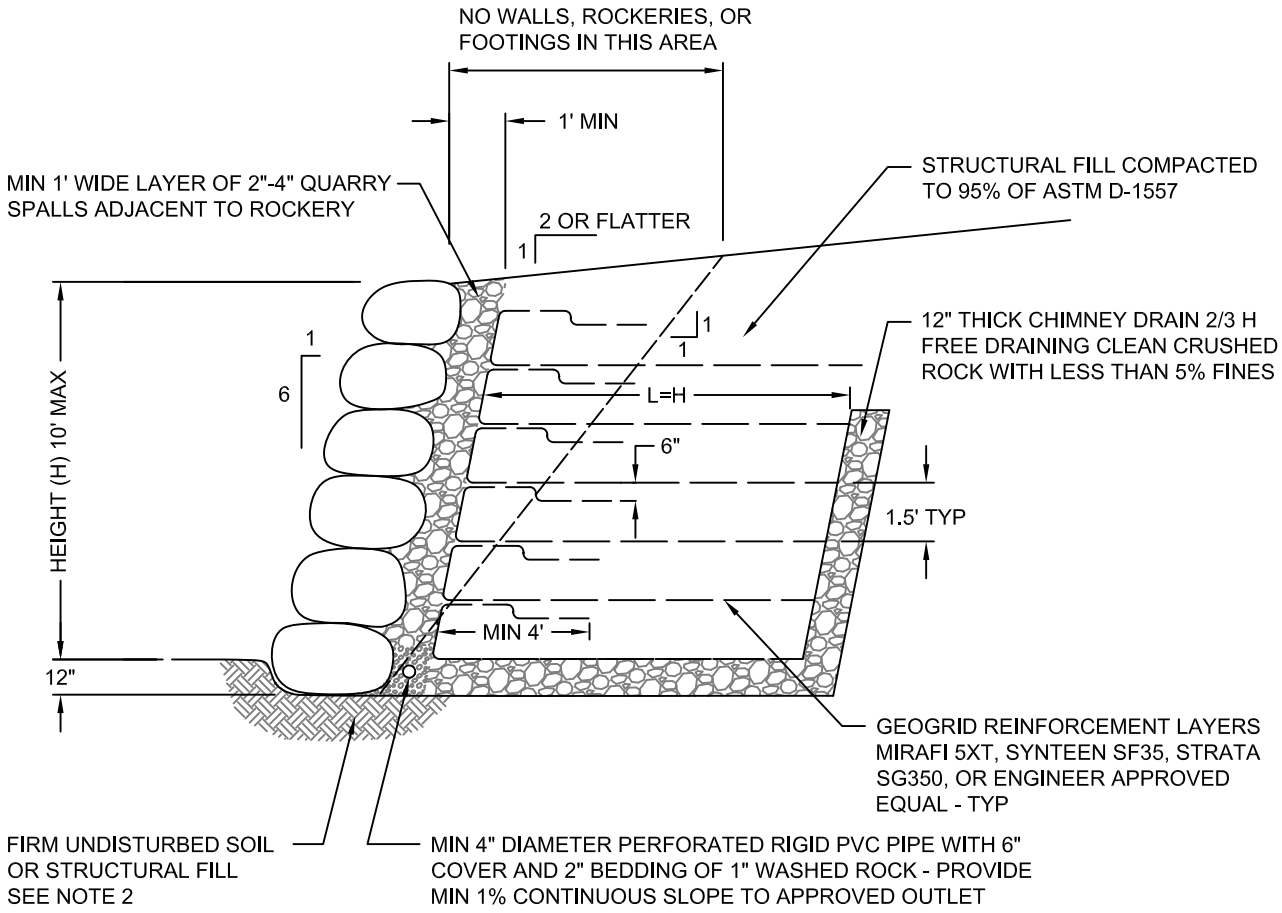

NOTES:

1. ROCKERIES HIGHER THAN 5' SHALL BE CONSTRUCTED OF ROCKS OF GRADUATED SIZES FROM 5-MAN TO 2-MAN, FROM BOTTOM TO TOP. ROCKERIES OF 5' OR LOWER SHALL BE CONSTRUCTED OF 3-MAN TO 2-MAN, FROM BOTTOM TO TOP.

2. INSPECTION OF SUBGRADE SOILS, GEOGRID PLACEMENT, COMPACTION OF STRUCTURAL FILL, ROCK PLACEMENT AND DRAINAGE BY GEOTECHNICAL ENGINEER IS REQUIRED.

3. ROCK SHALL BE SOUND AND HAVE A MINIMUM DENSITY OF 160 POUNDS PER CUBIC FOOT.

4. THE LONG DIMENSION OF ALL ROCKS SHALL BE PLACED PERPENDICULAR TO THE WALL. EACH ROCK SHOULD BEAR ON TWO ROCKS IN THE TIER BELOW.

5. MAXIMUM HEIGHT OF 3 FEET FOR ROCKERIES FACING UNREINFORCED FILL SOILS.

ROCK	LB.	AVG. DIMENSION (IN.)
1-MAN	50-200	12 TO 18
2-MAN	200-700	18 TO 28
3-MAN	700-2000	28 TO 36
4-MAN	2000-4000	36 TO 48
5-MAN	4000-6000	48 TO 54

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GEOGRID REINFORCED
ROCKERY DETAIL
LONDO FORBES CREEK
KIRKLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
KE160384A	7/16	3

APPENDIX

Coarse-Grained Soils - More than 50% (1) Retained on No. 200 Sieve	Gravels - More than 50% (1) of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines (5)	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines (5)	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% (1) or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines (5)	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines (5)	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% (1) or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

Coarse-Grained Soils

Density	SPT(2) blows/foot
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	>50

Fine-Grained Soils

Consistency	SPT(2) blows/foot
Very Soft	0 to 2
Soft	2 to 4
Medium Stiff	4 to 8
Stiff	8 to 15
Very Stiff	15 to 30
Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

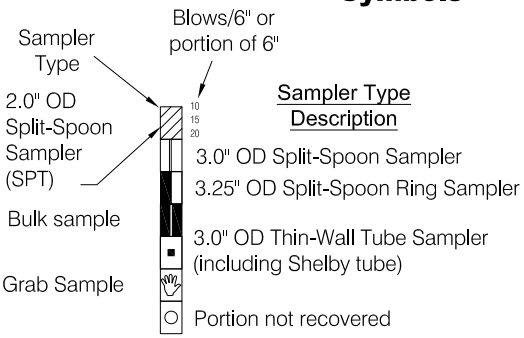
(3) Estimated Percentage

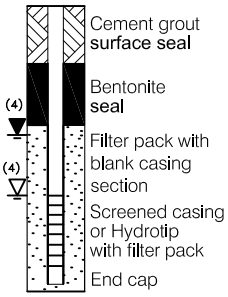
Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

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EXPLORATION LOG KEY

FIGURE A1

LOG OF EXPLORATION PIT NO. EP-1

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
1	Loose, moist, brown, silty SAND, few gravel.
	Recessional Outwash
2	Medium dense, moist, brown, medium SAND, trace to few silt, few gravel.
3	
4	
5	
6	
7	
8	
9	
10	Medium dense to dense, wet.
11	
12	
13	
14	
15	
16	
17	Bottom of exploration pit at depth 16 feet No ground water. Slight caving.
18	
19	
20	

Lien Plat
Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-2

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
1	Loose, moist, brown, silty SAND, few gravel.
	Possible Fill
2	Loose, wet, brown, medium SAND, few silt and gravel.
3	**Transitional Beds**
4	Soft, wet, blue-gray, sandy SILT, trace gravel.
5	
6	Stiff, moist, brown, SILT, trace to few SAND, trace gravel.
7	
8	
9	
10	Stiff, moist, blue-gray, SILT, trace sand, trace gravel.
11	
12	
13	
14	Bottom of exploration pit at depth 13 feet No ground water. No caving.
15	
16	
17	
18	
19	
20	

Lien Plat
Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-3

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
1	Loose, wet, brown, silty SAND, few gravel.
	Possible Fill
2	Medium dense, wet, brown, silty SAND, few gravel.
3	
4	
5	
6	**Recessional Outwash**
7	Medium dense, wet, brown, SAND with gravel, few silt.
8	
9	
10	
11	
12	Bottom of exploration pit at depth 11 feet No ground water. Slight caving at 6'.
13	
14	
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Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-4

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered. DESCRIPTION
	Topsoil
1	Loose, moist, dark brown, silty SAND, few gravel, thin fibrous roots.
	Pre-Vashon Lacustrine
2	Stiff, moist, brown, sandy SILT, few gravel.
3	
4	
5	
6	
7	
8	Stiff, moist to wet, blue-gray, SILT, trace sand and gravel.
9	
10	
11	Bottom of exploration pit at depth 10 feet No ground water. No caving.
12	
13	
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Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-5

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
	Loose, moist, brown, silty SAND, few gravel.
1	**Recessional Outwash**
	Medium dense, moist, brown, SAND, few silt and gravel, frequent thin roots.
2	
3	
4	
5	
6	**Transitional Beds**
	Dense, moist, tan, silty SAND, few gravel and weakly cemented.
7	Dense, moist, blue-gray, SAND, trace silt and gravel with (blue) silt interbeds.
8	
9	
10	
11	
12	Bottom of exploration pit at depth 11 feet Slight seepage at 11'. No caving.
13	
14	
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Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-6

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered. DESCRIPTION
	Topsoil
1	**Recessional Outwash** Medium dense, moist, brown, medium SAND, few silt, trace to some gravel.
2	
3	
4	**Advance Outwash**
5	Dense, wet, brown, sandy GRAVEL, trace to some silt.
6	
7	
8	
9	
10	
11	
12	
13	Bottom of exploration pit at depth 12 feet No ground water. No caving.
14	
15	
16	
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Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-7

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered. DESCRIPTION
	Topsoil
1	Loose, moist, brown, SAND, few silt and gravel.
	Recessional Outwash
2	Dense, moist, brown, medium SAND, trace silt and gravel, some fibrous roots
3	
4	
5	
	Transitional Beds
6	Very stiff, moist, blue-gray, SILT, few sand, trace gravel.
7	
8	
9	Grades to sandy SILT.
10	
11	
12	Bottom of exploration pit at depth 11 feet No ground water. No caving.
13	
14	
15	
16	
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19	
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Lien Plat
Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-8

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
1	**Recessional Outwash**
	Medium dense, moist, brown, medium SAND, few silt, few gravel, thin, fibrous roots.
2	
3	
4	**Transitional Beds**
	Stiff, wet, tan, SILT, few sand, trace gravel.
5	
6	
7	
8	Dense, wet, blue-gray, SAND, trace silt and gravel with very stiff (blue) silt interbeds.
9	
10	
11	Bottom of exploration pit at depth 10 feet No ground water. No caving.
12	
13	
14	
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20	

Lien Plat
Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-9

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
	Recessional Outwash
1	Medium dense, moist, brown, SAND, few silt and gravel, thin, fibrous roots.
2	
3	
4	Dense, moist, brown, sandy GRAVEL, trace to some silt.
	Pre-Vashon Lacustrine
5	Hard, moist, tan, SILT, few sand, trace gravel.
6	
7	
8	
9	Very stiff, wet, blue-gray SILT, few sand, trace gravel
10	
	Advance Outwash
11	Dense, wet, brown, gravelly SAND, trace silt.
12	
13	Bottom of exploration pit at depth 12 feet No ground water
14	
15	
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20	

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Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005

LOG OF EXPLORATION PIT NO. EP-10

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
1	Loose, moist, dark brown, SAND, few silt and gravel.
	Recessional Outwash
2	Medium dense, moist, brown, SAND, few silt and gravel
3	
	Transitional Beds
4	Stiff, moist, tan, SILT, few sand, trace gravel.
5	
6	
7	Dense, wet, blue-gray, SAND, trace silt and gravel with silt interbeds.
8	
9	
10	
11	Bottom of exploration pit at depth 10 feet No ground water
12	
13	
14	
15	
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17	
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19	
20	

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Kirkland, WA

Associated Earth Sciences, Inc.

Logged by: EG

Approved by:

Project No. KE05310A

June 2005