Preliminary Storm Drainage Report
For Full Project Site

Project Name: Alexa Lane Short Plat

Project Address: 12643 NE 70th St, Kirkland WA 98033

Parcel Number: 1241500190

Name of Developer: DGR Development

Name of Engineer: Todd Oberg, PE

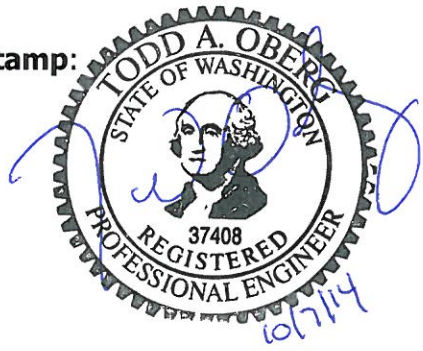
Company: The Blueline Group

Address: 25 Central Way, Suite 400, Kirkland, Washington

Phone Number: (425) 216-4051 x224

Report Date: October 7, 2014

Engineer's Stamp:



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PERMIT #	

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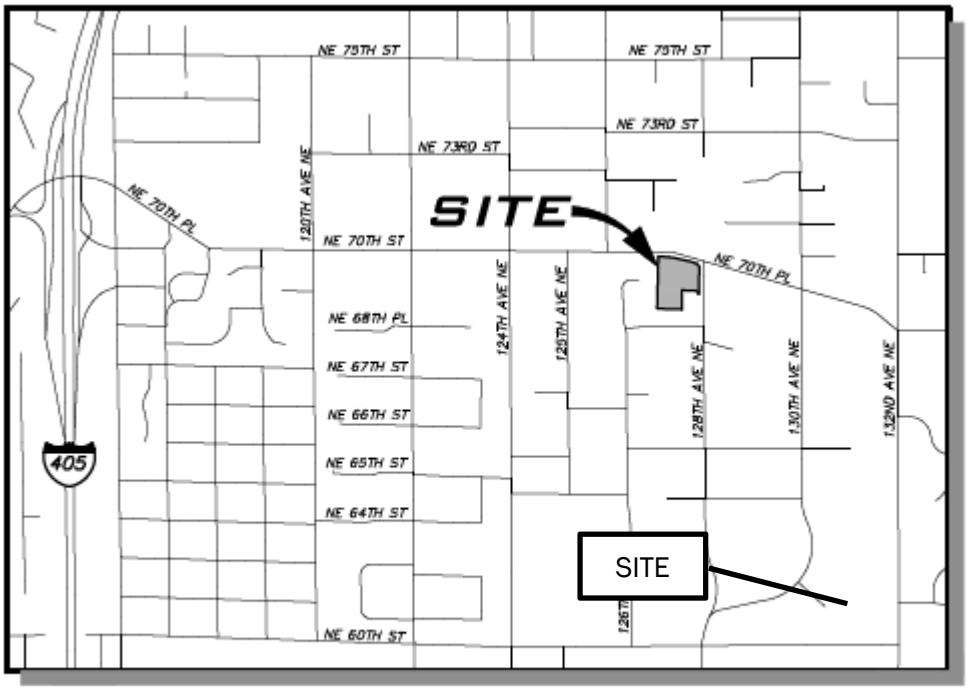
APPENDIX ..... A

Section 1 Project Overview

The project is located at 12643 NE 70th Street, in Kirkland, WA. More generally, the site is located in SW ¼ of Section 9, Township 25 N, Range 5 E. Please see the vicinity map below.

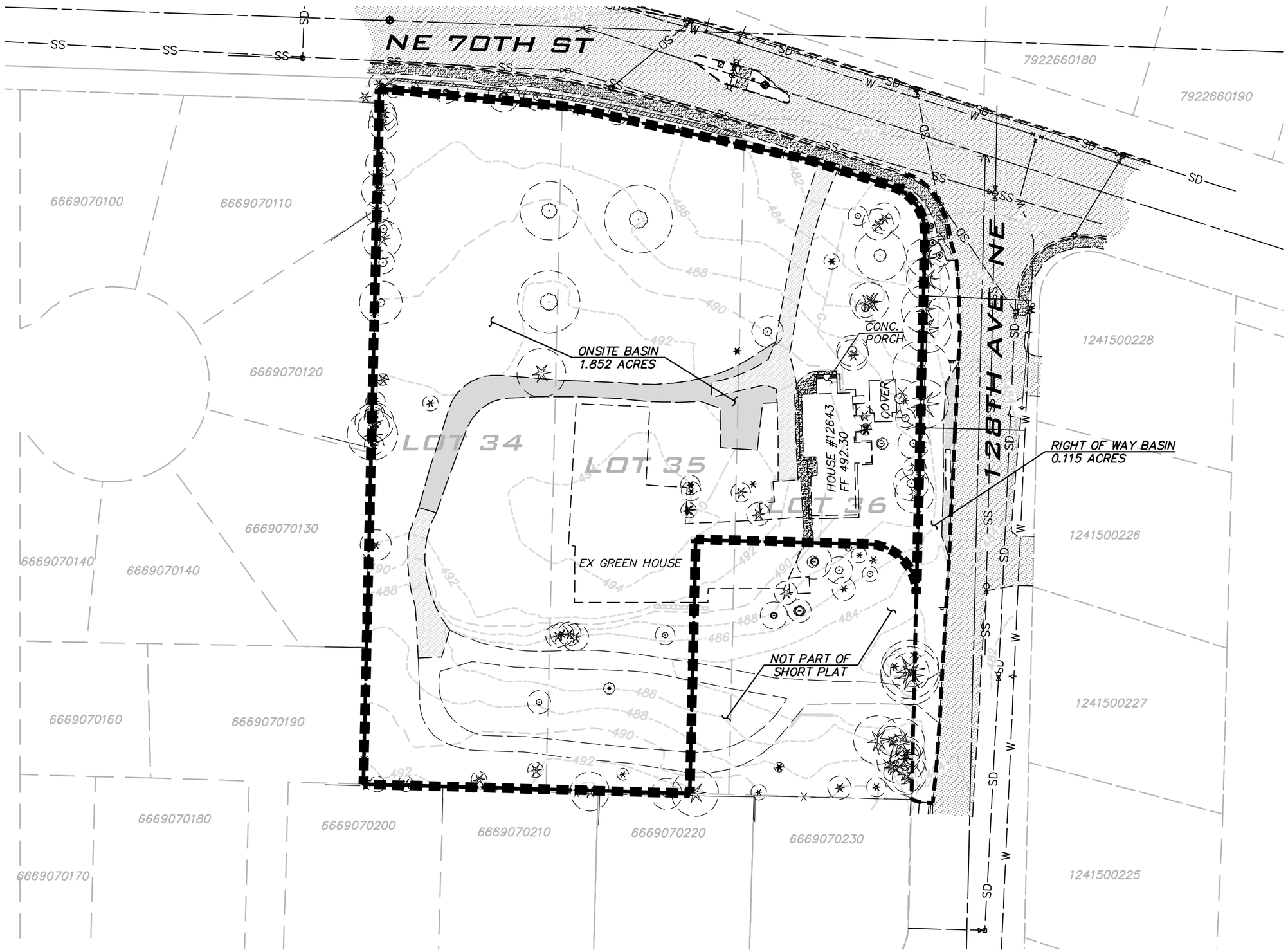


VICINITY MAP

NOT TO SCALE

Refer to the *Existing & Developed Conditions Exhibits* at the end of this section. The project is approximately 2.00 acres which includes a frontage area of 0.10 acres and an upstream area of approximately 0.05 acres. The project is comprised of a single parcel, APN 1241500190. The current site contains a single family residence and commercial nursery with landscaping, lawn, gravel access drive, greenhouses, and associated structures. In general, the site drains from the southern boundary of the site inward and then flows to the site's eastern boundary. Runoff also flows in all directions from a highpoint at the center of the site outward towards the northern and eastern boundaries. The site is bounded by NE 70th Street to the north, 128th Ave NE to the east, and by single family residences to the south and west. All existing structures and infrastructure onsite will be demolished and replaced with improvements and residencies as shown in the *Developed Conditions Exhibit.*

EXISTING CONDITIONS EXHIBIT



BLUELINE

EXISTING CONDITIONS EXHIBIT
ALEXA LANE SHORT PLAT
PRELIMINARY TIR

© 2014 THE BLUELINE GROUP

SCALE	AS NOTED
PROJECT MANAGER	TODD OBERG, PE
DESIGNED BY	CHRIS MILLER, PE
DRAWN BY	CHRIS MILLER, PE
PLOT DATE	September 26, 2014

JOB NUMBER:
14–197

FIGURE:
1

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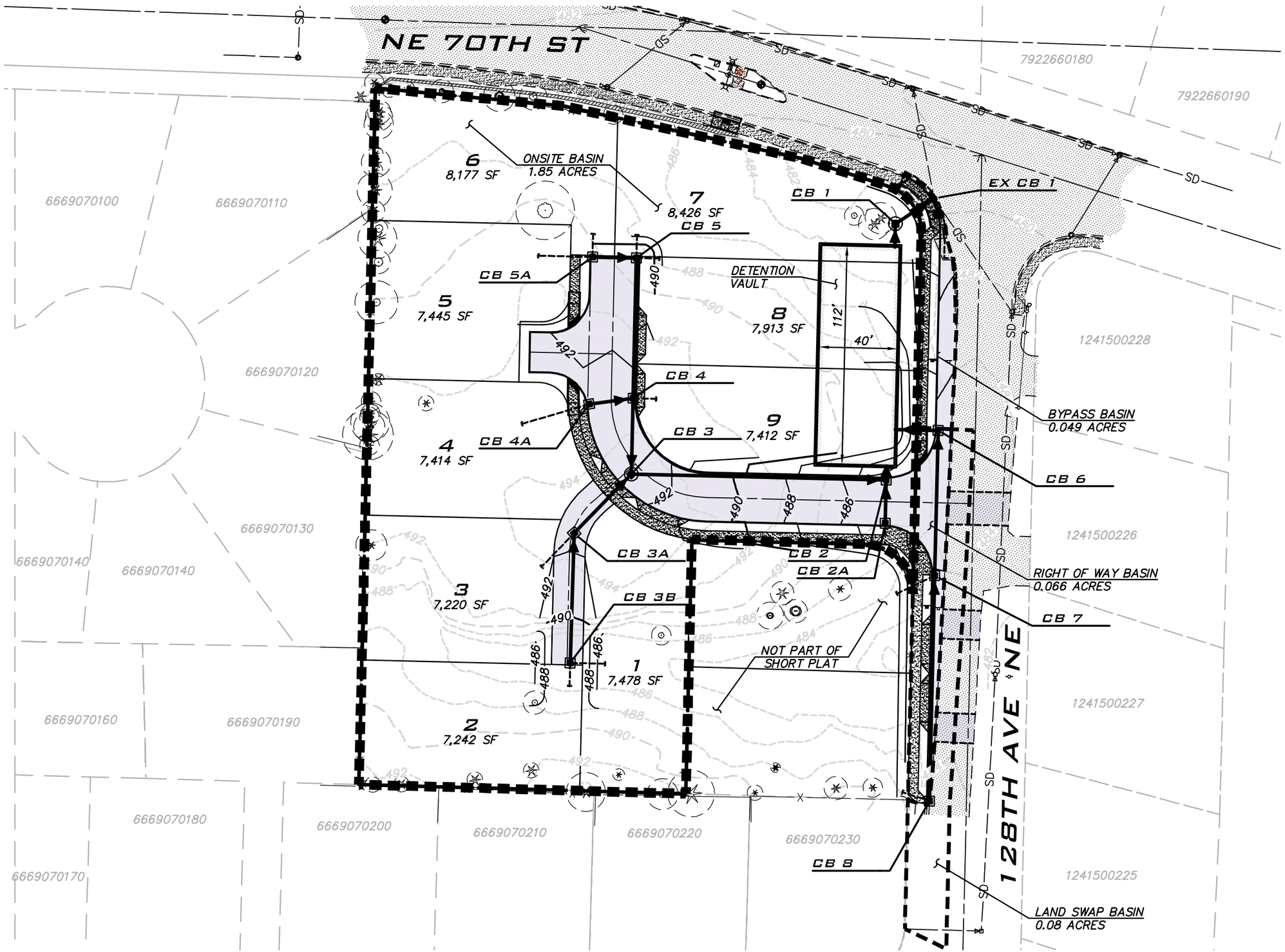
DEVELOPED CONDITIONS EXHIBIT



BLUELINE

DEVELOPED CONDITIONS EXHIBIT
ALEXA LANE SHORT PLAT
PRELIMINARY TIR

© 2014 THE BLUELINE GROUP

SCALE	AS NOTED
PROJECT MANAGER	TODD OBERG, PE
DESIGNED BY	CHRIS MILLER, PE
DRAWN BY	CHRIS MILLER, PE
PLOT DATE	September 24, 2014

JOB NUMBER:
14–197

FIGURE:
2

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Section 2 Conditions and Requirements Summary

Core and special requirements listed in Section 1.2 of the 2009 KCSWDM are listed below.

Core Requirement #1: Discharge at the Natural Location

See Section 3. In the existing conditions, stormwater runoff sheet flows easterly across the property to a ditch in the public ROW along NE 128th Street, and northerly across the property towards the public storm drainage system in 70th Street NE. In the developed conditions, runoff will be collected onsite conveyed to the detention facility and discharged to the northeast corner of the property at the corner of 70th Street NE and NE 128th Street.

Core Requirement #2: Off-site Analysis

See Section 3. A Level 1 Downstream Analysis prepared by The Blueline Group is included in the Offsite Analysis.

Core Requirement #3: Flow Control

See Section 4. Drywells with overflow connections will be installed on the lot per the recommendations in the geotechnical letter included in Section 6 of this report. The site will also provide a flow control facility meeting Level 2 Flow Fontrol requirements per Chapter 5 of the 2009 King County Stormwater Design Manual (KCSWDM).

Core Requirement #4: Conveyance System

See Section 5. The system will be designed in accordance with the 2009 KCSWDM, and will convey the 100-year, 24-hour storm event without overtopping.

Core Requirement #5: Erosion and Sediment Control

See Section 6. The temporary erosion and sedimentation control plan consists of temporary measures (rock entrance, inlet protection, silt fence, sediment trap, etc.) as well as permanent measures (hydroseeding and landscaping).

Core Requirement #6: Operations and Maintenance

. See Section 10. All drainage lines and structures within the ROW will be maintained by the City of Kirkland. All drainage lines and structures within the lot lines will be the responsibility of the individual lot owners.

Core Requirement #7: Financial Guarantees and Liability

See Section 9. A City of Kirkland Improvement Evaluation Packet will be included at final engineering.

Core Requirement #8: Water Quality

Please see Section 4. Since the developed site will create more than 5,000 sf PGIS, the site will provide water quality treatment facility meeting the requirements of Basic Water Quality per Chapter 6 and section 6.2 of the 2009 KCSWDM.

Special Requirement #1: Other Adopted Area-Specific Requirements: There are no known additional requirements for the subject project.

Special Requirement #2: Floodplain/Floodway: The subject site does not contain and is not adjacent to a flood hazard area. This Special Requirement is therefore, not applicable.

Special Requirement #3: Flood Protection Facilities: The subject site does not rely on an existing flood protection facility and will not modify or construct a new flood protection facility. This Special Requirement is therefore, not applicable.

Special Requirement #4: Source Control: The subject project is a single family development and not a commercial development. This Special Requirement is not applicable.

Special Requirement #5: Oil Control: The subject project is a single family development and not a high-use development. This Special Requirement is not applicable.

Permit Details

MyBuildingPermit.com
a service of eCityGov.net

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Activities **Inspections** **Conditions** **Fees**

INFORMATION ON PERMIT PRE14-01353

Permit Status:	Applied (status definition)	**Description:**
People Data:	(click for applicant/owner/contractor details)	Pre-Submittal, Land Use Pre-sub 8/5/14, 2pm. Griswold Nursary 2 lot LLA and 9 lot short plat.
Site Address:	12643 NE 70TH ST	
Application Date:	Jul 21, 2014	
Parcel Number:	124150-0192 (property map & information)	
City Staff:	Ron Hanson	

Activities

Plan Review: Building Dept. Review		
City Staff: Darrell Harmon	**Status:** Passed	**Date:** n/a
Notes: Building Review - Status as of 08/05/2014 is Approved. COMMENTS:		
Plan Review: Planning Dept. Review		
City Staff: Ron Hanson	**Status:** Started	**Date:** n/a
Notes: Planning Review - Status as of 07/25/2014 is Under Review. COMMENTS:		
Pre-Submittal Meeting		
City Staff: EnerGov Service	**Status:** Started	**Date:** n/a
Notes: Pre-Submittal Meeting: "Griswold Nursary, 2 lot LLA and 9 lot short plat,		
Plan Review: Fire Dept. Review		
City Staff: Grace Steuart	**Status:** Passed	**Date:** n/a
Notes: Fire Review - Status as of 07/23/2014 is Approved. COMMENTS:		
Plan Review: Public Works Dept. Review		
City Staff: Rob Jammerman	**Status:** Passed	**Date:** n/a
Notes: Public Works Review - Status as of 07/24/2014 is Approved. COMMENTS:		
Plan Review: Public Works Dept. Review		
City Staff: John Burkhalter	**Status:** Passed	**Date:** n/a
Notes: Public Works Review - Status as of 08/05/2014 is Approved. COMMENTS:		
Application Received		
City Staff: Allison Zike	**Status:** Passed	**Date:** Jul 21, 2014
Notes:		
Distribute Plans		
City Staff: EnerGov Service	**Status:** Passed	**Date:** Jul 21, 2014
Notes: Distribute Plans		

Inspections

Conditions

BUILDING General Conditions
Contact: Darrell Harmon dharmon@kirklandwa.gov
1. This project will be subject to Building Department fees. At the pre-application stage, the fees can only be estimated. It is the applicant's responsibility to contact the Building Department by phone or in person to determine the fees. The fees can also be reviewed at the City of Kirkland Development Services web site. The applicant should anticipate the following Building Department fees:
o Intake Fee (paid at application of a Building Permit)
o Inspection Fee (paid with the issuance of a Building Permit)
o Plumbing, Mechanical and Electrical, Intake and Inspection Fees
o Land Surface Modification (Grading), Intake and Inspection Fees
2. There may be additional development fees due the Planning and/or the Public Works Departments. It is the applicant's responsibility to contact the Planning and Public Works Departments by phone or in person to determine the fees.
3. Prior to issuance of Building, Demolition or Land Surface Modification permit applicant must submit a proposed rat baiting program for review and approval. Kirkland Municipal Ordinance 9.04.040
4. A Demolition permit is required for removal of existing structures prior to recording the lot line alteration and short plat.
5. Plumbing meter and service line shall be sized in accordance with the current UPC. We are currently using the 2012 edition.
6. The vault and any retaining walls will require a separate permit.
7. Building permits must comply with the International Building, Residential and Mechanical Codes and the Uniform Plumbing Code as adopted and amended by the State of Washington and the City of Kirkland. Kirkland currently has adopted the 2012 editions.
8. Structures must comply with International Energy Conservation Code as adopted and amended by the State of Washington. We are currently using the 2012 edition.
9. Kirkland reviews, issues and inspects all electrical permits in the city. Kirkland currently uses the 2009 Washington Cities Electrical Code chapters 1 and 3 as published by WABO.
10. Structures must be designed for seismic design category D, wind speed of 85 miles per hour and exposure B.
Contact: Grace Steuart at 425-587-3660; or gsteuart@kirklandwa.gov

HYDRANTS
One new hydrant is required to be installed on NE 70th Street at the entrance to the project. It shall be equipped with a 5" Storz fitting.

FIRE FLOW
Fire flow in the area is approximately 2700 gpm, which is adequate for development.

ACCESS
If Road A is designed as shown, the Fire Department has no additional requirements for access, with the exception of Lot 2.
The distance from Road A to the furthest setback of Lot 2 is approximately 200 feet, and it shows only 15 foot wide easement. The paved width must be 16 feet, or the house on Lot 2 may be sprinklered.

Fees

Item	Fee Amount	Fee Remaining
MyBuildingPermit.com Surcharge	$6.73	$0.00
Presubmittal Meeting*	$518.00	$0.00

Interactive Map and Parcel Data

The mapping and parcel data is provided by the local jurisdiction and/or county assessor.	The interactive map and parcel data is provided through NWMaps.net a regional government service provided by the eCityGov Alliance. A high-speed Internet connection is recommended.

Other permits associated with this parcel

Permit Number	Status	Description
		Pre-Submittal, Land Use

PRE14-01353	Applied	Pre-sub 8/5/14, 2pm. Griswold Nursary 2 lot LLA and 9 lot short plat.

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PROD - Version 1.08.401

Permit #: PRE14-01353
Project Name: Griswold Nursery SP
Project Address: 12643 NE 70th St
Date: August 5, 2014

PUBLIC WORKS CONDITIONS

Public Works Staff Contacts
Land Use and Pre-Submittal Process:

Building and Land Surface Modification (Grading) Permit Process:
John Burkhalter, Development Engineer Supervisor
Phone: 425-587-3846 Fax: 425-587-3807
E-mail: jburkhalter@kirklandwa.gov

Building and Land Surface Modification (Grading) Permit Process:
Philip Vartanian, Development Engineer
Phone: 425-587-3856 Fax: 425-587-3807
E-mail: pvartanian@kirklandwa.gov

Building and Land Surface Modification (Grading) Permit Process:
Dan Carmody, Development Engineer
Phone: 425-587-3842 Fax: 425-587-3807
E-mail: dcarmody@kirklandwa.gov

General Conditions:

1. All public improvements associated with this project including street and utility improvements, must meet the City of Kirkland Public Works Pre-Approved Plans and Policies Manual. A Public Works Pre-Approved Plans and Policies manual can be purchased from the Public Works Department, or it may be retrieved from the Public Works Department's page at the City of Kirkland's web site at www.kirklandwa.gov.

2. This project will be subject to Public Works Permit and Connection Fees. It is the applicant's responsibility to contact the Public Works Department by phone or in person to determine the fees. The fees can also be review the City of Kirkland web site at www.kirklandwa.gov The applicant should anticipate the following fees:
   - Water, Sewer, and Surface Water Connection Fees (paid with the issuance of a Building Permit)
   - Side Sewer Inspection Fee (paid with the issuance of a Building Permit)
   - Septic Tank Abandonment Inspection Fee

- Water Meter Fee (paid with the issuance of a Building Permit)
- Right-of-way Fee
- Review and Inspection Fee (for utilities and street improvements).
- Building Permits associated with this proposed project will be subject to the traffic, park, and school impact fees per Chapter 27 of the Kirkland Municipal Code. The impact fees shall be paid prior to issuance of the Building Permit(s). Any existing buildings within this project which are demolished will receive a Traffic Impact Fee credit, Park Impact Fee Credit and School Impact Fee Credit. This credit will be applied to the first Building Permits that are applied for within the project. The credit amount for each demolished building will be equal to the most currently adopted Fee schedule.

3. All street and utility improvements shall be permitted by obtaining a Land Surface Modification (LSM) Permit.

4. Submittal of Building Permits within a subdivision prior to recording:

- Submittal of a Building Permit with an existing parcel number prior to subdivision recording: A Building Permit can be submitted prior to recording of the subdivision for each existing parcel number in the subject project, however in order for the Building Permit to be deemed a complete application, all of the utility and street improvements for the new home must be submitted with application. However, the Building Permit will not be eligible for issuance until after the Land Surface Modification Permit is submitted, reviewed, and approved to ensure the comprehensive storm water design required by the subdivision approval is reviewed and approved, and then shown correctly on the Building Permit plans to match the Land Surface Modification Permit.

- Submittal of Building Permits within an Integrated Development Plan (IDP): If this subdivision is using the IDP process, the Building Permits for the new homes can only be applied for after the Land Surface Modification Permit has been submitted, reviewed, and approved.

- Submittal of a Building Permit within a standard subdivision (non IDP): If this subdivision is not using the IDP process, the Building Permits for the new houses can be applied for after the subdivision is recorded and the Land Surface Modification permit has been submitted, reviewed, and approved.

- Review of Expedited or Green Building Permits: A new single family home Building Permit within a subdivision can only be review on an expedited or green building fast track if submitted electronically through MBP and the Land Surface Modification permit has been submitted, reviewed, and approved.

- Review of detached multi-family building permits: Detached multi-family building permits can only be applied for after the Land Surface Modification permit <u>submitted, reviewed, and approved.</u>

5. Subdivision Performance and Maintenance Securities:

- The subdivision can be recorded in advance of installing all the required street and utility improvements by posting a performance security equal to 130% of the value of work. This security amount will be determined by using the City of Kirkland's Improvement Evaluation Packet. Contact the Development Engineer assigned to this project to assist with this process.
- If the Developer will be installing the improvements prior to recording of the subdivision, there is a standard right of way restoration security ranging from $10,000.00 to 30,000.00 (value determined based on amount of right-of-way disruption). This security will be held until the project has been completed.
- Once the subdivision has been completed there will be a condition of the permit to establish a two year Maintenance security.

6. This project is exempt from concurrency review.

7. All civil engineering plans which are submitted in conjunction with a building, grading, or right-of-way permit must conform to the Public Works Policy titled ENGINEERING PLAN REQUIREMENTS. This policy is contained in the Public Works Pre-Approved Plans and Policies manual.

8. All street improvements and underground utility improvements (storm, sewer, and water) must be designed by a Washington State Licensed Engineer; all drawings shall bear the engineers stamp.

9. All plans submitted in conjunction with a building, grading or right-of-way permit must have elevations which are based on the King County datum only (NAVD 88).

10. The required tree plan shall include any significant tree in the public right-of-way along the property frontage.

11. All subdivision recording documents shall include the following language:

    <u>Utility Maintenance:</u> Each property owner shall be responsible for maintenance of the sanitary sewer, storm water stub, rain garden, permeable pavement, or any infiltration facilities (known as Low Impact Development) from the point of use on their own property to the point of connection in the City sanitary sewer main or storm water main. Any portion of a sanitary sewer, surface water stub, rain garden, permeable pavement, or any infiltration facilities, which jointly serves more than one property, shall be jointly maintained and repaired by the property owners sharing such stub. The joint use and maintenance shall "run with the land" and will

be binding on all property owners within this subdivision, including their heirs, successors and assigns.

Public Right-of-way Sidewalk and Vegetation Maintenance: Each property owner shall be responsible for keeping the sidewalk abutting the subject property clean and litter free. The property owner shall also be responsible for the maintenance of the vegetation within the abutting landscape strip. The maintenance shall "run with the land" and will be binding on all property owners within this subdivision, including their heirs, successors and assigns.

If the lots have on-site private storm water facilities, include this language on the subdivision recording document:

Maintenance of On-site Private Stormwater Facilties: Each Lot within the Subdivision has a stormwater facility (infiltration trench, dry wells, dispersion systems, rain garden, and permeable pavement) which is designed to aid storm water flow control for the development. The stormwater facility within the property shall be owned, operated and maintained by the Owner. The City of Kirkland shall have the right to ingress and egress the Property for inspection of and to reasonable monitoring of the performance, operational flows, or defects of the stormwater/flow control facility.
If the City of Kirkland determines related maintenance or repair work of the stormwater facility is required, the City of Kirkland shall give notice to the Owner of the specific maintenance and/or repair work required. If the above required maintenance or repair is not completed within the time set by the City of Kirkland, the City of Kirkland may perform the required maintenance or repair, or contract with a private company capable of performing the stormwater facility maintenance or repair and the Owner will be required to reimburse the City for any such work performed.
The Owner is required to obtain written approval from the City of Kirkland prior to replacing, altering, modifying or maintaining the storm water facility.

Sanitary Sewer Conditions:

1. The applicant shall extend the existing public sewer system to provide sanitary sewer service for each lot within the proposed project.
    - Extend an 8" sewer main from NE 70th Place into the new plat road and terminate with a manhole; Or extend the main from 128th along the new plat road and terminate with a manhole and provide side sewers for Lots 5,6,7 and 8 to NE 70th Pl and/or 128th Ave NE.
    - Extend the 8" sewer main in 128th Ave NE to the south property line and terminate with a manhole. Provide schematic design showing how lots to the south will be served based on the design slope, or set pipe slope at 0.5%.

2. A Sanitary Sewer Latecomers Agreement may be recorded with the sewer extension in 128th if side sewer are provided to adjacent lot(s).

3. Provide a plan and profile design for the sewer line extension

4. The existing septic system shall be abandoned per City standards.

5. Provide a 6-inch minimum side sewer stub to each lot.

Water System Conditions:

1. The existing water main in the public right-of-way along the front of the subject property is adequate to serve this proposed development. Provide fire system upgrades as may be required by the Fire Department.

2. The applicant shall extend the existing public water system to provide water service for each lot. Extend an 8" water main along from 128th Ave NE and terminate with a hydrant.

3. Provide a separate 1" minimum water service from the water main to the meter for each lot; City of Kirkland will set the water meter. The water size is determined when the Building Permit is submitted and is sized per the Uniform Plumbing Code. A ¾" meter is the typical size for new single-family home.

4. The existing water service shall be abandoned unless otherwise approved by the Development Engineer or Construction Inspector.

Surface Water Conditions:

1. Provide temporary and permanent storm water control per the 2009 King County Surface Water Design Manual and the Kirkland Addendum (Policy D-10). See Policies D-2 and D-3 in the PW Pre-Approved Plans for drainage review information, or contact city of Kirkland Surface Water staff at (425) 587-3800 for help in determining drainage review requirements. Summarized below are the levels of drainage review based on site and project characteristics:

   - <u>Full Drainage Review</u>
     A full drainage review is required for any proposed project, new or redevelopment, that will:
     - ✓ Adds 5,000ft^2 or more of new impervious surface area or 10,000ft^2 or more of new plus replaced impervious surface area,
     - ✓ Propose 7,000ft^2 or more of land disturbing activity, or,

- ✓ Be a redevelopment project on a single or multiple parcel site in which the total of new plus replaced impervious surface area is 5,000ft^2 or more and whose valuation of proposed improvements (including interior improvements but excluding required mitigation and frontage improvements) exceeds 50% of the assessed value of the existing site improvements.

2. A preliminary drainage report (Technical Information Report) must be submitted with the subdivision application. This must include a downstream analysis for all projects (except small project Type 1) within the Holmes Point Overlay Zone.

3. Evaluate the feasibility and applicability of dispersion, infiltration, and other stormwater low impact development facilities on-site (per section 5.2 in the 2009 King County Surface Water Design Manual). If feasible, stormwater low impact development facilities are required. See PW Pre-Approved Plan Policy L-1 or L-2 (depending on drainage review) for more information on this requirement.

4. Because this project site is one acre or greater, the following conditions apply:

- Amended soil requirements (per Ecology BMP T5.13) must be used in all landscaped areas.
- If the project meets minimum criteria for water quality treatment (5,000ft2 pollution generating impervious surface area), the enhanced level of treatment is required if the project is multi-family residential, commercial, or industrial. Enhanced treatment targets the removal of metals such as copper and zinc.
- The applicant is responsible to apply for a Construction Stormwater General Permit from Washington State Department of Ecology. Provide the City with a copy of the Notice of Intent for the permit. Permit Information can be found at the following website: http://www.ecy.wa.gov/programs/wq/stormwater/construction/
    - Among other requirements, this permit requires the applicant to prepare a Storm Water Pollution Prevention Plan (SWPPP) and identify a Certified Erosion and Sediment Control Lead (CESCL) prior to the start of construction. The CESCL shall attend the City of Kirkland PW Dept. pre-construction meeting with a completed SWPPP.
- Turbidity monitoring by the developer/contractor is required if a project contains a lake, stream, or wetland.
- A Stormwater Pollution Prevention and Spill (SWPPS) Plan must be kept on site during all phases of construction and shall address construction-related pollution generating activities. Follow the guidelines in the 2009 King County Surface Water Design Manual for plan preparation.

5. Amended soil per Ecology BMP T5.13 is recommended for all landscaped areas.

6. If a storm water detention system is required, it shall be designed to Level II standards. Historic (forested) conditions shall be used as the pre-developed modeling condition.

7. If this project is creating or replacing more than 5000 square feet of new impervious area that will be used by vehicles (PGIS - pollution generating impervious surface). Provide storm water quality treatment per the 2009 King County Surface Water Design Manual. The enhanced treatment level is encouraged when feasible for multi-family residential, commercial, and industrial projects less than 1 acre in size.

8. Provide a level one off-site analysis (based on the King County Surface Water Design Manual, core requirement #2).

9. It doesn't appear that any work within an existing ditch will be required, however the developer has been given notice that the Army Corps of Engineers (COE) has asserted jurisdiction over upland ditches draining to streams. Either an existing Nationwide COE permit or an Individual COE permit may be necessary for work within ditches, depending on the project activities.
   Applicants should obtain the applicable COE permit; information about COE permits can be found at: U.S. Army Corps of Engineers, Seattle District Regulatory Branch http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx

   Specific questions can be directed to: Seattle District, Corps of Engineers, Regulatory Branch, CENWS-OD-RG, Post Office Box 3755, Seattle, WA 98124-3755, Phone: (206) 764-3495

10. Provide an erosion control report and plan with Building or Land Surface Modification Permit application. The plan shall be in accordance with the 2009 King County Surface Water Design Manual.

11. Construction drainage control shall be maintained by the developer and will be subject to periodic inspections. During the period from May 1 and September 30, all denuded soils must be covered within 7 days; between October 1 and April 30, all denuded soils must be covered within 12 hours. Additional erosion control measures may be required based on site and weather conditions. Exposed soils shall be stabilized at the end of the workday prior to a weekend, holiday, or predicted rain event.

12. Provide collection and conveyance of right-of-way storm drainage

13. Provide a separate storm drainage connection for each lot. All roof and driveway drainage must be tight-lined to the storm drainage system or utilize low impact development techniques. The tight line connections shall be installed with the individual new houses.

14. Provide a plan and profile design for the storm sewer system.

15. Provide a 15' wide access easement to the storm detention control manhole; easement must be improved with 10' of asphalt and drainage control to protect against erosion.

Street and Pedestrian Improvement Conditions:

1. The subject property abuts NE 70th Pl and 128th Ave NE. These streets are an Arterial and Neighborhood Access type streets. Zoning Code sections 110.10 and 110.25 require the applicant to make half-street improvements in rights-of-way abutting the subject property. Section 110.30-110.50 establishes that this street must be improved with the following:

   A. NE 70th Street:
      - Replace cracked and broken curb and gutter
      - Replace sidewalk with 8 foot sidewalk and street trees in 4x6 tree wells 30 foot on-center. Dedicate right-of-way as necessary to encompass the improvement.
      - Update the crosswalk ramps to comply with current ADA regulations.

   B. 128th Ave NE:
      - Match existing back of curb of street section to the south, provide Type A curb, planter strip, and street trees 30 feet on-center.
      - Install a 5 foot wide sidewalk.

   C. New Access Road:
      - Removed connection to NE 70th Pl. Have new road, if less than 200 feet in length, end with a vehicular turn around. Greater than 200 feet requires a cul-de-sac.
      - Provide Type A curb and gutter 24 feet wide with streets 30 foot on center. 5 foot sidewalk not required since road is less than 300 feet in length.
      - Dedicated 35 feet of right-of way, and at least 5 feet behind all curb for the new access.
      - Have the Building Department address this plat and provide correct street name on the drawings. All water services shall be tapped from the street for which the lot is addressed, please take this into account when designing water system improvements.

2. When three or more utility trench crossings occur within 150 lineal ft. of street length or where utility trenches parallel the street centerline, the street shall be overlaid with new asphalt or the existing asphalt shall be removed and replaced.
   - Existing streets with 4-inches or more of existing asphalt shall receive a 2-inch (minimum thickness) asphalt overlay. Grinding of the existing asphalt to blend in the overlay will be required along all match lines.
   - Existing streets with 3-inches or less of existing asphalt shall have the existing asphalt removed and replaced with an asphalt thickness equal or greater than

the existing asphalt provided however that no asphalt shall be less than 2-inches thick and the subgrade shall be compacted to 95% density.

3. Remove and replace all broken existing curb, gutter, and sidewalk along property frontage.

4. The driveway for each lot shall be long enough so that parked cars do not extend into the access easement or right-of-way (20 ft. min.)

5. All street and driveway intersections shall not have any visual obstructions within the sight distance triangle. See Public Works Pre-approved Policy R.13 for the sight distance criteria and specifications.

6. Prior to the final of the building or grading permit, pay for the installation of stop and street signs at the new intersections.

7. Install "NO PARKING ANYTIME" signs along 128th Ave NE if road width is less than 24 feet after installation of curb.

8. Install monuments on the new plat road per the subdivision mylar.

9. It shall be the responsibility of the applicant to relocate any above-ground or below-ground utilities which conflict with the project associated street or utility improvements.

10. Underground all new and existing on-site utility lines and overhead transmission lines.

11. Underground any new off-site transmission lines.

12. Zoning Code Section 110.60.9 establishes the requirement that existing utility and transmission (power, telephone, etc.) lines on-site and in rights-of-way adjacent to the site must be underground. The Public Works Director may determine if undergrounding transmission lines in the adjacent right-of-way is not feasible and defer the undergrounding by signing an agreement to participate in an undergrounding project, if one is ever proposed. In this case, the Public Works Director has determined that undergrounding of existing overhead utility on 128th Ave NE and NE 70th St/Pl is not feasible at this time and the undergrounding of off-site/frontage transmission lines should be deferred with a Local Improvement District (LID) No Protest Agreement. The final recorded subdivision mylar shall include the following note:

    Local Improvement District (LID) Waiver Agreement. Chapter 110.60.7.b of the Kirkland Zoning Code requires all overhead utility lines along the frontage of the subject property to be converted to underground unless the Public Works Director determines that it is infeasible to do so at the time of the subdivision recording. If it is determined to be

infeasible, then the property owner shall consent to the formation of a Local Improvement District, hereafter formed by the City or other property owners. During review of this subdivision it was determined that it was infeasible to convert the overhead utility lines to underground along the frontage of this subdivision on 128th Ave NE and NE 70th St/Pl. Therefore, in consideration of deferring the requirement to underground the overhead utility lines at the time of the subdivision recording, the property owner and all future property owners of lots within this subdivision hereby consent to the formation of a Local Improvement District hereafter formed by the City or other property owners

13. New street lights may be required per Puget Power design and Public Works approval. Contact the INTO Light Division at PSE for a lighting analysis. If lighting is necessary, design must be submitted prior to issuance of a grading or building permit.

Section 3 Offsite Analysis

This section contains a Level 1 Downstream Analysis.

TASK 1: DEFINE AND MAP THE STUDY AREA

A *Downstream Drainage Exhibit* and *Downstream Drainage Photographs* are included at the end of this section.

TASK 2: RESOURCE REVIEW

The best available resource information (City of Kirkland GIS and King County iMap) was reviewed for existing or potential problems. The following is a summary of the findings:

- The USDA Natural Resource Conservation Service (NRCS) Web Soil Survey indicates Alderwood gravelly sandy loam. However, an Infiltration Feasibility Evaluation prepared by Earth Solutions NW, LLC dated August 20, 2014 indicates the presence of Indianola loamy silty sand with fines at depths below 0.5 to 6.0 feet. A copy of the geotechnical letter is included in the Appendix.
- The site is located within the "To Redmond" Drainage Basin (City of Kirkland) and within the Lake Sammamish Watershed (King County Water Features).
- The site does not contain wetlands (City of Kirkland).
- The site does not contain streams and is not located within a floodplain (City of Kirkland).
- The site is not located in a Landslide Hazard Area (King County iMap).
- The site is not located in a Seismic Hazard Area (King County iMap).

TASK 3: FIELD INSPECTION

A site visit was conducted on Friday, September 12, 2014, a sunny day with temperatures around 60°F, to determine the upstream and downstream drainage characteristics. Refer to the *Existing Conditions Exhibit* in Section 1. A *Downstream Drainage Exhibit* and *Downstream Drainage Photographs* are included at the end of this section for reference.

ONSITE BASIN

The site contains an existing single-family residence as described in Section 1. In general, the site currently drains from east to northeast and includes a single drainage basin.

UPSTREAM BASIN

There is a small upstream area to the southeast of the sight. The upstream area consists of the ROW along NE 128th Street and is comprised of approximately 0.068 acres. The site sits at a high point, surrounded by other residential properties to the west and south, while bordering 70th Street NE right-of-way to the north and NE 128th Street to the east.

EXISTING DOWNSTREAM DRAINAGE PATH

Runoff discharges from the north and east north boundary lines of the site, flowing northerly and easterly across the property towards 70th Street NE and NE 128th Street. A network of catch basins and 15-inch and 18-inch pipes along 70th Street NE collects and conveys runoff to the east. Runoff flowing east from the site is conveyed toward NE 128th Street to be collected by a ditch and conveyed north toward 70th Street NE and south toward a natural low area near the entrance drive. Flow conveyed east and north along the ROWs continues east through a series of 15-inch and 18-inch pipes to end approximately ¼ mile downstream of the site.

TASK 4: DRAINAGE SYSTEM DESCRIPTION

The downstream drainage path was inspected for approximately ¼ - mile downstream. Please reference the *Downstream Drainage Exhibit, Offsite-Analysis Drainage System Table* and *Downstream Drainage Photographs* included at the end of this section.

The site contains a single drainage basin. Runoff sheet flows north and east across the property into a network of pipes and catch basins in 70th Street NE and a ditch along NE 128th Street. Flow continues east and north respectively toward a catch basin at the corner of 70th Street NE and NE 128th Street then continuing east along NE 70th Street for approximately ¼ mile. Not all catch basins could be opened due to heavy traffic volumes, but the locations of manholes were verified, and accessible catch basins were inspected.

EXISTING DOWNSTREAM DRAINAGE DESCRIPTION

Refer to the *Downstream Drainage Exhibit* for map figure locations. A high point near the center of the site presents slopes that convey runoff to the north (photo 1) and to the east (photo 2). Runoff flowing east from the site is either conveyed south or north along NE 128th Street via ditch flow as dictated by topography at "P*oint X"* (photo 3) marked in the exhibit. The area south of "*point X"* (photo 4) flows south and inward for approximately 96 feet to a natural low point along and near the ROW in NE 128th Street where it infiltrates (photo 5). Runoff to the north of "P*oint X*" is conveyed north via ditch flow for approximately 106 feet (photo 6) and enters a catch basin at the corner of 70th Street NE and NE 128th Street (photo 7). Runoff from the northeast portion of the site sheet flows to the north over vegetated ground cover and a driveway (photo 8) into the roadway gutter along 70th Street NE (photo 9). Gutter flow continues east for 68 feet along the south side of 70th Street NE. Flow enters a catch basin at the southwest corner of 70th Street NE and NE 128th Street and is conveyed north under 70th Street NE for approximately 58 feet via 12" pipe (photo 7). Flow enters a catch basin on the north side of 70th Street NE (photo 10) and is conveyed east for approximately 260 feet through a series of catch basins and 15-inch pipe (photos 10– 12). Flow enters a catch basin and is conveyed south under 70th Street NE for approximately 43 feet via a 15-inch pipe (photo 13). Flow enters a catch basin on the south side of 70th Street NE and is conveyed east for approximately 155 feet via 15-inch pipe (photo 14). Flow enters a catch basin and continues east along 70th Street NE through a series of catch basins and 18-inch pipes for approximately 830 feet (photos 15 – 22). The downstream was terminated at a catch basin (photo 22) approximately 1,419 feet from the project site.

TASK 5: MITIGATION OF EXISTING OR POTENTIAL PROBLEMS

At the time of the site investigation, no problems were found with the existing system, except for accumulation of leaves and other roadside debris around and in catch basin grates. Existing catch basins and pipes require general cleaning and maintenance which will be resolved with the city's next scheduled street cleaning. However, no immediate corrective maintenance is required at this time. No drainage complaints within the downstream path were noted to have occurred within the preceding ten year period.

An erosion and sedimentation control plan will be designed to reduce the discharge of sediment-laden runoff from the site. The plan is comprised of temporary measures (rock entrance, filter fence, straw mulch, etc.) as well as permanent measures (hydroseeding and landscaping). All ESC facilities will be periodically inspected and maintained as necessary during construction to minimize impacts to the downstream system.

DOWNSTREAM DRAINAGE PHOTOGRAPHS

Note: see the *Downstream Drainage Exhibit* for numbered locations of pictures.

Photo 1: Northern area of subject property looking east. Sheet flow to the east.

Photo 2: Southeastern area of subject property looking west along access road. Sheet flow to the east.

Photo 3: Looking north at "Point X", high point along western side of NE 128th Street where flow is conveyed north or south.

Photo 4: Looking south from "Point X". Flow is conveyed south approximately 96 feet.

Photo 5: Looking southwest at low point along NE 128th Street.

Photo 6: Looking north from "Point X" along NE 128th Street. Flow is conveyed north via ditch flow for approximately 106 feet.

Photo 7: Looking northeast at catch basin at intersection of 70th Street NE and NE 128th Street. Flow is conveyed north for approximately 58 feet.

Photo 8: Looking southwest at northeast portion of site. Flow sheet flows over vegetated ground cover and drive to the north towards 70th Street NE.

Photo 9: Looking east along south side of 70th Street NE where flow is conveyed in gutter of roadway.

Photo 10: Looking east along north side of 70th Street NE where flow is conveyed east for approximately 111 feet.

Photo 11: Looking east along 70th Street NE where flow is conveyed east for approximately 72 feet.

Photo 12: Looking east along 70th Street NE where flow is conveyed east for approximately 77 feet.

Photo 13: Looking south across 70th Street NE where flow is conveyed east approximately 43 feet.

Photo 14: Looking east along south side of 70th Street NE where flow is conveyed east for approximately 155 feet.

Photo 15: Looking east along of 70th Street NE where flow is conveyed east approximately 141 feet.

Photo 16: Looking east along of 70th Street NE where flow is conveyed east approximately 141 feet.

Photo 17: Looking east along of 70th Street NE where flow is conveyed east approximately 102 feet.

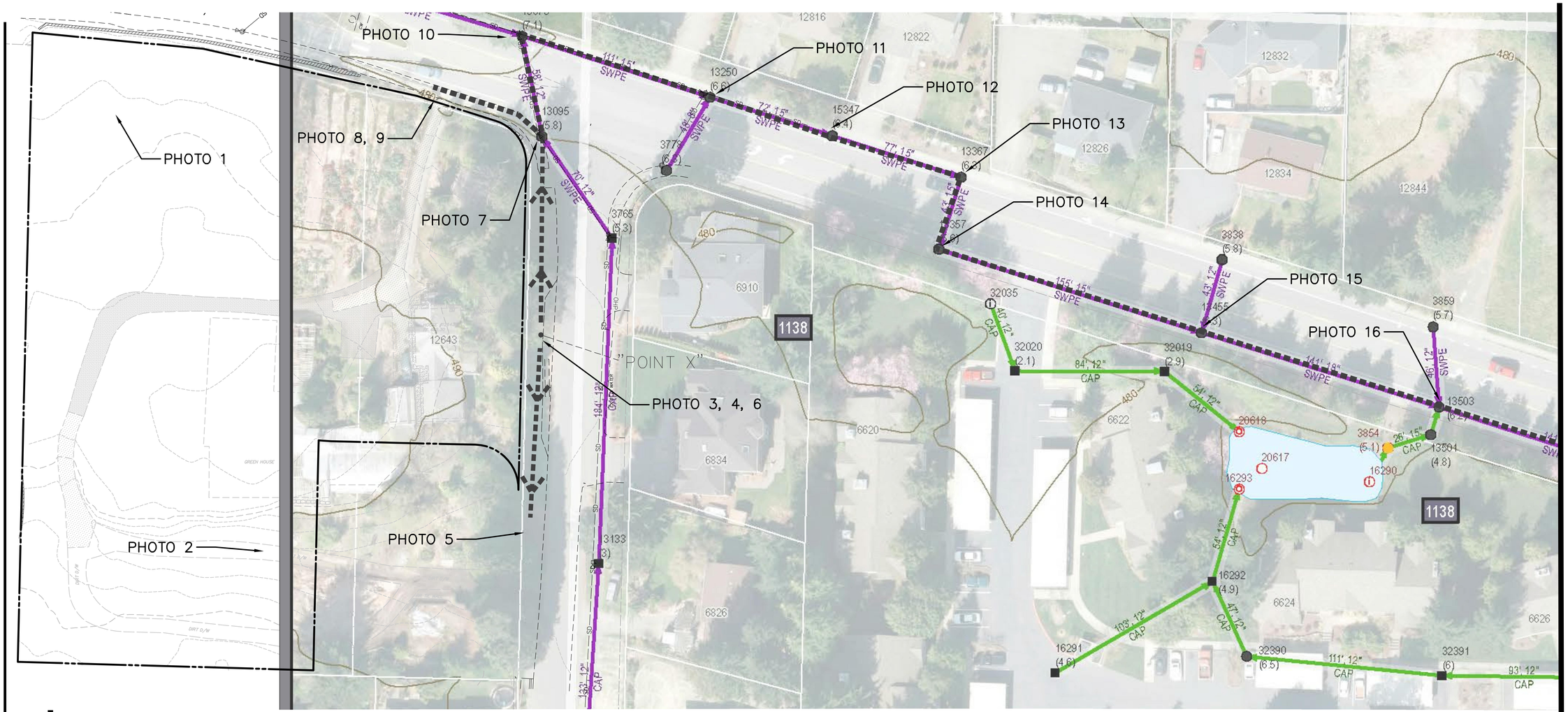
Photo 18: Looking east along 70th Street NE just east of NE 130th Street where flow is conveyed approximately 51 feet.

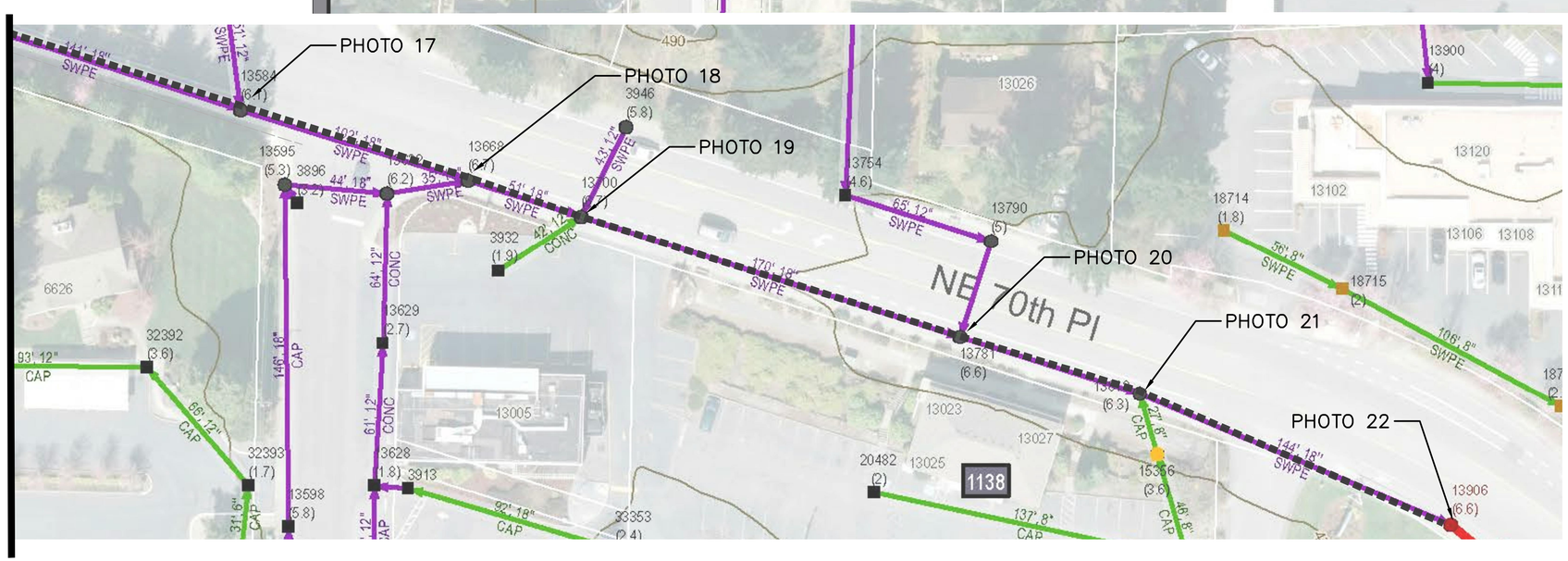
Photo 19: Looking east along of 70th Street NE where flow is conveyed east approximately 170 feet.

Photo 20: Looking east along of 70th Street NE where flow is conveyed east approximately 81 feet

Photo 21: Looking east along of 70th Street NE where flow is conveyed east approximately 144 feet.

Photo 22: Look east along the south side of 70th Street NE. The downstream analysis was terminated at this catch basin, just over ¼ mile from the site.





N

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
26 CENTRAL WAY, SUITE 400, KIRKLAND, WA 98033
P: 425.216.6051 F: 425.216.6061
WWW.BLUELINEGROUP.COM

SCALE: AS NOTED
PROJECT MANAGER: TODD OBERG
PROJECT ENGINEER: CHRIS MILLER
DESIGNER: CHESTER BENNETT
ISSUE DATE: 9/18/2014

NO	DATE	BY	REVISIONS

GRISWOLD
DOWNSTREAM PATH EXHIBIT
CITY OF KIRKLAND WASHINGTON

JOB NUMBER: 14-197
SHEET NAME:
SHT ____ OF ____

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22x34
Sep 18, 2014 – 12:57pm – User cbennett
E:\Projects\14197\dwg\Prelim\r14197BSP DOWNSTREAM.dwg

Section 4 Flow Control and Water Quality Analysis and Design

Runoff from the developed site will be collected on site via a network of catch basins and pipes within the proposed ROW road into the site from NE 128th Street and will be routed to the detention facility located in the northeast of the project site. Please see the *Developed Conditions Exhibit* in Section 1 of this report.

4.1 Hydraulic Analysis

The Western Washington Hydrology Model (WWHM) 2012 program was used to model the existing and developed conditions. The geotechnical engineering letter prepared by Earth Solutions NW, which is included in Section 7 of this report, categorizes the onsite soil as Alderwood gravelly sandy loam (AgC) formed in glacial till. Per the 2009 KCSWDM Alderwood series soils are assigned to hydrologic soil group C.

The project was modeled with the following parameters:

Rainfall Region:	Seatac
Scale Factor:	1.0

Existing Conditions

The existing basin boundary is made up of an onsite basin (1.852 acres), and an existing right-of-way basin (0.115 acres). Please see the *Existing Conditions Exhibit* in Section 1 of this report. The current site contains a single family residence and commercial nursery with landscaping, lawn, gravel access drive, greenhouses, and associated structures. In general, the site drains from the southern boundary of the site inward and then flows via moderate slopes to the site's eastern boundary. Runoff also flows in all directions from a highpoint at the center of the site outward via moderate slopes towards the northern and eastern boundaries.

The site lies within a Level 2 Flow Control Area which dictates that the existing condition be modeled in the historic (forested) condition. The areas used to compute the drainage calculations associated with the existing conditions, as well as the corresponding WWHM2012 output, are summarized as follows:

Existing Conditions

Onsite Area (C Forest)	1.852 acres
Ex Right-of-Way (C Forest)	0.115 acres
Total Existing Conditions Area	**1.967 acres**

WWHM2012 Peak Flows – Existing Conditions

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.058568
5 year	0.095969
10 year	0.120016
25 year	0.148623
50 year	0.168437
100 year	0.186945

DEVELOPED CONDITIONS

The developed condition consists of the Onsite Basin, which includes the lot areas (1.578 ac), the Road A right-of-way (0.240 ac), and Tract A (0.035 ac), and a portion of the existing right-of-way basin (0.066 ac) that will be routed to a combination detention/water quality vault. The remainder of the existing right-of-way basin (0.049 ac) will bypass the facility, but in the developed condition some upstream area will be included as a land swap basin (0.080 ac) to offset the bypass area.

As the site is within a Level 2 Flow Control Area the development is required to match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. Also match developed peak discharge rates to pre-developed peak discharge rates for the 2- and 10-year return periods. The detention portion of proposed vault passes all of these requirements. Please see the WWHM2012 Project Report in the Appendix of this Report. The areas used to compute the drainage calculations associated with the developed conditions, as well as the corresponding WWHM2012 output, are summarized as follows:

Developed Conditions

Onsite Basin

Lots			
Lot #	*Lot Area*		*Driveway Area*
1	7,478	sf	400
2	7,242	sf	400
3	7,220	sf	400
4	7,414	sf	400
5	7,445	sf	400
6	8,177	sf	400
7	8,426	sf	400
8	7,913	sf	498
9	7,412	sf	487
Total Area	68,727		sf
Driveway Area	3,785		sf
Roof Area	30,579		sf
Lawn Area	34,364		sf

Tract A		
Total Area	1,523	sf
Road/Driveway	1,523	sf
Road A		
Total Area	10,438	sf
Road/Driveway	7,690	sf
Sidewalk	1,130	sf
Lawn	1,618	sf

Ex Right-of-Way Basin

Total Area	2,893	sf
Road/Driveway	1,439	sf
Sidewalk	1,110	sf
Lawn	344	sf

Bypass Basin (not included in totals)

Total Area	2,129	sf
Road/Driveway	818	sf
Sidewalk	714	sf
Lawn	597	sf

Land Swap Basin

Total Area	3,501	sf
Road/Driveway	2,751	sf
Sidewalk	534	sf
Lawn	216	sf

Total Basin Area	87,082	sf	1.999	ac
Impervious Area				
Roof	30,579	sf	0.702	ac
Road	17,188	sf	0.395	ac
Sidewalk	2,774	sf	0.064	ac
Lawn Area				
Total	36,542	sf	0.839	ac

Detention Vault Information

Interior Width: 40 ft.

Interior Length: 112 ft.

Live Storage Depth: 7 ft.

Riser Diameter: 12 in.

Orifice 1 Diameter: 0.625 in. Elevation: 0 ft.

Orifice 2 Diameter: 1.4375 in. Elevation: 4.7 ft.

Orifice 3 Diameter: 2 in. Elevation: 6.5 ft.

WWHM2012 Peak Flows from Vault – Developed Condition

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.03279
5 year	0.058897
10 year	0.081557
25 year	0.117141
50 year	0.149244
100 year	0.18662

CITY OF KIRKLAND POLICY L-2 COMPLIANCE

At the time of this report it is proposed that limited infiltration drywells with overflow connections to the proposed storm drainage system will be provided for each lot in order to satisfy City of Kirkland Policy L-2. These will be sized to meet the BMP Area Requirements of City of Kirkland Policy L-2. Sizing calculations and proposed locations for these drywells will be provided with the LSM Permit submittal.

4.2 WATER QUALITY ANALYSIS AND DESIGN

The project contains over 5,000 sf of new or replaced pollution generating impervious surface, and is within a Basic Water Quality Treatment Area. Therefore the project must meet the requirements set forth in Section 1.2.8.1.A of the 2009 KCSWDM. The development proposes a combination detention/water quality vault which is an approved treatment option for Basic Water Quality per Section 6.1.1 of the 2009 KCSWDM. The wetvault portion of the vault, which is proposed to have 2' of dead storage, was sized using WWHM2012's Water Quality calculation for an online facility. Below is the WWHM2012 Water Quality output for the development:

<u>Water Quality</u>

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0.1683 acre-feet

On-line facility target flow: 0.1867 cfs

<u>Wetvault Sizing</u>

The proposed combination detention/water quality vault has the following characteristics:

Interior Width: 40 ft.
Interior Length: 112 ft.
Area per foot of dead storage = 40' x 112' = 4,480 sf

Required WQ Volume = 0.1683 ac-ft x 43,560 sf/acre = 7,331.15 cf

Therefore, with dead storage depth of 2': 40' x 112' x 2' = 8,960 cf

Section 5 Conveyance Design

The onsite conveyance system will consist of 6” storm pipe on the lots and 8” and 12” storm pipe in the public ROW. A conveyance analysis will be provided with the final TIR during the LSM permit submittal process.

Section 6 Special Reports and Studies

A letter summarizing Geotechnical findings dated August 20, 2014 by Earth Solutions NW, LLC is included in this section.

August 20, 2014
ES-3521

Earth Solutions NW LLC

• Geotechnical Engineering
• Construction Monitoring
• Environmental Sciences

DGR Development, Inc.
18323 Bothell Everett Highway, Suite 210
Bothell, Washington 98012

Attention: Mr. Dominique Ruybal

Subject: Geotechnical Consulting Services
Griswold Nursery
Residential Short Plat
12643 Northeast 70th Street
Kirkland, Washington

Dear Mr. Ruybal:

Earth Solutions NW, LLC (ESNW) has prepared this letter providing geotechnical consulting services for the proposed residential development at the subject site. Preliminary site development recommendations, including a preliminary infiltration evaluation, are provided in this letter.

Project Description

We understand the site will be developed with nine residential structures, a stormwater detention vault, and associated improvements. Given the topographic change across the sites, grading activities will likely involve cuts and fills on the order of five feet or less to establish the final design grades.

Building construction is anticipated to consist of relatively lightly-loaded wood framing and either raised wood floors with crawlspaces or slab-on-grade floors. Perimeter foundation loading is expected to range from approximately 1 to 2 kips per foot. Slab-on-grade loading is expected to be on the order of 150 psf.

If the above design estimates are incorrect or change, ESNW should be contacted to review the recommendations in this report. ESNW should review the final design to confirm that our geotechnical recommendations have been incorporated into the final design.

Surface

The site is located on the southwest corner of the intersection between Northeast 70th Street and 128th Avenue Northeast in Kirkland, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map) included in this study. The site is rectangular in shape and consists of three tax parcels. The site, at the time of fieldwork, was being used as a plant nursery. The site is currently developed with a single-family residence, greenhouses, and associated improvements. The remainder of the site is comprised of general landscape areas and a gravel access road that runs through the property.

The existing site topography generally descends gently towards the north from the single-family residence location, which sits on a small scale ridge-like feature on the property, with a total elevation change on the order of eight to ten feet. The site topography also drops from the ridge feature towards the south approximately eight feet towards the southern property boundary.

Subsurface

A representative of ESNW observed, logged and sampled five test pits excavated at accessible locations using a trackhoe and operator provided by the client for the purposes of characterizing the subsurface conditions. The approximate locations of the test pits are depicted on the Test Pit Location Plan (Plate 2). Please refer to the test pit logs provided in Appendix A for a detailed description of the subsurface conditions.

Topsoil

Topsoil was encountered at all of the test pit locations extending to depths of between about one to ten inches below existing grade. Topsoil is not suitable for use as structural fill nor should it be mixed with material to be used as structural fill. Topsoil or otherwise unsuitable material can be used in landscaping areas if desired.

Fill

Fill was not encountered at any of the test pit locations. There is the potential for limited amounts of fill surrounding the existing improvements, at the top of the slope located adjacent to the residence, greenhouses, and existing road alignments. Fill soil may be suitable for use as structural fill; however a representative of ESNW should be retained during the construction phases of the site development to evaluate the suitability of using on-site soils for structural fill.

Native Soil

Underlying the topsoil and fill, native soils consisting primarily of medium dense to dense silty sand with gravel (Unified Soil Classification, SM), and poorly graded sand with silt and gravel (SP-SM) glacial till deposits were encountered extending to the maximum exploration depth of ten feet below existing grades. Dense conditions were generally encountered at approximately three feet in depth.

Geologic Setting

The referenced geologic map resource identifies glacial till (Qgt) deposits across the site and surrounding areas. The referenced SCS soil survey identifies Alderwood gravelly sandy loam series soils (AgC) across the entirety of the site. Alderwood series soils formed in glacial till and are assigned to the Hydrologic Soil Group B.

The soil conditions observed at the test pit locations are generally consistent with glacial till deposits.

Groundwater

Groundwater was not observed in the test pits during the fieldwork (August 2014). However, groundwater can perch and travel along the contact between the weathered and unweathered till. Seepage should be expected in grading activities at this site, particularly during the winter, spring and early summer months. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

Geologically Hazardous Areas

We reviewed Chapter 85 – Geologically Hazardous Areas of the Kirkland Zoning Code. The slope located off the south side of the existing residence is inclined at a gradient above 40 percent, and is approximately eight feet in elevation change from top to toe. This slope meets the criteria for potential landslide hazard designation based on the steepness of the slope; but is under the threshold based on elevation change. Both hazard areas are discussed below.

Landslide Potential

The site is underlain by dense glacial till deposits. This soil type is relatively stable with respect to landslide potential. No signs of recent movement such as slumps, scarps, bare soil or seeps were observed during our fieldwork. In our opinion, the steep slope area is stable in the current configuration. In our opinion, the risk of landslide resulting from the proposal will not increase provided the following recommendations and those detailed in this report are included in the final design.

- Foundation elements should maintain a minimum setback of 15 feet from the top of slopes inclined at 40 percent or greater and that are at least 10 feet in height. Foundations can be deepened to meet these criteria as long as the exposed foundation wall face maintains a horizontal setback of at least five feet from the top of the slope. ESNW must observe the subgrade to confirm conditions are as anticipated.

- Decks shall be designed to capture rainfall and convey to an approved discharge. This will require a waterproof membrane or similar configuration. Water must not pond above or flow over temporary or permanent slopes.

Erosion Hazards

While the KZC does not include the AgC series soil as a potential erosion hazard soil type, given the steep gradient on the slope south of the existing residence, this area should be considered sensitive with respect to erosion if grading plans do not call for removing this slope during mass grading operations. In our opinion, site grading plans and construction means and methods should ensure that erosion does not occur on the steep slope. Provided these conditions are maintained, in our opinion, the risk or erosion is no greater than the current potential.

Seismic Hazards

In our opinion, the risk of seismically-induced instability on the sloped area is low due to the presence of dense glacial till soil and the lack of an established shallow groundwater table.

Site Preparation and Earthwork

Site preparation activities will likely include removing existing structures and vegetation from the development envelope, installing temporary erosion control measures, and establishing grading limits. The primary geotechnical considerations during the proposed site preparation and earthwork activities will involve cut and fill activities, structural fill placement and compaction, underground utility installations, and final building and pavement area subgrade preparation.

Temporary Erosion Control

The primary construction entrance will be off the Northeast 70th Street frontage, where new paving areas are likely to be constructed for the road that is to allow for travel through the site and intersect with 128th Avenue Northeast. Temporary construction entrances and drive lanes, consisting of at least 12 inches of quarry spalls, can be considered in order to minimize off-site soil tracking and to provide a stable access entrance surface. Geotextile fabric may also be considered underlying the quarry spalls for greater stability of the temporary construction entrance.

Erosion control measures should consist of silt fencing placed around the site perimeter, or at a minimum, around the down gradient of the site perimeter. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Temporary sedimentation ponds or other approaches for controlling surface water runoff should be in place prior to beginning earthwork activities.

In-situ Soils

The moisture sensitivity of the native soil can generally be characterized as high. Localized areas of increased silt content within the sand may exist, and would likely increase the moisture sensitivity of the soils, potentially leading to rapid soil deterioration when exposed to excessive moisture. Successful use of the soil as structural fill will largely be dictated by the moisture content at the time of placement and compaction. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, a contingency should be included in the project scope to account for export of unsuitable soil and import of granular structural fill.

Imported Soils

Imported soil intended for use as structural fill should consist of a well-graded granular soil with a moisture content that is at or near the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded granular soil with a fines content of 5 percent or less defined as the percent passing the Number 200 sieve, based on the minus three-quarter inch fraction.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). Additionally, more stringent compaction specifications may be required for utility trench backfill zones, depending on the responsible utility district or jurisdiction.

Preliminary Storm Vault Design

Vault foundations should be supported on competent native soil or crushed rock placed atop competent native soil. Final storm vault designs must incorporate adequate buffer space from property boundaries such that temporary excavations to construct the vault structure can be successfully completed. Perimeter drains should be installed around the vault and conveyed to an approved discharge point. The presence of perched groundwater seepage should be anticipated during excavation activities for the vault.

The following parameters can be used for preliminary stormwater vault design:

• Allowable soil bearing capacity (dense native soil)	5,000 psf
• Active earth pressure (unrestrained)	35 pcf
• Active earth pressure (unrestrained, hydrostatic)	80 pcf
• At-rest earth pressure (restrained)	55 pcf
• At-rest earth pressure (restrained, hydrostatic)	100 pcf
• Coefficient of friction	0.40
• Passive earth pressure	300 pcf
• Seismic surcharge	6H* (active condition) 12H* (at-rest condition)

*Where H equals the retained height

Retaining walls should be backfilled with free-draining material or suitable sheet drainage that extends along the height of the walls. The upper one foot of the wall backfill can consist of a less permeable soil, if desired. A perforated drain pipe should be placed along the base of the wall and connected to an approved discharge location. If the elevation of the vault bottom is such that gravity flow to an outlet is not possible, the portion of the vault below the drain should be designed to include hydrostatic pressure. Design values accounting for hydrostatic pressure are included above.

ESNW should observe grading operations for the vault and the subgrade conditions prior to concrete forming and pouring to confirm conditions are as anticipated, and to provide supplemental recommendations as necessary. Additionally, ESNW should be contacted to review final vault designs to confirm that appropriate geotechnical parameters have been incorporated.

Foundations

The proposed residential buildings may be supported on conventional continuous and spread footing foundations bearing on competent native soils, re-compacted fill soils, or new structural fill. In general, native soils suitable for support of foundations should be encountered at depths of approximately three feet below existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary. Organic material exposed at foundation subgrade elevations must be removed and grades restored with structural fill.

Provided foundations will be supported as described above, the following parameters can be used for preliminary design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity can assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Slab-On-Grade Floors

Slab-on-grade floors for the proposed residential buildings constructed at this site should be supported on a firm and unyielding subgrade. Where feasible, the native soils exposed at the slab-on-grade subgrade level can likely be compacted in place to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to construction of the slab.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less (percent passing the Number 200 sieve, based on the minus three-quarter inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Drainage

Perched groundwater should be anticipated in deeper site excavations, such as utility trench areas, depending on the time of year grading operations take place. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and to provide recommendations to reduce the potential for instability related to seepage effects.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond above or flow over slopes.

Footing drains should be installed along the base of foundations and conveyed to an approved discharge.

Infiltration Feasibility

Infiltration of stormwater runoff from downspouts on the subject site can be pursued in our opinion; being mindful that the site is underlain by glacial till material. Glacial till soil demonstrates a severely reduced capacity for infiltration; and if infiltration is to be pursued a contingency must be made to allow for overflow of any drywells or infiltration trenches. ESNW can provide further recommendations for design of infiltration facilities if desired.

LIMITATIONS

The recommendations and conclusions provided in this report are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test locations may exist, and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

Additional Services

ESNW should have an opportunity to review the final design with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.

We trust this letter meets your current needs. If you have any questions, or if additional information is required, please call.

Sincerely,

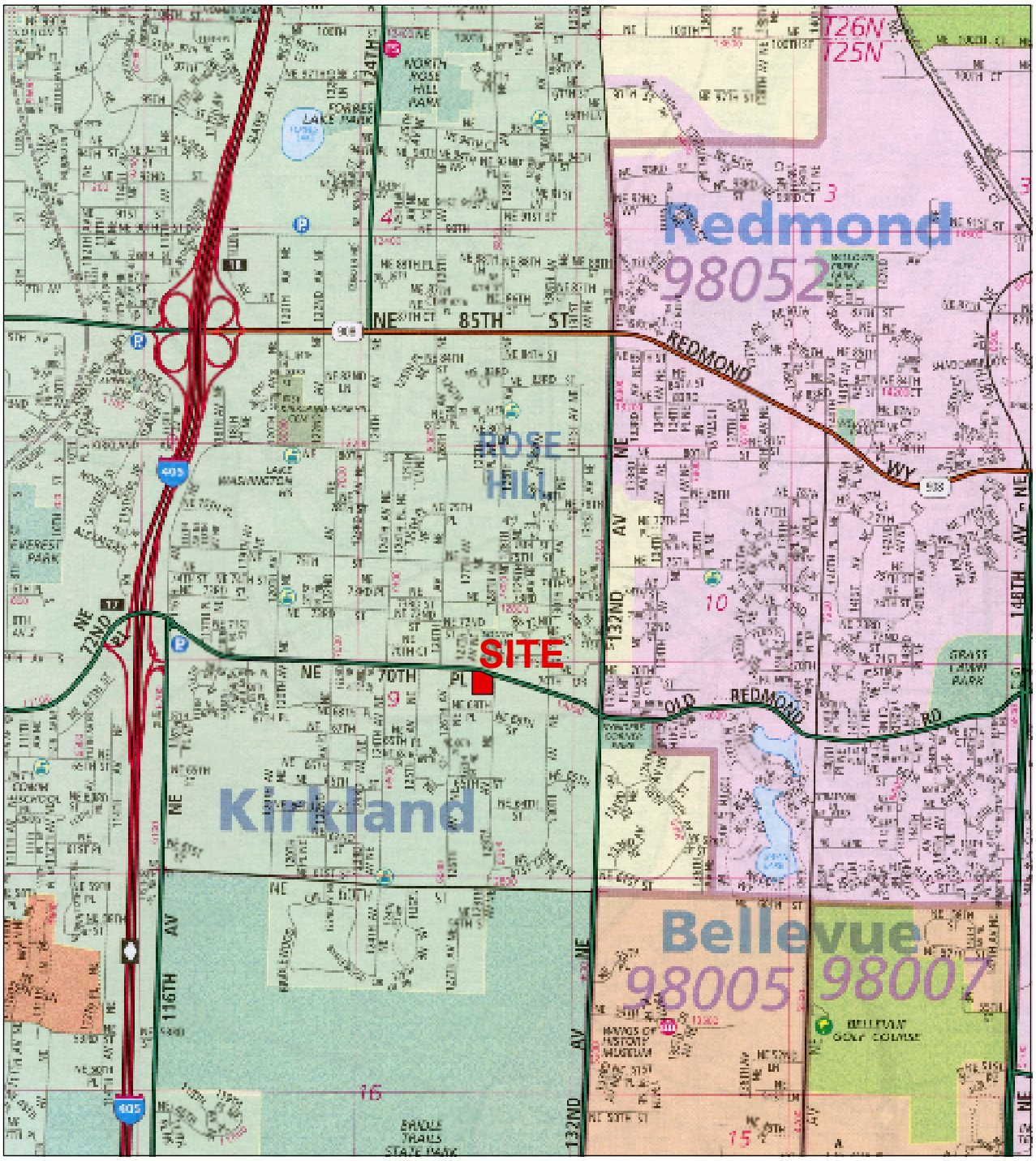
EARTH SOLUTIONS NW, LLC

KYLE R. CAMPBELL
STATE OF WASHINGTON
27674
REGISTERED
PROFESSIONAL ENGINEER
8/20/14

Stephen H. Avril
Staff Geologist

Kyle R. Campbell, P.E.
Principal

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Test Pit Logs
Grain Size Distribution



Reference:
King County, Washington
Map 536
By The Thomas Guide
Rand McNally
32nd Edition

NORTH

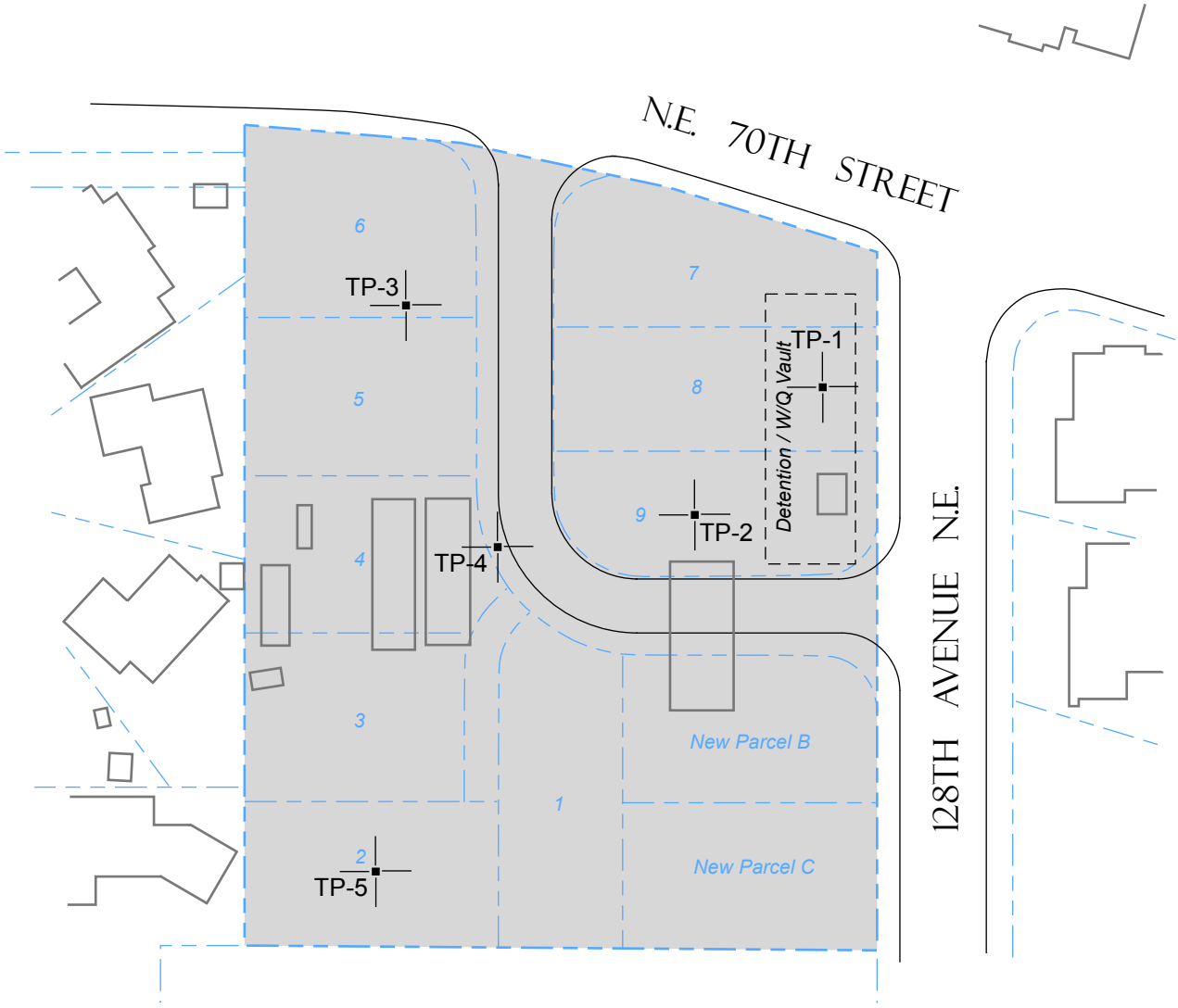
Earth Solutions NW LLC

Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
Griswold Plat
Kirkland, Washington

Drwn.	GLS	Date	08/19/2014	Proj. No.	3521
Checked	SSR	Date	Aug. 2014	Plate	1

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-3521, Aug. 2014

Subject Site

Existing Building

4 — Proposed Lot Number

NORTH

1"=80'

0 40 80 160

Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Test Pit Location Plan
Griswold Plat
Kirkland, Washington

Drwn.	GLS	Date	08/19/2014	Proj. No.	3521
Checked	SSR	Date	Aug. 2014	Plate	2

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

CLIENT DGR Development
PROJECT NAME Griswold Plat
PROJECT NUMBER 3521
PROJECT LOCATION Kirkland, Washington
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 10": moss
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	TOPSOIL
		MC = 25.20%	SM		Brown silty SAND with gravel, medium dense, moist (Weathered Till)
					-becomes dense
		MC = 4.80%			
5		MC = 2.90%		5.0	
			SP-SM		Brown poorly graded SAND with silt, dense, moist
					-becomes slightly cemented
10				10.0	
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.
					Bottom of test pit at 10.0 feet.

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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

CLIENT DGR Development
PROJECT NAME Griswold Plat
PROJECT NUMBER 3521
PROJECT LOCATION Kirkland, Washington
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 12": wood chips
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
				1.0	
		MC = 11.10%	SM		Brown silty SAND with gravel, medium dense, moist (Weathered Till)
					-becomes dense and unweathered
		MC = 8.30%			
5		MC = 5.90%		5.0	
					Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation.
					Bottom of test pit at 5.0 feet.

Earth Solutions NW
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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT DGR Development
PROJECT NAME Griswold Plat
PROJECT NUMBER 3521
PROJECT LOCATION Kirkland, Washington
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 10": mulch
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
				1.0	
			SM		Brown silty SAND with gravel, medium dense, moist (Weathered Till)
					-becomes dense and unweathered
5		MC = 5.90%			
				6.0	
					Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation.
					Bottom of test pit at 6.0 feet.

Earth Solutions NW
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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

CLIENT DGR Development
PROJECT NAME Griswold Plat
PROJECT NUMBER 3521
PROJECT LOCATION Kirkland, Washington
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION ____ **TEST PIT SIZE** ____
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD ____
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 8": mulch
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	TOPSOIL
		MC = 11.10% Fines = 12.10%	SM		Brown silty SAND, medium dense, moist [USDA Classification: brown SAND] -cobbles -becomes dense
5		MC = 11.60%		5.0	-weathered till Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 5.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

CLIENT DGR Development
PROJECT NAME Griswold Plat
PROJECT NUMBER 3521
PROJECT LOCATION Kirkland, Washington
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR Client Provided
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 4": bare soil
AFTER EXCAVATION —

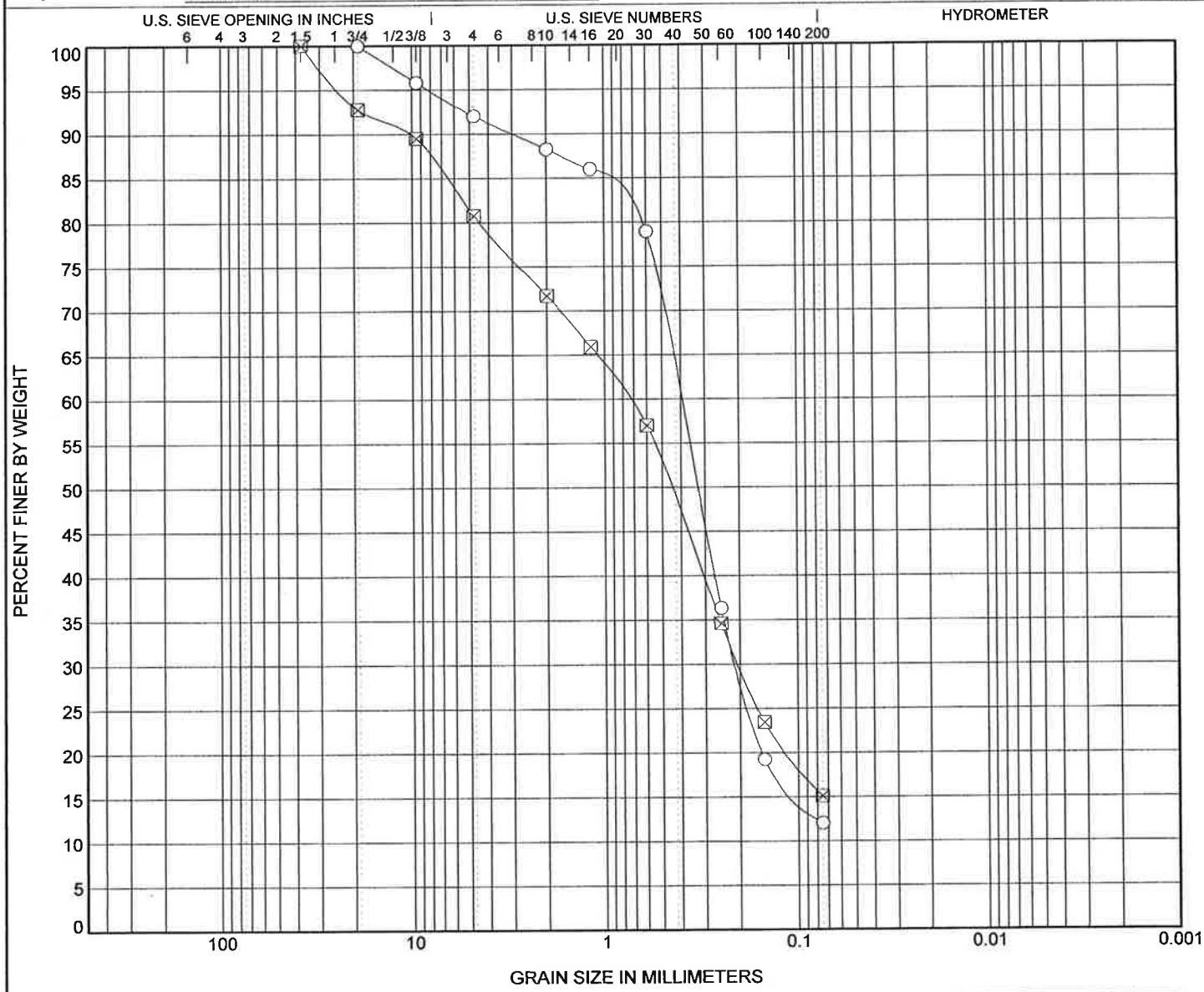
DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	TOPSOIL
					Brown silty SAND with gravel, dense, moist (Weathered Till)
		MC = 10.20%	SM		-becomes dense to very dense and unweathered
5					
		MC = 8.80% Fines = 15.10%		6.0	[USDA Classification: gray gravelly loamy SAND]
					Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation.
					Bottom of test pit at 6.0 feet.

GRAIN SIZE DISTRIBUTION

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-284-3300

CLIENT DGR Development **PROJECT NAME** Griswold Plat

PROJECT NUMBER ES-3521 **PROJECT LOCATION** Kirkland



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
○	TP-4	1.0ft.	USDA: Brown Sand. USCS: SM.				1.71	6.60
⊠	TP-5	6.0ft.	USDA: Gray Gravelly Loamy Sand. USCS: SM w Gravel.					

	Specimen Identification		D100	D60	D30	D10			%Silt	%Clay
○	TP-4	1.0ft.	19	0.406	0.207				12.1	
⊠	TP-5	6.0ft.	37.5	0.754	0.202				15.1	

Section 7 Other Permits

No other permits related to the site storm drainage are required.

Section 8 TESC Analysis and Design

The ESC plan is designed to reduce the discharge of sediment-laden runoff from the site according to Section 1.2.5 and Section 2.3.1.3 of the 2009 KCSWDM. The plan is comprised of temporary measures (rock entrance, filter fence, straw mulch, etc.) as well as permanent measures (hydroseeding and landscaping).

The following BMPs will be applied to prevent erosion and trap sediments within the project site and will be shown on the TESC plan with the LSM permit submittal:

- **Clearing Limits** – Prior to any site clearing or grading, the clearing limits as noted on sheet TP-01 are to be marked in the field. The trees to remain should have tree protection measures installed per City of Kirkland standards.

- **Cover Measures** – Temporary and permanent cover measures shall be provided to protect all disturbed areas. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two consecutive working days during the wet season (October 1 to April 30). These time limits may be relaxed if an area poses a low risk of erosion due to soil type, slope gradient, anticipated weather conditions, or other factors. Cover measures include the use of surface roughening, mulch, erosion control nets and blankets, plastic covering, seeding, and sodding.

- **Perimeter Protections** – Perimeter protection to filter sediment from sheet flow shall be located downslope of disturbed areas and shall be installed prior to upslope grading. The location of the proposed silt fence is show on sheet TP-01. During the wet season, 50 linear feet of silt fence per acre of disturbed area must be stockpiled on site.

- **Traffic Area Stabilization** – A stabilized construction entrance shall be installed as the first step in clearing and grading. The construction entrance is to be installed per City of Kirkland Standard Plan No. CK-E.01.

- **Sediment Retention** – The site generally slopes east to west, therefore silt fence will be installed along the western, northern and southern boundary of the site to retain all sediment on site. Catch basin inlet protection will also be installed at 3 existing catch basin locations indicated on sheet TP-01.

- **Dewatering Control** –Runoff generated by dewatering (if needed) shall be treated by releasing the water to a well vegetated, gently sloping area.

- **Dust Control** – Preventative measures to minimize the wind transport of soil shall be taken when a traffic hazard may be create or when sediment transported by wind is likely to be deposited in water resources or adjacent properties. When necessary, water should be used to control dust. Water should be sprayed on exposed soils until wet, but runoff shall not be generated by spraying. Oil should not be used for dust control.

Section 9 Bond Quantities and Facilities Summary

City of Kirkland Improvement Evaluation Worksheet will be included in the final TIR.

Section 10 Operations and Maintenance

An Operations and Maintenance Manual will be provided with the final TIR

Appendix

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Alexa Lane
Site Name:	Alexa Lane
Site Address:	12643 NE 70th St
City:	Kirkland
Report Date:	9/26/2014
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.00
Version:	2014/04/24

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Pre-Development

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Forest, Mod	1.967
Pervious Total	1.967
Impervious Land Use	Acres
Impervious Total	0
Basin Total	1.967

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Vault Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Lawn, Mod	0.838
Pervious Total	0.838
Impervious Land Use	Acres
ROADS FLAT	0.395
ROOF TOPS FLAT	0.702
SIDEWALKS FLAT	0.064
Impervious Total	1.161
Basin Total	1.999

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

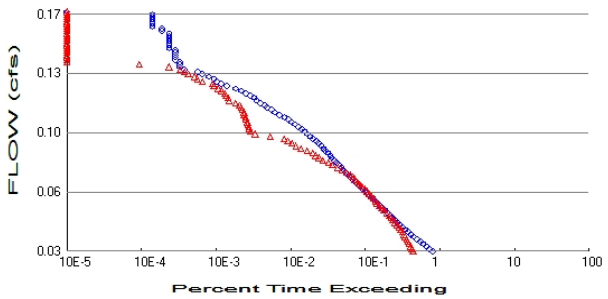
Width: 40 ft.
Length: 112 ft.
Depth: 8 ft.
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.625 in. Elevation:0 ft.
Orifice 2 Diameter: 1.4375 in Elevation:4.7 ft.
Orifice 3 Diameter: 2 in. Elevation:6.5 ft.
Element Flows To:
Outlet 1 Outlet 2

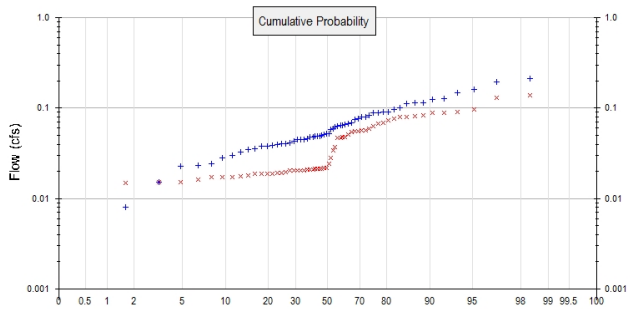
Vault Hydraulic Table

Stage(ft)	Area(ac)	Volume(ac-ft)	Discharge(cfs)	Infilt(cfs)
0.0000	0.102	0.000	0.000	0.000
0.0889	0.102	0.009	0.003	0.000
0.1778	0.102	0.018	0.004	0.000
0.2667	0.102	0.027	0.005	0.000
0.3556	0.102	0.036	0.006	0.000
0.4444	0.102	0.045	0.006	0.000
0.5333	0.102	0.054	0.007	0.000
0.6222	0.102	0.064	0.008	0.000
0.7111	0.102	0.073	0.008	0.000
0.8000	0.102	0.082	0.009	0.000
0.8889	0.102	0.091	0.009	0.000
0.9778	0.102	0.100	0.010	0.000
1.0667	0.102	0.109	0.010	0.000
1.1556	0.102	0.118	0.011	0.000
1.2444	0.102	0.128	0.011	0.000
1.3333	0.102	0.137	0.011	0.000
1.4222	0.102	0.146	0.012	0.000
1.5111	0.102	0.155	0.012	0.000
1.6000	0.102	0.164	0.013	0.000
1.6889	0.102	0.173	0.013	0.000
1.7778	0.102	0.182	0.013	0.000
1.8667	0.102	0.192	0.014	0.000
1.9556	0.102	0.201	0.014	0.000
2.0444	0.102	0.210	0.014	0.000
2.1333	0.102	0.219	0.015	0.000
2.2222	0.102	0.228	0.015	0.000
2.3111	0.102	0.237	0.015	0.000
2.4000	0.102	0.246	0.015	0.000
2.4889	0.102	0.256	0.016	0.000
2.5778	0.102	0.265	0.016	0.000
2.6667	0.102	0.274	0.016	0.000
2.7556	0.102	0.283	0.017	0.000
2.8444	0.102	0.292	0.017	0.000
2.9333	0.102	0.301	0.017	0.000
3.0222	0.102	0.310	0.017	0.000
3.1111	0.102	0.320	0.018	0.000
3.2000	0.102	0.329	0.018	0.000
3.2889	0.102	0.338	0.018	0.000

3.3778	0.102	0.347	0.018	0.000
3.4667	0.102	0.356	0.019	0.000
3.5556	0.102	0.365	0.019	0.000
3.6444	0.102	0.374	0.019	0.000
3.7333	0.102	0.384	0.019	0.000
3.8222	0.102	0.393	0.020	0.000
3.9111	0.102	0.402	0.020	0.000
4.0000	0.102	0.411	0.020	0.000
4.0889	0.102	0.420	0.020	0.000
4.1778	0.102	0.429	0.021	0.000
4.2667	0.102	0.438	0.021	0.000
4.3556	0.102	0.448	0.021	0.000
4.4444	0.102	0.457	0.021	0.000
4.5333	0.102	0.466	0.021	0.000
4.6222	0.102	0.475	0.022	0.000
4.7111	0.102	0.484	0.028	0.000
4.8000	0.102	0.493	0.039	0.000
4.8889	0.102	0.502	0.046	0.000
4.9778	0.102	0.511	0.051	0.000
5.0667	0.102	0.521	0.056	0.000
5.1556	0.102	0.530	0.059	0.000
5.2444	0.102	0.539	0.063	0.000
5.3333	0.102	0.548	0.066	0.000
5.4222	0.102	0.557	0.070	0.000
5.5111	0.102	0.566	0.073	0.000
5.6000	0.102	0.575	0.075	0.000
5.6889	0.102	0.585	0.078	0.000
5.7778	0.102	0.594	0.081	0.000
5.8667	0.102	0.603	0.083	0.000
5.9556	0.102	0.612	0.085	0.000
6.0444	0.102	0.621	0.088	0.000
6.1333	0.102	0.630	0.090	0.000
6.2222	0.102	0.639	0.092	0.000
6.3111	0.102	0.649	0.094	0.000
6.4000	0.102	0.658	0.096	0.000
6.4889	0.102	0.667	0.098	0.000
6.5778	0.102	0.676	0.130	0.000
6.6667	0.102	0.685	0.145	0.000
6.7556	0.102	0.694	0.157	0.000
6.8444	0.102	0.703	0.168	0.000
6.9333	0.102	0.713	0.177	0.000
7.0222	0.102	0.722	0.218	0.000
7.1111	0.102	0.731	0.554	0.000
7.2000	0.102	0.740	1.072	0.000
7.2889	0.102	0.749	1.720	0.000
7.3778	0.102	0.758	2.476	0.000
7.4667	0.102	0.767	3.326	0.000
7.5556	0.102	0.777	4.260	0.000
7.6444	0.102	0.786	5.272	0.000
7.7333	0.102	0.795	6.355	0.000
7.8222	0.102	0.804	7.506	0.000
7.9111	0.102	0.813	8.720	0.000
8.0000	0.102	0.822	9.995	0.000
8.0889	0.102	0.831	11.32	0.000
8.1778	0.000	0.000	12.71	0.000

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.967
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.838
Total Impervious Area: 1.161

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.058568
5 year	0.095969
10 year	0.120016
25 year	0.148623
50 year	0.168437
100 year	0.186945

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.03279
5 year	0.058897
10 year	0.081557
25 year	0.117141
50 year	0.149244
100 year	0.18662

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.067	0.019
1950	0.080	0.054
1951	0.128	0.140
1952	0.040	0.017
1953	0.032	0.048
1954	0.050	0.021
1955	0.080	0.019
1956	0.064	0.073
1957	0.052	0.021
1958	0.057	0.021

1959	0.049	0.021
1960	0.088	0.069
1961	0.049	0.051
1962	0.030	0.017
1963	0.041	0.024
1964	0.059	0.057
1965	0.039	0.057
1966	0.038	0.021
1967	0.090	0.048
1968	0.051	0.020
1969	0.049	0.021
1970	0.040	0.037
1971	0.045	0.021
1972	0.097	0.089
1973	0.043	0.059
1974	0.048	0.022
1975	0.066	0.020
1976	0.047	0.020
1977	0.007	0.015
1978	0.040	0.034
1979	0.024	0.015
1980	0.114	0.083
1981	0.036	0.021
1982	0.074	0.056
1983	0.063	0.021
1984	0.038	0.018
1985	0.023	0.017
1986	0.100	0.022
1987	0.089	0.063
1988	0.035	0.019
1989	0.023	0.018
1990	0.212	0.076
1991	0.112	0.089
1992	0.046	0.028
1993	0.045	0.016
1994	0.015	0.015
1995	0.064	0.056
1996	0.149	0.098
1997	0.115	0.090
1998	0.028	0.019
1999	0.126	0.082
2000	0.045	0.021
2001	0.008	0.012
2002	0.052	0.047
2003	0.077	0.019
2004	0.083	0.079
2005	0.061	0.019
2006	0.069	0.067
2007	0.160	0.129
2008	0.195	0.080
2009	0.091	0.047

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2121	0.1395
2	0.1954	0.1291
3	0.1603	0.0977

4	0.1485	0.0905
5	0.1280	0.0894
6	0.1257	0.0890
7	0.1146	0.0829
8	0.1144	0.0820
9	0.1125	0.0797
10	0.1004	0.0792
11	0.0971	0.0758
12	0.0911	0.0726
13	0.0899	0.0692
14	0.0886	0.0671
15	0.0883	0.0630
16	0.0826	0.0587
17	0.0800	0.0572
18	0.0796	0.0566
19	0.0773	0.0562
20	0.0742	0.0560
21	0.0689	0.0544
22	0.0674	0.0514
23	0.0664	0.0479
24	0.0642	0.0477
25	0.0641	0.0474
26	0.0634	0.0473
27	0.0613	0.0368
28	0.0588	0.0345
29	0.0575	0.0284
30	0.0518	0.0241
31	0.0517	0.0219
32	0.0506	0.0217
33	0.0498	0.0215
34	0.0493	0.0215
35	0.0493	0.0214
36	0.0486	0.0214
37	0.0477	0.0210
38	0.0475	0.0209
39	0.0459	0.0208
40	0.0448	0.0206
41	0.0446	0.0206
42	0.0446	0.0205
43	0.0431	0.0204
44	0.0415	0.0202
45	0.0402	0.0196
46	0.0401	0.0193
47	0.0395	0.0192
48	0.0391	0.0190
49	0.0382	0.0189
50	0.0376	0.0188
51	0.0359	0.0188
52	0.0350	0.0180
53	0.0324	0.0178
54	0.0302	0.0173
55	0.0280	0.0171
56	0.0243	0.0171
57	0.0232	0.0163
58	0.0227	0.0153
59	0.0151	0.0153
60	0.0080	0.0148
61	0.0070	0.0123

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0293	17079	9360	54	Pass
0.0307	15492	9011	58	Pass
0.0321	14070	8637	61	Pass
0.0335	12797	8265	64	Pass
0.0349	11569	7929	68	Pass
0.0363	10515	7636	72	Pass
0.0377	9565	7356	76	Pass
0.0391	8750	7099	81	Pass
0.0405	8036	6744	83	Pass
0.0419	7347	6352	86	Pass
0.0433	6737	6036	89	Pass
0.0447	6190	5717	92	Pass
0.0462	5726	5388	94	Pass
0.0476	5309	5037	94	Pass
0.0490	4924	4753	96	Pass
0.0504	4569	4455	97	Pass
0.0518	4235	4126	97	Pass
0.0532	3951	3811	96	Pass
0.0546	3643	3544	97	Pass
0.0560	3388	3283	96	Pass
0.0574	3133	3080	98	Pass
0.0588	2915	2926	100	Pass
0.0602	2706	2744	101	Pass
0.0616	2488	2579	103	Pass
0.0630	2314	2398	103	Pass
0.0644	2136	2246	105	Pass
0.0658	1973	2099	106	Pass
0.0672	1824	1936	106	Pass
0.0686	1702	1798	105	Pass
0.0700	1577	1679	106	Pass
0.0715	1442	1556	107	Pass
0.0729	1325	1441	108	Pass
0.0743	1232	1331	108	Pass
0.0757	1147	1195	104	Pass
0.0771	1083	1040	96	Pass
0.0785	1020	912	89	Pass
0.0799	947	771	81	Pass
0.0813	885	688	77	Pass
0.0827	824	576	69	Pass
0.0841	760	511	67	Pass
0.0855	725	465	64	Pass
0.0869	674	422	62	Pass
0.0883	623	355	56	Pass
0.0897	589	291	49	Pass
0.0911	549	251	45	Pass
0.0925	506	221	43	Pass
0.0939	469	195	41	Pass
0.0953	427	173	40	Pass
0.0968	388	113	29	Pass
0.0982	356	72	20	Pass
0.0996	328	62	18	Pass
0.1010	298	59	19	Pass
0.1024	270	59	21	Pass

0.1038	242	57	23	Pass
0.1052	219	56	25	Pass
0.1066	199	53	26	Pass
0.1080	176	53	30	Pass
0.1094	152	51	33	Pass
0.1108	130	51	39	Pass
0.1122	119	48	40	Pass
0.1136	104	46	44	Pass
0.1150	95	44	46	Pass
0.1164	83	39	46	Pass
0.1178	74	32	43	Pass
0.1192	69	31	44	Pass
0.1206	61	29	47	Pass
0.1221	54	28	51	Pass
0.1235	46	25	54	Pass
0.1249	39	23	58	Pass
0.1263	30	20	66	Pass
0.1277	25	19	76	Pass
0.1291	22	14	63	Pass
0.1305	20	12	60	Pass
0.1319	17	11	64	Pass
0.1333	14	9	64	Pass
0.1347	12	8	66	Pass
0.1361	8	7	87	Pass
0.1375	7	5	71	Pass
0.1389	7	2	28	Pass
0.1403	7	0	0	Pass
0.1417	6	0	0	Pass
0.1431	6	0	0	Pass
0.1445	6	0	0	Pass
0.1459	6	0	0	Pass
0.1474	6	0	0	Pass
0.1488	5	0	0	Pass
0.1502	5	0	0	Pass
0.1516	5	0	0	Pass
0.1530	5	0	0	Pass
0.1544	5	0	0	Pass
0.1558	5	0	0	Pass
0.1572	5	0	0	Pass
0.1586	4	0	0	Pass
0.1600	4	0	0	Pass
0.1614	3	0	0	Pass
0.1628	3	0	0	Pass
0.1642	3	0	0	Pass
0.1656	3	0	0	Pass
0.1670	3	0	0	Pass
0.1684	3	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.1683 acre-feet
On-line facility target flow:	0.1867 cfs.
Adjusted for 15 min:	0.1867 cfs.
Off-line facility target flow:	0.1042 cfs.
Adjusted for 15 min:	0.1042 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 1 POC	☐	226.47			☐	0.00			
Total Volume Infiltrated		226.47	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic

Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   Alexa Lane.wdm
MESSU      25   PreAlexa Lane.MES
           27   PreAlexa Lane.L61
           28   PreAlexa Lane.L62
           30   POCAlexa Lane1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Pre-Development             MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                          in  out           ***
   11     C, Forest, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11            0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Pre-Development***
PERLND  11                       1.967     COPY   501     12
PERLND  11                       1.967     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                                ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *      *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   Alexa Lane.wdm
MESSU      25   MitAlexa Lane.MES
           27   MitAlexa Lane.L61
           28   MitAlexa Lane.L62
           30   POCAlexa Lane1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      17
      IMPLND       1
      IMPLND       4
      IMPLND       8
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  1                    MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   17     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   17         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   17              0       4.5      0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   17              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                  ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   17            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   17              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
```

```
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Vault Basin***
PERLND  17                       0.838     RCHRES   1      2
PERLND  17                       0.838     RCHRES   1      3
IMPLND   1                       0.395     RCHRES   1      5
IMPLND   4                       0.702     RCHRES   1      5
IMPLND   8                       0.064     RCHRES   1      5

******Routing******
PERLND  17                       0.838     COPY     1     12
IMPLND   1                       0.395     COPY     1     15
IMPLND   4                       0.702     COPY     1     15
IMPLND   8                       0.064     COPY     1     15
PERLND  17                       0.838     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<-----------------><---> User T-series  Engl Metr LKFG           ***
                                          in  out                           ***
    1     Vault  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
```

```
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                        ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1               1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                           ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.102847  0.000000  0.000000
  0.088889  0.102847  0.009142  0.003059
  0.177778  0.102847  0.018284  0.004326
  0.266667  0.102847  0.027426  0.005298
  0.355556  0.102847  0.036568  0.006117
  0.444444  0.102847  0.045710  0.006840
  0.533333  0.102847  0.054852  0.007492
  0.622222  0.102847  0.063993  0.008093
  0.711111  0.102847  0.073135  0.008651
  0.800000  0.102847  0.082277  0.009176
  0.888889  0.102847  0.091419  0.009673
  0.977778  0.102847  0.100561  0.010145
  1.066667  0.102847  0.109703  0.010596
  1.155556  0.102847  0.118845  0.011028
  1.244444  0.102847  0.127987  0.011445
  1.333333  0.102847  0.137129  0.011846
  1.422222  0.102847  0.146271  0.012235
  1.511111  0.102847  0.155413  0.012612
  1.600000  0.102847  0.164555  0.012977
  1.688889  0.102847  0.173697  0.013333
  1.777778  0.102847  0.182838  0.013679
  1.866667  0.102847  0.191980  0.014017
  1.955556  0.102847  0.201122  0.014347
  2.044444  0.102847  0.210264  0.014669
  2.133333  0.102847  0.219406  0.014985
  2.222222  0.102847  0.228548  0.015294
  2.311111  0.102847  0.237690  0.015597
  2.400000  0.102847  0.246832  0.015894
  2.488889  0.102847  0.255974  0.016185
  2.577778  0.102847  0.265116  0.016472
  2.666667  0.102847  0.274258  0.016753
  2.755556  0.102847  0.283400  0.017030
```

```
  2.844444  0.102847  0.292542  0.017303
  2.933333  0.102847  0.301684  0.017571
  3.022222  0.102847  0.310825  0.017835
  3.111111  0.102847  0.319967  0.018096
  3.200000  0.102847  0.329109  0.018352
  3.288889  0.102847  0.338251  0.018606
  3.377778  0.102847  0.347393  0.018855
  3.466667  0.102847  0.356535  0.019102
  3.555556  0.102847  0.365677  0.019345
  3.644444  0.102847  0.374819  0.019586
  3.733333  0.102847  0.383961  0.019823
  3.822222  0.102847  0.393103  0.020058
  3.911111  0.102847  0.402245  0.020289
  4.000000  0.102847  0.411387  0.020519
  4.088889  0.102847  0.420529  0.020745
  4.177778  0.102847  0.429670  0.020970
  4.266667  0.102847  0.438812  0.021192
  4.355556  0.102847  0.447954  0.021411
  4.444444  0.102847  0.457096  0.021629
  4.533333  0.102847  0.466238  0.021844
  4.622222  0.102847  0.475380  0.022057
  4.711111  0.102847  0.484522  0.027989
  4.800000  0.102847  0.493664  0.039639
  4.888889  0.102847  0.502806  0.046272
  4.977778  0.102847  0.511948  0.051493
  5.066667  0.102847  0.521090  0.055956
  5.155556  0.102847  0.530232  0.059925
  5.244444  0.102847  0.539374  0.063540
  5.333333  0.102847  0.548515  0.066884
  5.422222  0.102847  0.557657  0.070012
  5.511111  0.102847  0.566799  0.072963
  5.600000  0.102847  0.575941  0.075765
  5.688889  0.102847  0.585083  0.078439
  5.777778  0.102847  0.594225  0.081003
  5.866667  0.102847  0.603367  0.083470
  5.955556  0.102847  0.612509  0.085849
  6.044444  0.102847  0.621651  0.088151
  6.133333  0.102847  0.630793  0.090383
  6.222222  0.102847  0.639935  0.092551
  6.311111  0.102847  0.649077  0.094660
  6.400000  0.102847  0.658219  0.096716
  6.488889  0.102847  0.667360  0.098722
  6.577778  0.102847  0.676502  0.129981
  6.666667  0.102847  0.685644  0.145488
  6.755556  0.102847  0.694786  0.157584
  6.844444  0.102847  0.703928  0.167972
  6.933333  0.102847  0.713070  0.177276
  7.022222  0.102847  0.722212  0.218071
  7.111111  0.102847  0.731354  0.554460
  7.200000  0.102847  0.740496  1.072318
  7.288889  0.102847  0.749638  1.720536
  7.377778  0.102847  0.758780  2.476459
  7.466667  0.102847  0.767922  3.326331
  7.555556  0.102847  0.777064  4.260635
  7.644444  0.102847  0.786205  5.272279
  7.733333  0.102847  0.795347  6.355709
  7.822222  0.102847  0.804489  7.506421
  7.911111  0.102847  0.813631  8.720670
  8.000000  0.102847  0.822773  9.995274
  8.088889  0.102847  0.831915  11.32749
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
```

```
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1999/ 9/30 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.106E-03     0.00000  0.0000E+00     0.00000  -6.328E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 2002/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-6.925E-03     0.00000  0.0000E+00     0.00000  -9.751E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
```

```
DATE/TIME: 2004/ 7/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.333E-03     0.00000  0.0000E+00     0.00000  -5.251E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 2006/ 7/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-3.232E-03     0.00000  0.0000E+00     0.00000  -2.126E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

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Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com