City of West Linn
Planning & Development • 22500 Salamo Rd #1000 • West Linn, Oregon 97068
Telephone 503.656.4211 • Fax 503.656.4106 • westlinnoregon.gov

DEVELOPMENT REVIEW APPLICATION

For Office Use Only		
STAFF CONTACT	PROJECT NO(S). WAP-16-09 / WRG-16-05	
NON-REFUNDABLE FEE(S) 2600	REFUNDABLE DEPOSIT(S) 1700	TOTAL 4300

Type of Review (Please check all that apply):

- ☐ Annexation (ANX)
- ☐ Appeal and Review (AP) *
- ☐ Conditional Use (CUP)
- ☐ Design Review (DR)
- ☐ Easement Vacation
- ☐ Extraterritorial Ext. of Utilities
- ☐ Final Plat or Plan (FP)
- ☐ Flood Management Area
- ☐ Hillside Protection & Erosion Control
- ☐ Historic Review
- ☐ Legislative Plan or Change
- ☐ Lot Line Adjustment (LLA) */**
- ☐ Minor Partition (MIP) (Preliminary Plat or Plan)
- ☐ Non-Conforming Lots, Uses & Structures
- ☐ Planned Unit Development (PUD)
- ☐ Pre-Application Conference (PA) */**
- ☐ Street Vacation
- ☐ Subdivision (SUB)
- ☐ Temporary Uses *
- ☐ Time Extension *
- ☐ Variance (VAR)
- ☒ Water Resource Area Protection/Single Lot (WAP) 2600
- ☐ Water Resource Area Protection/Wetland (WAP)
- ☒ Willamette & Tualatin River Greenway (WRG) 1700
- ☐ Zone Change

Home Occupation, Pre-Application, Sidewalk Use, Sign Review Permit, and Temporary Sign Permit applications require different or additional application forms, available on the City website or at City Hall.

Site Location/Address:
3588
Robin View Drive

Assessor's Map No.: 21E13
Tax Lot(s): 3000
Total Land Area: 42300 SF

Brief Description of Proposal:

To build a single family home in WRA and WRG.

Applicant Name: (please print) Bill Winkenbach BC Custom Construction Inc. Phone: 503-722-8700
Address: 410 High St. Email: bill@bccustomconstruction.net
City State Zip: Oregon City, OR 97045

Owner Name (required): (please print) Jeff Parker Phone: 503-742-1942
Address: 1800 Blankenship Road, Suite 200 Email: jeff@blackhawkd.com
City State Zip: West Linn, OR 97068

Consultant Name: (please print) All County Surveyors and Planners Inc Phone: 503-668-3151
Address: PO Box 955 Email: rocco@allcountysurveyors.com
City State Zip: Sandy, OR

RECEIVED
JUL 25 2016
PLANNING & BUILDING
CITY OF WEST LINN
INT. TIME

1. All application fees are non-refundable (excluding deposit). **Any overruns to deposit will result in additional billing.**
2. The owner/applicant or their representative should be present at all public hearings.
3. A denial or approval may be reversed on appeal. No permit will be in effect until the appeal period has expired.
4. **Three (3) complete hard-copy sets (single sided) of application materials must be submitted with this application. One (1) complete set of digital application materials must also be submitted on CD in PDF format. If large sets of plans are required in application please submit only two sets.**

* No CD required / ** Only one hard-copy set needed

The undersigned property owner(s) hereby authorizes the filing of this application, and authorizes on site review by authorized staff. I hereby agree to comply with all code requirements applicable to my application. Acceptance of this application does not infer a complete submittal. All amendments to the Community Development Code and to other regulations adopted after the application is approved shall be enforced where applicable. Approved applications and subsequent development is not vested under the provisions in place at the time of the initial application.

Applicant's signature _____ Date _____ Owner's signature *(required)* _____ Date 7/22/16

WATER RESOURCE AREA
DEVELOPMENT REVIEW APPLICATION FOR
Robin View Drive
West Linn, OR

July, 2016

Applicant/Owner:
Jeff Parker
18000 Blankenship Rd. #200
West Linn, OR 97068
503-742-1942

Representative:
Ray L. Moore, P.E.
Rocco X. Nguyen, E.I.

All County
Surveyors & Planners, Inc.
Surveying, Planning and Civil Engineering
P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
Fax: (503) 668-4730

RENEWAL DATE: 12/31/2016

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Project Insight

Project Location:	Robin View Drive, West Linn, OR 97068
Legal Description:	T2S, R1E, Section 13, Tax Lot 3000
Zones:	City of West Linn Zone LDR-10
Site Size:	Approximately 42,285 square feet (0.97 acres)
Proposal:	To Construct a Single Family Home within a WRA
Representative:	All County Surveyors & Planners, Inc. Ray Moore, PE, PLS P.O. Box 955 Sandy, OR 97055 Phone: 503-668-3151 Email: raym@allcountysurveyors.com
Applicant/Owner:	Jeff Parker 18000 Blankenship Rd. #200 West Linn, OR 97068 Phone: 503-742-1942 Email: jeff@parkerdev.com

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Exhibit A

Development Review Application

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Exhibit B

Project Narrative

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PROJECT DESCRIPTION

The proposed project is to develop a house and a driveway. The site is located at Robin View Drive on Tax Lot 3000. The property had a single garage that has been removed. The site is currently vacant. The site slopes downward to the southeast towards Trillium Creek. The site contains more than 80 trees. According to City of West Linn's Metro Data Resource Center, the site contains areas that are protected by the WRA and HCA.

To sustain stormwater runoff from the development, one rain garden will be installed on site. The proposed rain garden was sized using the City of Portland's Simplified Approach. To size the rain garden, the total area of impervious area of 7,150 SF (house and driveway) was multiplied by 0.06 to yield 429 SF. The proposed rain garden of 456 SF exceeds the minimum requirements. Refer to the preliminary stormwater report for additional details.

The Geotechnical Report yields that the proposed construction is geotechnically feasible, provided that the recommendations of said report are incorporated into design and construction phases of the project. Refer to the attached Geotechnical Report for additional details.

The following code chapters will be addressed.

- Chapter 28 – Willamette and Tualatin River Protection
- Chapter 32 – Water Resource Area Protection

28.110 APPROVAL CRITERIA

No application for development on property within the protection area shall be approved unless the decision-making authority finds that the following standards have been met or can be met by conditions of approval. The development shall comply with the following criteria as applicable:

A. Development: All sites.

1. Sites shall first be reviewed using the HCA Map to determine if the site is buildable or what portion of the site is buildable. HCAs shall be verified by the Planning Director per CDC 28.070 and site visit. Also, "tree canopy only" HCAs shall not constitute a development limitation and may be exempted per CDC 28.070(A). The municipal code protection for trees and Chapters 55 and 85 CDC tree protection shall still apply.

Response: This section is met. According to the HCA Map provided by the City of West Linn's Metro Data Resource Center, the site contains both allowed development and limited development areas. There is approximately 17,325 SF of allowed development area and 24,046 SF of limited development area. The proposed house is located within the allowed development area.

2. HCAs shall be avoided to the greatest degree possible and development activity shall instead be directed to the areas designated "Habitat and Impact Areas Not Designated as HCAs," consistent with subsection (A)(3) of this section.

Response: This section is met. The proposed house is located within "Habitat and Impact Areas Not Designated as HCAs" and avoids the HCA. Refer to preliminary site plans for additional details.

3. If the subject property contains no lands designated "Habitat and Impact Areas Not Designated as HCAs" and development within HCA land is the only option it shall be directed towards the low HCA areas first, then medium HCA areas and then to high HCA as the last choice. The goal is to, at best, avoid or, at least, minimize disturbance of the HCAs. (Water-dependent uses are exempt from this provision.)

Response: The subject property does contain land designated "Habitat and Impact Areas Not Designated as HCAs" and has an area of approximately 17,325 SF. The proposed house will not be within the HCA designated areas and is 36 feet from HCA boundary line.

4. All development, including exempted activities of CDC 28.040, shall have approved erosion control measures per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual, rev. 2008, in place prior to site disturbance and be subject to the requirements of CDC 32.070 and 32.080 as deemed applicable by the Planning Director.

Response: This section will be met. We propose to submit an erosion control plan per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual.

B. Single-family or attached residential. Development of single-family homes or attached housing shall be permitted on the following HCA designations and in the following order of preference with "a" being the most appropriate and "d" being the least appropriate:

a "Habitat and Impact Areas Not Designated as HCAs"

b Low HCA

c Moderate HCA

d High HCA

1. Development of land classifications in "b," "c" and "d" shall not be permitted if at least a 5,000-square-foot area of buildable land ("a") exists for home construction, and associated impermeable surfaces (driveways, patios, etc.).

2. If 5,000 square feet of buildable land ("a") are not available for home construction, and associated impermeable surfaces (driveways, patios, etc.) then combinations of land classifications ("a," "b" and "c") totaling a maximum of 5,000 square feet shall be used to avoid intrusion into high HCA lands. Development shall emphasize area "a" prior to extending construction into area "b," then "c" lands.

3. The underlying zone FAR shall also apply as well as allowable lot coverage.

4. Development may occur on legal lots and non-conforming lots of record located completely within the HCA areas or that have the majority of the lot in the HCA to the extent that the applicant has less than 5,000 square feet of non-HCA land.

Development shall disturb the minimum necessary area to allow the proposed use or activity, shall direct development to any available non-HCA lands and in any situation shall create no more than 5,000 square feet of impervious surface. (Driveways, paths, patios, etc., that are constructed of approved water-permeable materials will not count in calculating the 5,000-square-foot lot coverage.) The underlying zone FAR and allowable lot coverage shall also apply and may result in less than 5,000 square feet of lot coverage.

When only HCA land is available then the structure shall be placed as far away from the water resource area or river as possible. To facilitate this, the front setback of the structure or that side which is furthest away from the water resource or river may be reduced to a five-foot setback from the front property line without a variance. Any attached garage must provide a 20-foot by 20-foot parking pad or driveway so as to provide off-street parking exclusive of the garage. The setbacks of subsection C of this section shall still apply.

5. Driveways, paths, patios, etc., that are constructed of approved water-permeable materials will be exempt from the lot coverage calculations of subsections (B)(1) through (4) of this section and the underlying zone.

6. Table showing development allowed by land classification:

	Development Allowed
Non-HCA ("a")	Yes
Low-Medium HCA ("b" and "c")	Yes, if less than 5,000 sq. ft. of non-HCA land available. Avoid "d."
High HCA ("d")	Yes, but only if less than 5,000 sq. ft. of "a," "b" and "c" land available.
Non-conforming Structures (structures on HCA land)	Yes: vertically, laterally and/or away from river. Avoid "d" where possible.

(The underlying zone FAR and allowable lot coverage shall also apply.)

Response: There is no proposed development of land classification in "b," "c," and "d." The development will only be within land classification "a." Refer to site plans for additional details. There are no proposed water permeable materials for this site.

C. Setbacks from top of bank.

1. Development of single-family homes or attached housing on lands designated as "Habitat and Impact Areas Not Designated as HCAs" shall require a structural setback of 15 feet from any top of bank that represents the edge of the land designated as "Habitat and Impact Areas Not Designated as HCAs."

Response: This section is met. The proposed house is approximately 36 feet from the edge of the land designated as "Habitat and Impact Areas Not Designated as HCAs." This exceeds the minimum requirement of 15 feet. Refer to site plans for additional details.

2. At-grade water-permeable patios or decks within 30 inches of grade may encroach into that setback but must keep five feet from top of bank and cannot cantilever over the top of bank or into the five-foot setback area.

Response: This is not applicable. The proposed house will not have any water-permeable patios or decks within 30 inches of grade encroaching into the setback.

3. For properties that lack a distinct top of bank the applicant shall identify the boundary of the area designated as "Habitat and Impact Areas Not Designated as HCAs" which is closest to the river. A structural setback of 15 feet is required from that boundary line. That 15-foot measurement extends from the boundary line away from the river. At-grade water-permeable patios or decks within 30 inches of grade may encroach into that setback 10 feet but must keep five feet from the boundary and cannot cantilever into the five-foot setback area. For vacant lots of record that comprise no lands with "Habitat and Impact Areas Not Designated as HCAs" designation or insufficient lands with those designations so that the above setbacks cannot be met, the house shall be set back as far from river as possible to accommodate house as part of the allowed 5,000 square feet of impermeable surfaces.

Response: This is not applicable. The proposed house will not have any water-permeable patios or decks within 30 inches of grade encroaching into the setback.

D. Development of lands designated for industrial, commercial, office, public and other non-residential uses.

1. Development of lands designated for industrial, multi-family, mixed use, commercial, office, public and other non-single-family residential uses shall be permitted on the following land designations and in the following order of preference with "a" being the most appropriate for development and "d" being the least appropriate:

a "Habitat and Impact Areas Not Designated as HCAs"

b Low HCA

c Moderate HCA

d High HCA

2. Developing HCA land.

a. Where non-HCA or areas designated as "Habitat and Impact Areas Not Designated as HCAs" are lacking or are in such limited supply as to render uses allowed by the underlying zone (e.g., general industrial) functionally impractical, the HCA may be utilized and built upon but shall emphasize "b" and "c" designations.

b. Where it is proposed that a "d" or high HCA classification be used, the property owner must demonstrate that the proposed use is clearly a water-dependent use. Proximity to the river for the purpose of views is not valid grounds. However, public interpretive facilities of historic facilities such as the government locks will be permitted as well as wildlife interpretive facilities and ADA-accessible platforms.

Response: This section is not applicable. The proposed development is not designated for industrial, multi-family, mixed use, commercial, office, public, or other non-single family residential uses.

E. Hardship provisions and non-conforming structures.

1. For the purpose of this chapter, non-conforming structures are existing structures whose building footprint is completely or partially on HCA lands. Any additions, alterations, replacement, or rehabilitation of existing non-conforming non-water-related structures (including decks), roadways, driveways, accessory uses and accessory structures shall avoid encroachment upon the HCAs, especially high HCAs, except that:

a. A 10-foot lateral extension of an existing building footprint is allowed if the lateral extension does not encroach any further into the HCA or closer to the river or water resource area than the portion of the existing footprint immediately adjacent.

b. An addition to the existing structure on the side of the structure opposite to the river or water resource area shall be allowed. There will be no square footage limitation in this direction except as described in subsection (E)(1)(c) of this section.

c. The same allowance for the use of, and construction of, 5,000 square feet of total impervious surface for sites in HCAs per subsections (B)(2) through (4) of this section shall apply to lots in this section.

d. Vertical additions are permitted including the construction of additional floors.

e. The provisions of Chapter 66 CDC, Non-conforming Structures, shall not apply.

Response: There are no existing non-conforming structures on site.

F. Access and property rights.

1. Private lands within the protection area shall be recognized and respected.

Response: This section is met. The private lands within the protection area will be recognized and respected. The majority of the proposed development is outside of the HCA. The proposed stormwater pipe will be within the HCA and is proposed to be replanted.

2. Where a legal public access to the river or elsewhere in the protection area exists, that legal public right shall be recognized and respected.

Response: This section is not applicable. The property is not located on a river.

3. To construct a water-dependent structure such as a dock, ramp, or gangway shall require that all pre-existing legal public access or similar legal rights in the protection area be recognized and respected. Where pre-existing legal public access, such as below the OLW, is to be obstructed by, for example, a ramp, the applicant shall provide a reasonable alternate

route around, over or under the obstruction. The alternate route shall be as direct as possible. The proposed route, to include appropriate height clearances under ramps/docks and specifications for safe passage over or around ramps and docks, shall be reviewed and approved by the Planning Director for adequacy.

Response: This section is not applicable. The property is not located on a lake or river. There are no proposed docks, ramps, or gangways.

4. Any public or private water-dependent use or facility shall be within established DSL-authorized areas.

Response: This section is not applicable. The property is not located on a lake or river. There are no proposed public or private water accesses.

5. Legal access to, and along, the riverfront in single-family residential zoned areas shall be encouraged and pursued especially when there are reasonable expectations that a continuous trail system can be facilitated. The City recognizes the potential need for compensation where nexus and proportionality tests are not met. Fee simple ownership by the City shall be preferred. The trail should be dimensioned and designed appropriate to the terrain it traverses and the user group(s) it can reasonably expect to attract. The City shall be responsible for signing the trail and delineating the boundary between private and public lands or access easements.

Response: This section is not applicable. There is no proposed legal access to, and along, the riverfront.

G. Incentives to encourage access in industrial, multi-family, mixed use, commercial, office, public and non-single-family residential zoned areas.

1. For all industrial, multi-family, mixed use, commercial, office, public and other non-single-family residential zones, this section encourages the dedication or establishment of access easements to allow legal public access to, and along, the river. Support for access may be found in the Parks Master Plan, a neighborhood plan or any applicable adopted sub-area plans. The emphasis will be upon locating paths where there is a reasonable expectation that the path can be extended to adjacent properties to form a connective trail system in the future, and/or where the trail will provide opportunities for appreciation of, and access to, the river.

2. Height or density incentives may be available to developers who provide public access. Specifically, commercial, industrial, multi-family, mixed use, and public projects may be constructed to a height of 60 feet. No variance is required for the 60-foot height allowance regardless of the underlying zone height limitations; however, the following conditions must be met:

a. Provide a minimum 20-foot-wide all-weather public access path along the project's entire river frontage (reduced dimensions would only be permitted in response to physical site constraints such as rock outcroppings, significant trees, etc.); and

b. Provide a minimum 10-foot-wide all-weather public access path from an existing public right-of-way to that riverfront path or connect the riverfront path to an existing riverfront path on an adjoining property that accesses a public right-of-way.

c. Fencing may be required near steep dropoffs or grade changes.

Response: The proposed property is not for industrial, multi-family, mixed use, commercial, office, public, or non-single-family residential zoned area.

H. Partitions, subdivisions and incentives.

1. When dividing a property into lots or parcels, an applicant shall verify the boundaries of the HCA on the property.

2. Applicant shall partition or subdivide the site so that all lots or parcels have a buildable site or envelope available for home construction located on non-HCA land or areas designated "Habitat and Impact Areas Not Designated as HCAs" per the HCA Map.

3. Development of HCA-dominated lands shall be undertaken as a last resort. A planned unit development (PUD) of Chapter 24 CDC may be required.

4. Incentives are available to encourage provision of public access to, and/or along, the river. By these means, planned unit developments shall be able to satisfy the shared outdoor recreation area requirements of CDC 55.100(F). Specifically, for every square foot of riverfront path, the applicant will receive credit for two square feet in calculating the required shared outdoor recreation area square footage. Applicants shall also be eligible for a density bonus under CDC 24.150(B). To be eligible to receive either of these incentives, applicants shall:

a. Provide a minimum 20-foot-wide all-weather public access path along the project's entire river frontage (reduced dimensions would only be permitted in response to physical site constraints such as rock outcroppings, significant trees, etc.); and

b. Provide a minimum 10-foot-wide all-weather public access path from an existing public right-of-way to that riverfront path or connect the riverfront path to an existing riverfront path on an adjoining property that accesses a public right-of-way;

c. Fencing may be required near steep dropoffs or grade changes.

Response: There are no proposed partitions, subdivisions, or incentives.

I. Docks and other water-dependent structures.

1. Once the preference rights area is established by DSL, the property owner identifies where the water-dependent use will be located within the authorized portion of the preference rights area. The water-dependent use should be centered or in the middle of the preference rights/authorized area or meet the side yard setbacks of the underlying zone.

Private and public non-commercial docks are permitted where dredging is required so long as all applicable federal and State permits are obtained. Dredging is encouraged if deposits silt up under an existing dock. Dredging is seen as preferable to the construction of longer docks/ramps.

2. Both joint and single use docks shall not extend into the water any further than necessary to provide four feet between the ship's keel or fixed propeller/rudder and the bottom of the water at any time during the water's lowest point.

3. In no case except as provided in this section shall a private ramp and private dock extend more than 100 feet from OLW towards the center of the river or slough. In the case of L-shaped docks, the 100 feet shall be measured from the OLW to the furthest part of the private dock closest to the center of the river.

4. Docks on sloughs and similar channels shall not extend more than 30 percent of the distance between two land masses at OHW, such as between the mainland and an island or peninsula, measured in a lineal manner at right angle to the dominant shoreline. In no way shall a dock impede existing public usage or block navigation of a channel.

5. Boat storage associated with a rail launch facility shall be located above the OHW, either vertically raised above the ordinary high water line or set back behind the OHW. Such boat storage structure will be natural wood colors or similar earth tones. Private railed launch facilities are permitted for individual boat owners. The onshore setback of the storage structure is equal distance on both sides as extended perpendicular to the thread of the stream, or seven and one-half feet, whichever is the greater setback.

6. The width of each deck section shall be no more than 12 feet wide.

7. For only single-user and joint-user docks, pilings shall not exceed a maximum height of eight feet above the 100-year flood elevation.

8. A single user non-commercial dock shall not exceed 400 square feet in deck area. The boat slip is not included in the calculation of this square footage limitation.

9. Private non-commercial boat houses are allowed but only if they are within 50 feet of OLW and/or in locations sufficiently screened from view so that they do not have a significant visual impact on views from adjacent and nearby homes. Building and roof colors shall be brown, gray, beige, natural or similar earth tones. Non-commercial boat houses shall not exceed 12 feet in height measured from the boat house deck level to the roof peak. The size of the boat house shall be sized to accommodate one boat only and shall not exceed a footprint greater

than 500 square feet. Boatlifts are permitted within the boat house. The above provisions also apply to open-walled boat shelters with or without boatlifts.

Response: There are no proposed docks or other water-related structures.

J. Joint docks.

1. Joint use boat docks may be permitted by the reviewing authority where the applicants are riverfront property owners, ideally owners of adjacent lots of record.

2. Co-owners of the joint dock use shall be prohibited from having their own non-joint dock.

3. A joint use agreement shall be prepared which will be included in the application for review by the reviewing authority and subsequently recorded. A copy of the recorded document with the County Recorder's stamp shall be submitted to the City.

4. A condition of approval for any joint use permit shall be that the dock must be used to serve the same lots of record for which the dock permit was issued. Joint use cannot be transferred to, or used by, any party other than the original applicants or the future owners of those properties.

5. Joint docks may go on the common property line between the two landowners who are sharing the dock. Unless agreed to by the adjoining owner, joint docks not being shared with the adjacent property owner must be at least 15 feet from the preference rights area side lines or centered in the middle of the preference rights area.

K. Non-conforming docks and other water-related structures. Pre-existing non-conforming structures, including docks, ramps, boat houses, etc., as defined in this chapter may remain in place. Replacement in kind (e.g., replacement of decking and other materials) will be allowed provided the replacement meets the standards of this chapter. However, if any non-conforming structure that is damaged and destroyed or otherwise to be replaced to the extent that the rebuilding or replacing (including replacement in kind) would exceed 50 percent of the current replacement cost of the entire structure, the owner shall be required to meet all the standards of this chapter.

Response: There are no proposed non-conforming docks or other water-related structures.

L. Roads, driveways, utilities, or passive use recreation facilities. Roads, driveways, utilities, public paths, or passive use recreation facilities may be built in those portions of HCAs that include wetlands, riparian areas, and water resource areas when no other practical alternative exists but shall use water-permeable materials unless City engineering standards do not allow that. Construction to the minimum dimensional standards for roads is required. Full mitigation and revegetation is required, with the applicant to submit a mitigation plan pursuant to CDC 32.070 and a revegetation plan pursuant to CDC 32.080. The maximum disturbance width for utility corridors is as follows:

1. For utility facility connections to utility facilities, no greater than 10 feet wide.

2. For upgrade of existing utility facilities, no greater than 15 feet wide.

3. For new underground utility facilities, no greater than 25 feet wide, and disturbance of no more than 200 linear feet of water quality resource area, or 20 percent of the total linear feet of water quality resource area, whichever is greater.

Response: This section is met. All proposed roads, driveways, and utilities are outside of the HCA. A portion of the HCA will be used to build an overflow pipe for stormwater conveyance. Approximately 350 SF of HCA will be disturbed and will be replanted to City standards. Refer to Mitigation Map in the preliminary plans for additional details.

M. Structures. All buildings and structures in HCAs and riparian areas, including all exterior mechanical equipment, should be screened, colored, or surfaced so as to blend with the riparian environment. Surfaces shall be non-polished/reflective or at least expected to lose their luster within a year. In addition to the specific standards and criteria applicable to water-dependent uses (docks), all other provisions of this chapter shall apply to water dependent uses, and any structure shall be no larger than necessary to accommodate the use.

Response: This section is met. The propose house is outside the HCA and is within Habitat and Impact Areas not designated as a HCA.

N. Water-permeable materials for hardscapes. The use of water-permeable materials for parking lots, driveways, patios, and paths as well as flow-through planters, box filters, bioswales and drought tolerant plants are strongly encouraged in all “a” and “b” land classifications and shall be required in all “c” and “d” land classifications. The only exception in the “c” and “d” classifications would be where it is demonstrated that water-permeable driveways/hardscapes could not structurally support the axle weight of vehicles or equipment/storage load using those areas. Flow through planters, box filters, bioswales, drought tolerant plants and other measures of treating and/or detaining runoff would still be required in these areas.

Response: This section is met. A rain garden is proposed to be installed with drought tolerant plants to manage the increased impervious area of the development The proposed rain garden has an area of 456 SF to manage approximately 6,900 SF of impervious area.

O. Signs and graphics. No sign or graphic display inconsistent with the purposes of the protection area shall have a display surface oriented toward or visible from the Willamette or Tualatin River. A limited number of signs may be allowed to direct public access along legal routes in the protection area.

Response: There are no proposed signs or graphics.

P. Lighting. Lighting shall not be focused or oriented onto the surface of the river except as required by the Coast Guard. Lighting elsewhere in the protection area shall be the minimum

necessary and shall not create off-site glare or be omni-directional. Screens and covers will be required.

Response: There are no proposed new lighting structures.

Q. Parking. Parking and unenclosed storage areas located within or adjacent to the protection area boundary shall be screened from the river in accordance with Chapter 46CDC, Off-Street Parking, Loading and Reservoir Areas. The use of water-permeable material to construct the parking lot is either encouraged or required depending on HCA classification per CDC 28.110(N)(4).

Response: The site does not have any river to be screened from. There is no proposed loading or reservoir areas. Proposed off-street parking is outside of the HCA and include the driveway and garage.

R. Views. Significant views of the Willamette and Tualatin Rivers shall be protected as much as possible as seen from the following public viewpoints: Mary S. Young Park, Willamette Park, Cedar Oak Park, Burnside Park, Maddox Park, Cedar Island, the Oregon City Bridge, Willamette Park, and Fields Bridge Park.

Response: This section is not applicable. The proposed development is not located along the Willamette or Tualatin Rivers.

S. Aggregate deposits. Extraction of aggregate deposits or dredging shall be conducted in a manner designed to minimize adverse effects on water quality, fish and wildlife, vegetation, bank stabilization, stream flow, visual quality, noise and safety, and to promote necessary reclamation.

Response: This section is not applicable. There is no proposed dredging or extraction of aggregate deposits.

T. Changing the landscape/grading.

1. Existing predominant topographical features of the bank line and escarpment shall be preserved and maintained except for disturbance necessary for the construction or establishment of a water related or water dependent use. Measures necessary to reduce potential bank and escarpment erosion, landslides, or flood hazard conditions shall also be taken.

Any construction to stabilize or protect the bank with rip rap, gabions, etc., shall only be allowed where there is clear evidence of erosion or similar hazard and shall be the minimum needed to stop that erosion or to avoid a specific and identifiable hazard. A geotechnical engineer's stamped report shall accompany the application with evidence to support the proposal.

Response: This section is met. The proposed house is not located on a bank line or escarpment and will maintain existing predominant topographical features.

2. The applicant shall establish to the satisfaction of the approval authority that steps have been taken to minimize the impact of the proposal on the riparian environment (areas between the top of the bank and the low water mark of the river including lower terrace, beach and river edge).

Response: This section is not applicable. There is no river, lower terrace, beach, or river edge located on the site.

3. The applicant shall demonstrate that stabilization measures shall not cause subsequent erosion or deposits on upstream or downstream properties.

Response: This section will be met. The contractor will follow the recommendations provided in the geotechnical report in order to not cause subsequent erosion or deposits on upstream or downstream properties.

4. Prior to any grading or development, that portion of the HCA that includes wetlands, creeks, riparian areas and water resource area shall be protected with an anchored chain link fence (or approved equivalent) at its perimeter and shall remain undisturbed except as specifically allowed by an approved Willamette and Tualatin River Protection and/or water resource area (WRA) permit. Such fencing shall be maintained until construction is complete. That portion of the HCA that includes wetlands, creeks, riparian areas and water resource area shall be identified with City-approved permanent markers at all boundary direction changes and at 30- to 50-foot intervals that clearly delineate the extent of the protected area.

Response: This section is not applicable. The proposed house is located outside the HCA.

5. Full erosion control measures shall be in place and approved by the City Engineer prior to any grading, development or site clearing.

Response: This section will be met. Erosion control measures will be submitted prior to construction.

U. Protect riparian and adjacent vegetation. Vegetative ground cover and trees upon the site shall be preserved, conserved, and maintained according to the following provisions:

1. Riparian vegetation below OHW removed during development shall be replaced with indigenous vegetation, which shall be compatible with and enhance the riparian environment and approved by the approval authority as part of the application.

Response: It is not proposed to remove riparian vegetation below OHW during development.

2. Vegetative improvements to areas within the protection area may be required if the site is found to be in an unhealthy or disturbed state by the City Arborist or his designated expert. "Unhealthy or disturbed" includes those sites that have a combination of native trees, shrubs, and groundcover on less than 80 percent of the water resource area and less than 50 percent tree canopy coverage in the primary and secondary habitat conservation area to be preserved. "Vegetative improvements" will be documented by submitting a revegetation plan meeting

CDC 28.160 criteria that will result in the primary and secondary habitat conservation area to be preserved having a combination of native trees, shrubs, and groundcover on more than 80 percent of its area, and more than 50 percent tree canopy coverage in its area. The vegetative improvements shall be guaranteed for survival for a minimum of two years. Once approved, the applicant is responsible for implementing the plan prior to final inspection.

Response: This section will be met. If the site is found to be in an unhealthy or disturbed state, vegetative improvements will be done under code standards.

3. Tree cutting shall be prohibited in the protection area except that:

a. Diseased trees or trees in danger of falling may be removed with the City Arborist's approval; and

b. Tree cutting may be permitted in conjunction with those uses listed in CDC28.030 with City Arborist approval; to the extent necessary to accommodate the listed uses;

c. Selective cutting in accordance with the Oregon Forest Practices Act, if applicable, shall be permitted with City Arborist approval within the area between the OHW and the greenway boundary provided the natural scenic qualities of the greenway are maintained. (Ord. 1576, 2008; Ord. 1590 § 1, 2009; Ord. 1604 §§ 29 – 36, 2011; amended during July 2014 supplement; Ord. 1635 § 17, 2014; Ord. 1636 § 27, 2014)

Response: There are no proposed trees to be cut in the protection area. Refer to site plans for details of which trees are being cut.

32.060 APPROVAL CRITERIA (STANDARD PROCESS)

No application for development on property containing a WRA shall be approved unless the approval authority finds that the proposed development is consistent with the following approval criteria, or can satisfy the criteria by conditions of approval:

A. WRA protection/minimizing impacts.

1. Development shall be conducted in a manner that will avoid or, if avoidance is not possible, minimize adverse impact on WRAs.

Response: This section is met. The majority of the new development will avoid the WRA as it will be outside the protected area. A small portion of the the WRA will be used for stormwater conveyance Refer to site plan for additional details.

2. Mitigation and re-vegetation of disturbed WRAs shall be completed per CDC32.090 and 32.100 respectively.

Response: This section is met. Mitigation and re-vegetation will be provided in section 32.090 and 32.100.

B. Storm water and storm water facilities.

1. Proposed developments shall be designed to maintain the existing WRAs and utilize them as the primary method of storm water conveyance through the project site unless:

a. The surface water management plan calls for alternate configurations (culverts, piping, etc.); or

Response: This section is met. The stormwater will be collected and piped a proposed rain garden. Any rainwater that exceeds the capacity of the rain garden will the piped to the back of the site to riprap before discharging into the creek. Refer to site plans for additional details.

b. Under CDC 32.070, the applicant demonstrates that the relocation of the water resource will not adversely impact the function of the WRA including, but not limited to, circumstances where the WRA is poorly defined or not clearly channelized.

Re-vegetation, enhancement and/or mitigation of the re-aligned water resource shall be required as applicable.

Response: The stormwater system is designed so that it will not adversely impact the function of the WRA. It is estimated that 350 SF of the WRA will be disturbed and that it will be restored as required by the city. See the mitigation plan for additional information.

2. Public and private storm water detention, storm water treatment facilities and storm water outfall or energy dissipaters (e.g., rip rap) may encroach into the WRA if:

a. Accepted engineering practice requires it;

b. Encroachment on significant trees shall be avoided when possible, and any tree loss shall be consistent with the City's Tree Technical Manual and mitigated per CDC 32.090;

c. There shall be no direct outfall into the water resource, and any resulting outfall shall not have an erosive effect on the WRA or diminish the stability of slopes; and

d. There are no reasonable alternatives available.

A geotechnical report may be required to make the determination regarding slope stability.

Response: This section is met. It is proposed that a private stormwater rain garden with an outfall will be piped to the back of the site towards Trillium Creek. The outfall will have a flow disperser to dissipate energy. The geologist recommends a lined rain garden a hard pipe for the outfall to ensure no water runs over the surface.

3. Roadside storm water conveyance swales and ditches may be extended within rights-of-way located in a WRA. When possible, they shall be located along the side of the road furthest from the water resource. If the conveyance facility must be located along the side of the road closest to the water resource, it shall be located as close to the road/sidewalk as possible and include habitat friendly design features (treatment train, rain gardens, etc.).

Response: There are no proposed roadside stormwater conveyance swales or ditches.

4. Storm water detention and/or treatment facilities in the WRA shall be designed without permanent perimeter fencing and shall be landscaped with native vegetation.

Response: There are no proposed fencing around any stormwater detention or treatment facilities. Plants residing in the drainage swale will be native.

5. Access to public storm water detention and/or treatment facilities shall be provided for maintenance purposes. Maintenance driveways shall be constructed to minimum width and use water permeable paving materials. Significant trees, including roots, shall not be disturbed to the degree possible. The encroachment and any tree loss shall be mitigated per CDC 32.090. There shall also be no adverse impacts upon the hydrologic conditions of the site.

Response: There are no proposed public stormwater detention or treatment facilities.

C. Dedications and easements. The City shall request dedications of the WRA to the City when acquisition of the WRA by dedication or easement would serve a public purpose. When such a dedication or easement is mutually agreed upon, the applicant shall provide the documentation for

the dedication or easement. Nothing in this section shall prohibit the City from condemning property if:

1. The property is necessary to serve an important public purpose; and

2. Alternative means of obtaining the property are unsuccessful.

Response: The proposed development is in a lot that was existing prior to the WRA

D. WRA width. Except for the exemptions in CDC 32.040, applications that are using the alternate review process of CDC 32.070, or as authorized by the approval authority consistent with the provisions of this chapter, all development is prohibited in the WRA as established in Table 32-2 below:

Table 32-2. Required Width of WRA

Protected WRA Resource (see Chapter 2 CDC, Definitions)	Slope Adjacent to Protected Water Resource[1,3]	Starting Point for Measurements from Water Resource[1,3]	Width of WRA on Each Side of the Water Resource
A. Water Resource	0% - 25%	OHW or delineated edge of wetland	65 feet
B. Water Resource (Ravine)	over 25% to a distinct top of slope[2]	OHW or delineated edge of wetland	From water resource to top of slope[2] (30-foot minimum), plus an additional 50 feet[4]
C. Water Resource	Over 25% for more than 30 feet, and no distinct top of slope for at least 150 feet	OHW or delineated edge of wetland	200 feet
D. Riparian Corridor	Any	OHW	100 feet
E. Formerly Closed Drainage Channel Reopened	Any	OHW	15 feet

F. Ephemeral Stream	Any	Stream thread or centerline	15 feet with treatment or vegetation (see CDC32.050(G)(1))
G. Fish Bearing Streams per Oregon Department of Fish and Wildlife (ODFW) or 2003-2004 Survey	Applies to all that stream section where fish were inventoried and upstream to the first known barrier to fish passage.	OHW or delineated edge of wetland	100 feet when no greater than 25% slope. See B or C above for steeper slopes
H. Re-aligned Water Resource	See A, B, C, D, F, or G, above	OHW or delineated edge of wetland	See A, B, C, D, F, or G, above

[1] The slope is the average slope in the first 50 feet as measured from bankfull stage or OHW.

[2] Where the protected water resource is confined by a ravine or gully, the top of slope is the location (30-foot minimum) where the slope breaks to less than 15 percent for at least 50 feet.

[3] At least three slope measurements along the water resource, at no more than 100-foot increments, shall be made for each property for which development is proposed. Depending upon topography, the width of the protected corridor may vary.

[4] The 50-foot distance may be reduced to 25 feet if a geotechnical study by a licensed engineer or similar accredited professional demonstrates that the slope is stable and not prone to erosion.

Response: This section is met. The proposed building is outside of the WRA and is 63 feet from the top of the 25% slope. Refer to site plans for additional details.

E. Roads, driveways and utilities.

1. New roads, driveways, or utilities shall avoid WRAs unless the applicant demonstrates that no other practical alternative exists. In that case, road design and construction techniques shall minimize impacts and disturbance to the WRA by the following methods:

a. New roads and utilities crossing riparian habitat areas or streams shall be aligned as close to perpendicular to the channel as possible.

b. Roads and driveways traversing WRAs shall be of the minimum width possible to comply with applicable road standards and protect public safety. The footprint of grading and site clearing to accommodate the road shall be minimized.

c. Road and utility crossings shall avoid, where possible:

1) Salmonid spawning or rearing areas;

2) Stands of mature conifer trees in riparian areas;

3) Highly erodible soils;

4) Landslide prone areas;

5) Damage to, and fragmentation of, habitat; and

6) Wetlands identified on the WRA Map.

Response: This section is met. The proposed driveways and utilities avoid the WRA. See preliminary site plans for additional details.

2. Crossing of fish bearing streams and riparian corridors shall use bridges or arch-bottomless culverts or the equivalent that provides comparable fish protection, to allow passage of wildlife and fish and to retain the natural stream bed.

Response: There are no proposed crossings of the stream or riparian corridor.

3. New utilities spanning fish bearing stream sections, riparian corridors, and wetlands shall be located on existing roads/bridges, elevated walkways, conduit, or other existing structures or installed underground via tunneling or boring at a depth that avoids tree roots and does not alter the hydrology sustaining the water resource, unless the applicant demonstrates that it is not physically possible or it is cost prohibitive. Bore pits associated with the crossings shall be restored upon project completion. Dry, intermittent streams may be crossed with open cuts during a time period approved by the City and any agency with jurisdiction.

Response: There are no proposed utilities crossing the stream or riparian corridor.

4. No fill or excavation is allowed within the ordinary high water mark of a water resource, unless all necessary permits are obtained from the City, U.S. Army Corps of Engineers and Oregon Department of State Lands (DSL).

Response: There are no proposed fill or excavation within the ordinary high water mark of the stream.

5. Crossings of fish bearing streams shall be aligned, whenever possible, to serve multiple properties and be designed to accommodate conduit for utility lines. The applicant shall, to the extent legally permissible, work with the City to provide for a street layout and crossing location that will minimize the need for additional stream crossings in the future to serve surrounding properties.

Response: There is no proposed crossing of the stream or riparian corridor.

F. Passive recreation. Low impact or passive outdoor recreation facilities for public use including, but not limited to, multi-use paths and trails, not exempted per CDC 32.040(B)(2), viewing platforms, historical or natural interpretive markers, and benches in the WRA, are subject to the following standards:

1. Trails shall be constructed using non-hazardous, water permeable materials with a maximum width of four feet or the recommended width under the applicable American Association of State Highway and Transportation Officials (AASHTO) standards for the expected type and use, whichever is greater.

2. Paved trails are limited to the area within 20 feet of the outer boundary of the WRA, and such trails must comply with the storm water provisions of this chapter.

3. All trails in the WRA shall be set back from the water resource at least 30 feet except at stream crossing points or at points where the topography forces the trail closer to the water resource.

4. Trails shall be designed to minimize disturbance to existing vegetation, work with natural contours, avoid the fall line on slopes where possible, avoid areas with evidence of slope failure and ensure that trail runoff does not create channels in the WRA.

5. Foot bridge crossings shall be kept to a minimum. When the stream bank adjacent to the foot bridge is accessible (e.g., due to limited vegetation or topography), where possible, fences or railings shall be installed from the foot bridge and extend 15 feet beyond the terminus of the foot bridge to discourage trail users and pets from accessing the stream bank, disturbing wildlife and habitat areas, and causing vegetation loss, stream bank erosion and stream turbidity. Bridges shall not be made of continuous impervious materials or be treated with toxic substances that could leach into the WRA.

6. Interpretive facilities (including viewpoints) shall be at least 10 feet from the top of the water resource's bankfull flow/OHW or delineated wetland edge and constructed with a fence between users and the resource. Interpretive signs may be installed on footbridges.

Response: The proposed development is not for passive recreation.

G. Daylighting Piped Streams.

1. As part of any application, covered or piped stream sections shown on the WRA Map are encouraged to be "daylighted" or opened. Once it is daylighted, the WRA will be limited to 15 feet on either side of the stream. Within that WRA, water quality measures are required which may include a storm water treatment system (e.g., vegetated bioswales), continuous vegetative ground cover (e.g., native grasses) at least 15 feet in width that provides year round efficacy, or a combination thereof.

2. The re-opened stream does not have to align with the original piped route but may take a different route on the subject property so long as it makes the appropriate upstream and downstream connections and meet the standards of subsections (G)(3) and (4) of this section.

3. A re-aligned stream must not create WRAs on adjacent properties not owned by the applicant unless the applicant provides a notarized letter signed by the adjacent property owner(s) stating that the encroachment of the WRA is permitted.

4. The evaluation of proposed alignment and design of the reopened stream shall consider the following factors:

a. The ability of the reopened stream to safely carry storm drainage through the area without causing significant erosion.

b. Continuity with natural contours on adjacent properties, slope on site and drainage patterns.

c. Continuity of adjacent vegetation and habitat values.

d. The ability of the existing and proposed vegetation to filter sediment and pollutants and enhance water quality.

e. Provision of water temperature conducive to fish habitat.

5. Any upstream or downstream WRAs or riparian corridors shall not apply to, or overlap, the daylighted stream channel.

6. When a stream is daylighted the applicant shall prepare and record a legal document describing the reduced WRA required by subsections (G)(1) and (5) of this section. The document will be signed by a representative of the City and recorded at the applicant's expense to better ensure long term recognition of the reduced WRA and reduced restrictions for the daylighted stream section.

Response: There are no proposed piped streams for this development.

H. The following habitat friendly development practices shall be incorporated into the design of any improvements or projects in the WRA to the degree possible:

1. Restore disturbed soils to original or higher level of porosity to regain infiltration and storm water storage capacity.

Response: This section will be met. Disturbed soils during construction will be restored to original level of porosity to regain infiltration and stormwater storage capacity.

2. Apply a treatment train or series of storm water treatment measures to provide multiple opportunities for storm water treatment and reduce the possibility of system failure.

Response: This section is met. The proposed stormwater design will collect water from the roofs into the planter. This planter is sized to handle the proposed development and will have an overflow pipe that runs down to a flow spreader before discharging into the creek.

3. Incorporate storm water management in road rights-of-way.

Response: There is no proposed incorporation of stormwater management in the road right-of-way. The road right-of-way is insufficient in size to provide adequate stormwater management.

4. Landscape with rain gardens to provide on-lot detention, filtering of rainwater, and groundwater recharge.

Response: This section is met. The proposed rain garden is on-lot and provides detention, filtering of rainwater, and groundwater recharge.

5. Use multi-functional open drainage systems in lieu of conventional curb-and-gutter systems.

Response: This section is met. A portion of the driveway will drain to a standard curb-and-gutter system. All roof runoff will be conveyed by the rain garden.

6. Use green roofs for runoff reduction, energy savings, improved air quality, and enhanced aesthetics.

Response: There are no proposed green roofs.

7. Retain rooftop runoff in a rain barrel for later on-lot use in lawn and garden watering.

Response: There is no proposed rain barrel for this site. A majority of the lot is within the WRA will remain protected.

8. Disconnect downspouts from roofs and direct the flow to vegetated infiltration/filtration areas such as rain gardens.

Response: This section is met. All roof runoff will be conveyed through the rain garden and overflow will be piped down to a flow spreader near the creek.

9. Use pervious paving materials for driveways, parking lots, sidewalks, patios, and walkways.

Response: This section is met. The proposed deck will be constructed with pressure treated wood.

10. Reduce sidewalk width to a minimum four feet. Grade the sidewalk so it drains to the front yard of a residential lot or retention area instead of towards the street.

Response: There is no existing sidewalk. A four foot sidewalk will be constructed if the city requires one.

11. Use shared driveways.

Response: There are no opportunities for shared driveways for the proposed site.

12. Reduce width of residential streets and driveways, especially at WRA crossings.

Response: The proposed development has an existing street and will utilize this street as an access point for the driveway.

13. Reduce street length, primarily in residential areas, by encouraging clustering.

Response: The proposed development is connecting to existing streets.

14. Reduce cul-de-sac radii and use pervious and/or vegetated islands in center to minimize impervious surfaces.

Response: The proposed development is connecting to existing streets.

15. Use previously developed areas (PDAs) when given an option of developing PDA versus non-PDA land.

Response: This section is met. The proposed development is an area that was previous developed.

16. Minimize the building, hardscape and disturbance footprint.

Response: This section is met. The location of the proposed house is to minimize the disturbance on the WRA. Refer to preliminary site plans for additional details.

17. Consider multi-story construction over a bigger footprint. (Ord. 1623 § 1, 2014; Ord. 1635 § 19, 2014)

Response: This section is met. The proposed house will be multi-story to have a smaller footprint.

32.090 MITIGATION PLAN

A A mitigation plan shall only be required if development is proposed within a WRA (including development of a PDA). (Exempted activities of CDC 32.040 do not require mitigation unless specifically stated. Temporarily disturbed areas, including TDAs associated with exempted activities, do not require mitigation, just grade and soil restoration and re-vegetation.) The mitigation plan shall satisfy all applicable provisions of CDC 32.100, Re-Vegetation Plan Requirements.

B. Mitigation shall take place in the following locations, according to the following priorities (subsections (B)(1) through (4) of this section):

1. On-site mitigation by restoring, creating or enhancing WRAs.

Response: The proposed stormwater conveyance system will disturbed approximately 350 SF of the WRA. This area will be replanted with native plants.

2. Off-site mitigation in the same sub-watershed will be allowed, but only if the applicant has demonstrated that:

a. It is not practicable to complete mitigation on-site, for example, there is not enough area on-site; and

b. The mitigation will provide equal or superior ecological function and value.

Response: There is no proposed mitigation off-site.

3. Off-site mitigation outside the sub-watershed will be allowed, but only if the applicant has demonstrated that:

a. It is not practicable to complete mitigation on-site, for example, there is not enough area on-site; and

b. The mitigation will provide equal or superior ecological function and value.

Response: There is no proposed mitigation off-site.

4. Purchasing mitigation credits though DSL or other acceptable mitigation bank.

Response: The proposed development will not be purchasing any mitigation credits.

C. Amount of mitigation.

1. The amount of mitigation shall be based on the square footage of the permanent disturbance area by the application. For every one square foot of non-PDA disturbed area, on-site mitigation shall require one square foot of WRA to be created, enhanced or restored.

Response: This section will be met. The proposed stormwater system will disturb 350 SF and will be restored and replanted with native vegetation.

2. For every one square foot of PDA that is disturbed, on-site mitigation shall require one half a square foot of WRA vegetation to be created, enhanced or restored.

Response: There is no PDA that is being disturbed with this development.

3. For any off-site mitigation, including the use of DSL mitigation credits, the requirement shall be for every one square foot of WRA that is disturbed, two square feet of WRA shall be created, enhanced or restored. The DSL mitigation credits program or mitigation bank shall require a legitimate bid on the cost of on-site mitigation multiplied by two to arrive at the appropriate dollar amount.

Response: The development is not proposing any off-site mitigation.

D. The Planning Director may limit or define the scope of the mitigation plan and submittal requirements commensurate with the scale of the disturbance relative to the resource and pursuant to the authority of Chapter 99 CDC. The Planning Director may determine that a consultant is required to complete all or a part of the mitigation plan requirements.

E. A mitigation plan shall contain the following information:

1. A list of all responsible parties including, but not limited to, the owner, applicant, contractor, or other persons responsible for work on the development site.

2. A map showing where the specific adverse impacts will occur and where the mitigation activities will occur.

0CDC 32.100.

4. An implementation schedule, including timeline for construction, mitigation, mitigation maintenance, monitoring, and reporting. All in-stream work in fish bearing streams shall be done in accordance with the Oregon Department of Fish and Wildlife.

5. Assurances shall be established to rectify any mitigation actions that are not successful within the first three years. This may include bonding or other surety. (Ord. 1623 § 1, 2014)

Response: This section is met. Refer to the preliminary site plans for additional information on the mitigation plan.

32.100 RE-VEGETATION PLAN REQUIREMENTS

A. In order to achieve the goal of re-establishing forested canopy, native shrub and ground cover and to meet the mitigation requirements of CDC 32.090 and vegetative enhancement of CDC 32.080, tree and vegetation plantings are required according to the following standards:

1. All trees, shrubs and ground cover to be planted must be native plants selected from the Portland Plant List.

2. Plant size. Replacement trees must be at least one-half inch in caliper, measured at six inches above the ground level for field grown trees or above the soil line for container grown trees (the one-half inch minimum size may be an average caliper measure, recognizing that trees are not uniformly round), unless they are oak or madrone which may be one gallon size. Shrubs must be in at least a one-gallon container or the equivalent in ball and burlap and must be at least 12 inches in height.

3. Plant coverage.

a. Native trees and shrubs are required to be planted at a rate of five trees and 25 shrubs per every 500 square feet of disturbance area (calculated by dividing the number of square feet of disturbance area by 500, and then multiplying that result times five trees and 25 shrubs, and rounding all fractions to the nearest whole number of trees and

shrubs; for example, if there will be 330 square feet of disturbance area, then 330 divided by 500 equals 0.66, and 0.66 times five equals 3.3, so three trees must be planted, and 0.66 times 25 equals 16.5, so 17 shrubs must be planted). Bare ground must be planted or seeded with native grasses or herbs. Non-native sterile wheat grass may also be planted or seeded, in equal or lesser proportion to the native grasses or herbs.

b. Trees shall be planted between eight and 12 feet on center and shrubs shall be planted between four and five feet on center, or clustered in single species groups of no more than four plants, with each cluster planted between eight and 10 feet on center. When planting near existing trees, the dripline of the existing tree shall be the starting point for plant spacing measurements.

4. Plant diversity. Shrubs must consist of at least two different species. If 10 trees or more are planted, then no more than 50 percent of the trees may be of the same genus.

5. Invasive vegetation. Invasive non-native or noxious vegetation must be removed within the mitigation area prior to planting.

6. Tree and shrub survival. A minimum survival rate of 80 percent of the trees and shrubs planted is expected by the third anniversary of the date that the mitigation planting is completed.

7. Monitoring and reporting. Monitoring of the mitigation site is the ongoing responsibility of the property owner. Plants that die must be replaced in kind.

8. To enhance survival of tree replacement and plantings, the following practices are required:

a. Mulching. Mulch new plantings a minimum of three inches in depth and 18 inches in diameter to retain moisture and discourage weed growth.

b. Irrigation. Water new plantings one inch per week between June 15th to October 15th, for the three years following planting.

c. Weed control. Remove, or control, non-native or noxious vegetation throughout maintenance period.

d. Planting season. Plant bare root trees between December 1st and February 28th, and potted plants between October 15th and April 30th.

e. Wildlife protection. Use plant sleeves or fencing to protect trees and shrubs against wildlife browsing and resulting damage to plants.

B. When weather or other conditions prohibit planting according to schedule, the applicant shall ensure that disturbed areas are correctly protected with erosion control measures and shall provide

the City with funds in the amount of 125 percent of a bid from a recognized landscaper or nursery which will cover the cost of the plant materials, installation and any follow up maintenance. Once the planting conditions are favorable the applicant shall proceed with the plantings and receive the funds back from the City upon completion, or the City will complete the plantings using those funds. (Ord. 1623 § 1, 2014)

Response: Landscaping plans will be submitted when building permits are applied for.

32.110 HARDSHIP PROVISIONS

The purpose of this section is to ensure that compliance with this chapter does not deprive an owner of reasonable use of land. To avoid such instances, the requirements of this chapter may be reduced. The decision-making authority may impose such conditions as are deemed necessary to limit any adverse impacts that may result from granting relief. The burden shall be on the applicant to demonstrate that the standards of this chapter, including Table 32-2, Required Width of WRA, will deny the applicant "reasonable use" of his/her property.

Response: The proposed development qualifies for hardship provisions but does not seek it at this time. This development meets the sections listed above.

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Exhibit C

Metro 2005 Habitat Conservation Areas (HCAs)

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Metro 2005
Habitat Conservation Areas (HCAs)

Conservation Area

- High
- Moderate
- Low
- Habitat and Impact Areas no designated as HCAs

- West Linn Exceptions

West Linn Exceptions include the Planning Director's land use decisions: MISC-08-19, MISC-10-26, and memo dated January 25, 2011

Data Source: Metro Data Resource Center
Habitat Conservation Areas Map December 15, 2005
Urban Growth Management Functional Plan
Title 13, Nature in Neighborhoods
Adopted Sept. 29, 2005 (Metro Ordinance No. 05 -1077C)
Amended Dec. 8, 2005 (Metro Ordinance No. 05 -1097A)

Exhibit D

Geotechnical Report

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GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

Geotechnical Engineering Report

Robin's View Drive
Clackamas County Tax Parcel 00297244
West Linn, Oregon 97068

GeoPacific Engineering, Inc. Job No. 16-4131
March 18, 2016

14835 SW 72nd Avenue
Portland, Oregon 97224

Tel (503) 598-8445
Fax (503) 941-9281

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Real-World Geotechnical Solutions
Investigation • Design • Construction Support

March 17, 2016
Project No. 16-4131

BC Custom Homes
Mr. Bill Winkenbach
410 High Street
Oregon City, Oregon 97045
Phone: (503) 722-8700

SUBJECT: GEOTECHNICAL ENGINEERING REPORT
ROBIN'S VIEW DRIVE
CLACKAMAS COUNTY TAX PARCEL 00297244
WEST LINN, OREGON 97068

PROJECT INFORMATION

This report presents the results of a geotechnical engineering study conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our investigation was to evaluate subsurface conditions at the site, and to provide geotechnical recommendations for site development. This geotechnical study was performed in accordance with GeoPacific Agreement for Geotechnical Services P-5537, dated January 26, 2016, and your subsequent authorization of our proposal and *General Conditions for Geotechnical Services*.

Location:	Clackamas County Tax Lot 00297244 Robin's View Drive West Linn, Oregon NW ¼ Sec 13, T2S, R1E, Willamette Meridian (see Figure 1)
Property Owner:	BC Custom Homes 410 High Street Oregon City, Oregon 97045
Jurisdictional Agency:	City of West Linn, Oregon
Prepared By:	GeoPacific Engineering, Inc 14835 SW 72nd Avenue Portland, Oregon 97224 Tel (503) 598-8445 Fax (503) 941-9281

SITE AND PROJECT DESCRIPTION

The site is comprised of Clackamas County tax parcel 00297244 in West Linn, Oregon, totaling approximately 0.99-acres in size, and is irregular in shape. The property is located adjacent to the west of 3600 Robin View Drive, and adjacent to the east of 18822 Old River Drive. The site is bordered to the northwest by Robins View Drive, and to the south by a steep sloping area which extends to a creek. Currently the site contains an abandoned residential home, a detached garage, and pavement areas in the northwestern portion. The central and south eastern portions of the lot are heavily vegetated with coniferous trees and dense, understory vegetation.

Topography in the northern and northwestern portion of the lot where the existing home is located slopes gently to the southeast with site gradients ranging from approximately 1 to 10 percent. To the southeast, the lot slopes moderately approximately 100 feet with site gradients ranging from approximately 10 to 20 percent. Approximately 200 feet southeast of the northern property boundary, the lot slopes steeply approximately 40 feet vertically to a creek below. The steeply sloping creek bank contains gradients ranging from approximately 100 to 150 percent. Based upon review of a topographic survey provided by the client, site elevations range from approximately 50 to 108 feet above mean sea level (amsl). The approximate site latitude and longitude is 45.395201, -122.639736, and the legal description is the NW ¼ of Section 13, T2S, R1E, Willamette Meridian. The regulatory jurisdictional agency is the City of West Linn, Oregon.

As indicated on Figure 2, GeoPacific understands that development at the site will consist of construction of a two-story, wood framed, residential home, incorporating typical spread foundations and crawl space, at the approximate northwestern edge of the property, where site gradients are under twenty percent. Based upon our review of the site plan, we understand that the rear footing line will be located approximately sixty-five to seventy feet from the break in slope where site gradients exceed twenty-five percent. We understand that a private driveway will be constructed extending from Robin's View Drive to the new residence, which will likely include installation of new underground utilities. We anticipate maximum structural loads of the proposed house foundation to be on the order of 1,500 psf. We anticipate cuts to be on the order of five feet or less. We anticipate limited fill placement.

REGIONAL GEOLOGIC SETTING

Regionally, the subject site lies within the Willamette Valley/Puget Sound lowland, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. A series of discontinuous faults subdivide the Willamette Valley into a mosaic of fault-bounded, structural blocks (Yeats et al., 1996). Uplifted structural blocks form bedrock highlands, while down-warped structural blocks form sedimentary basins.

According to the *Geologic Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon* (State of Oregon Department of Geology and Mineral Industries, Hull, Donald A. 1989), near-surface soils are expected to consist of Pleistocene-aged (approximately 2.6 million to 12,000 years ago), coarse sand to silt deposited by repeated catastrophic flood outbursts of Glacial Lake Missoula (Qff). Underlying the flood deposits, geologic mapping indicates that soils likely consist of the middle Miocene-aged (approximately 23 to 5.3 million years ago) Basalts of Sand Hollow (Tfsh). The basalts are generally composed of dense,

finely crystalline rock that is commonly fractured along blocky and columnar vertical joints. *The Relative Earthquake Hazard Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon* (State of Oregon Department of Geology and Mineral Industries, Hull, Donald, A., 1995), indicates that the subject site is located within Zone A. Zone A is indicates areas of the greatest hazard. *The Web Soil Survey (United States Department of Agriculture, Natural Resource Conservation Service (USDA NRCS 2016 Website)*, indicates that near-surface soils primarily consist of the Woodburn silt loam soils series. Woodburn series soils generally consist of very deep, moderately well drained silts and sands that formed in silty stratified, glacio-lacustrine deposits.

REGIONAL SEISMIC SETTING

At least four major fault zones capable of generating damaging earthquakes are thought to exist in the vicinity of the subject site. These include the Portland Hills Fault Zone, the Lacamas Creek/Sandy River Fault Zone, the Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that include the central Portland Hills Fault, the western Oatfield Fault, and the eastern East Bank Fault. These faults occur in a northwest-trending zone that varies in width between 3.5 and 5.0 miles. The combined three faults reportedly vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years) sediment (Madin, 1990). The Portland Hills Fault occurs along the Willamette River at the base of the Portland Hills, and is located approximately 2.4 miles northeast of the site. The Oatfield Fault occurs along the western side of the Portland Hills, and is located approximately 1.2 miles southwest of the site. The East Bank Fault occurs along the eastern margin of the Willamette River, and is located approximately 6.1 miles northeast of the site. The accuracy of the fault mapping is stated to be within 500 meters (Wong, et al., 2000).

According to the USGS Earthquake Hazards Program, the fault was originally mapped as a down-to-the-northeast normal fault, but has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults, and as a steep escarpment caused by asymmetrical folding above a south-west dipping, blind thrust fault. The Portland Hills fault offsets Miocene Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene aged Missoula flood deposits. No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

Lacamas Creek / Sandy River Fault Zone

The northwest trending Lacamas Creek Fault intersects the northeast trending Sandy River Fault north of Camas, Washington at Lacamas Lake, approximately 18.5 miles northeast of the subject

site. According to the USGS Earthquake Hazards Program the fault has been mapped as a normal fault with down-to-the-southwest displacement, and has also been described as a steeply northeast or southwest-dipping, oblique, right-lateral, slip-fault. The trace of the Lacamas Lake fault is marked by the very linear lower reach of Lacamas Creek. No fault scarps on Quaternary surficial deposits have been described. The Lacamas Lake fault offsets Pliocene-aged sedimentary conglomerates generally identified as the Troutdale formation, and Pliocene to Pleistocene aged basalts generally identified as the Boring Lava formation. Recent seismic reflection data across the probable trace of the fault under the Columbia River yielded no unequivocal evidence of displacement underlying the Missoula flood deposits, however, recorded mild seismic activity during the recent past indicates this area may be potentially seismogenic.

Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW-trending faults that lies about 17.4 miles southwest of the subject site. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment (Yeats et al., 1996; Werner et al., 1992). A geologic reconnaissance and photogeologic analysis study conducted for the Scoggins Dam site in the Tualatin Basin revealed no evidence of deformed geomorphic surfaces along the structural zone (Unruh et al., 1994). No seismicity has been recorded on the Gales Creek Fault or Newberg Fault (the fault closest to the subject site); however, these faults are considered to be potentially active because they may connect with the seismically active Mount Angel Fault and the rupture plane of the 1993 M5.6 Scotts Mills earthquake (Werner et al. 1992; Geomatrix Consultants, 1995).

According to the USGS Earthquake Hazards Program, the Mount Angel fault is mapped as a high-angle, reverse-oblique fault, which offsets Miocene rocks of the Columbia River Basalts, and Miocene and Pliocene sedimentary rocks. The fault appears to have controlled emplacement of the Frenchman Spring Member of the Wanapum Basalts, and thus must have a history that predates the Miocene age of these rocks. No unequivocal evidence of deformation of Quaternary deposits has been described, but a thick sequence of sediments deposited by the Missoula floods covers much of the southern part of the fault trace.

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year (Goldfinger et al., 1996). A growing body of geologic evidence suggests that prehistoric subduction zone earthquakes have occurred (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). This evidence includes: (1) buried tidal marshes recording episodic, sudden subsidence along the coast of northern California, Oregon, and Washington, (2) burial of subsided tidal marshes by tsunami wave deposits, (3) paleoliquefaction features, and (4) geodetic uplift patterns on the Oregon coast. Radiocarbon dates on buried tidal marshes indicate a recurrence interval for major subduction zone earthquakes of 250 to 650 years with the last event occurring 300 years ago (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). The inferred seismogenic portion of the plate interface lies approximately along the Oregon Coast at depths of between 20 and 40 kilometers below the surface.

FIELD EXPLORATION AND SUBSURFACE CONDITIONS

Our site-specific explorations for this report were conducted on March 7, 2016. One exploratory soil boring (B-1) was drilled at the site to a depth of 41.5 feet below the existing ground surface (bgs) using a track-mounted, solid-stem drill system subcontracted by GeoPacific. At each boring location, SPT (Standard Penetration Test) sampling was performed in general accordance with ASTM D1586 using a 2-inch outside diameter split-spoon sampler and a 140-pound hammer equipped with a rope and cathead mechanism. During the test, a sample is obtained by driving the sampler 18 inches into the soil with the hammer free-falling 30 inches. The number of blows for each 6 inches of penetration is recorded. The Standard Penetration Resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration. If 50 or more blows are recorded within a single 6-inch interval, the test is terminated, and the blow count is recorded as 50 blows for the number of inches driven. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. In addition, a total of three exploratory test pits (TP-1 through TP-3) were excavated at the site to a maximum depth of 10 feet bgs using a track-mounted excavator subcontracted by GeoPacific. The approximate locations of the explorations are indicated on Figure 2.

It should be noted that exploration locations were located in the field by pacing or taping distances from apparent property corners and other site features shown on the plans provided. As such, the locations of the explorations should be considered approximate. During the explorations, GeoPacific observed and recorded pertinent soil information such as color, stratigraphy, strength, and soil moisture content. Soils were classified in general accordance with the Unified Soil Classification System (USCS). At the completion of each test, the soil boring was backfilled with bentonite chips, and the test pits were backfilled loosely with onsite soil. Exploration logs are presented in the appendix of this report. Soil and groundwater conditions encountered in the explorations are summarized below.

Soil Descriptions

Topsoil: Underlying the ground surface at the locations of our test pit explorations, soils were observed to consist of dark brown, very moist, moderately organic Lean CLAY (OL-CL), containing blackberry and tree roots. The topsoil horizon was observed to be approximately 24-inches-thick at the locations explored. It is likely that the thickness of the organic soil layers will increase in areas where trees are present.

Lean CLAY: Underlying the topsoil at the locations of our explorations, soils were observed to consist of brown, very moist, soft to medium stiff, Lean CLAY (CL). This soil type was observed to extend to a depth of 10 feet within our soil boring exploration. Pocket penetrometer readings conducted within the upper four feet of the test pit explorations indicated unconfined compressive strengths ranging from 0.5 to 2.5 tons/ft^2. SPT blow count N-values ranged from 3 to 6. In general, the upper two or three feet of the soil profile displayed soft soil conditions. Below a depth of two feet soil stiffness increased. The soil type classified as Lean CLAY (CL), according to the USCS soil classification system.

Sandy SILT: Underlying the Lean CLAY at the location of our soil boring, soils were observed to consist of brown, very moist, soft to medium stiff, low plasticity, Sandy SILT (ML), containing fine sand. This soil type was observed to extend to a depth of 25 feet within our soil boring exploration.

SPT blow count N-values ranged from 4 to 7. The soil type classified as Sandy SILT (ML), according to the USCS soil classification system.

Silty SAND: Underlying the Sandy SILT at the location of our soil boring, soils were observed to consist of light brown, damp to moist, loose to medium dense, low plasticity, Silty SAND (SM), containing fine to medium sized sand. This soil type was observed to extend to a depth of 37 feet within our soil boring exploration. SPT blow count N-values ranged from 6 to 11. The soil type classified as Silty SAND (SM), according to the USCS soil classification system.

Clayey GRAVEL: Underlying the Silty SAND at the location of our soil boring, soils were observed to consist of red brown to orange and black, Clayey GRAVEL (GC), containing a Lean CLAY matrix with angular basalt and subrounded andesite fragments. The soil type appeared to be partially cemented. This soil type was observed to extend to the maximum depth of exploration within our soil boring exploration. An SPT blow count N-value of 70 was measured within the soil layer. The soil type classified as Clayey GRAVEL (GC), according to the USCS soil classification system.

Groundwater and Soil Moisture

On March 7, 2016, observed soil moisture conditions were generally damp to very moist. Groundwater was not encountered within our explorations which extended to a maximum depth of approximately 41.5 feet bgs. The creek at the bottom of the slope on the southern portion of the site was observed to contain water. According to the *Estimated Depth to Groundwater in the Portland, Oregon Area, (United States Geological Survey, Snyder, 2015 website)*, groundwater is expected to be present at an approximate depth of 49 feet below the ground surface. It is anticipated that groundwater conditions will vary depending on the season, local subsurface conditions, changes in site utilization, and other factors. Perched groundwater may be encountered in localized areas. Seeps and springs may exist in areas not explored, and may become evident during site grading.

Quantitative Slope Stability Modeling

GeoPacific conducted a quantitative slope stability analysis of the proposed development at the subject site. The proposed development plan, topographic site map, approximate subsurface exploration locations, and geologic cross-section A to A', is indicated on the attached Figures 2 and 3. Slope-W cross-sections are presented in the appendix of this report.

Quantitative slope stability modeling and analyses were performed to evaluate slope stability on the site under existing, pre-construction, and post-construction conditions using the SLOPE/W computer program developed by Geo-Slope International of Calgary, Canada. This numerical analysis program utilizes a two-dimensional limiting equilibrium method to calculate the factor of safety of a potential slip surface, and incorporates search routines to identify the most critical potential failure surfaces for the cases analyzed. Factors of safety were calculated using the Morgenstern-Price method of slices.

Existing subsurface conditions through the proposed development area were modeled as a four-layer system with layers consisting of Lean CLAY, Sandy SILT, Silty SAND, and Clayey

GRAVEL; representative of soil conditions encountered within our subsurface explorations. Slope topography, subsurface geometry, and other conditions modeled in the analyses are based on field measurements, LIDAR and USGS topographic mapping, and topographic data provided by the client.

Slope Stability Calculations A to A'

For stability calculations of the southeast facing slope with the structural load of the proposed development, the potential failure model was considered primarily as circular or planar sliding along a basal shear surface. Shear strength parameters used in the models were selected based on soil conditions encountered within our subsurface explorations, SPT N-values, and our local experience with similar soil and geologic conditions. The internal angle of friction of each soil type was estimated based on empirical correlations of SPT N-Value measurements, soil type, and vertical effective stress (adapted from DeMello, 1971, Coduto, 2001, Figure 4.11). We recommend Site Class D be used for design per the 2014 Oregon Structural Specialty Code (OSSC) Table 1613.5.2, and as defined in ASCE 7, Chapter 20, Table 20.3-1. Peak horizontal ground acceleration values used in seismic analysis were obtained in accordance with Section 1803.5.12 of the 2014 OSSC.

The slope stability analysis was conducted at the site in order to identify the factor of safety against sliding with the proposed development as we understand it, including the proposed house located as indicated on Figure 2, and a structural load of 1,500 psf. Existing conditions soil parameters assumed in the stability calculations are summarized in Table 1. The results of our analysis are summarized in Table 2. Slope stability analysis cross-sections are presented as attachments to this report. The location of the geologic cross-section is indicated on Figure 2, and presented in Figure 3.

Table 1 - Summary of Estimated Soil Strength Parameters – A to A'

Geologic Unit	Wet Unit Weight (pcf)	Friction Angle	Cohesion (psf)
Lean CLAY (CL)	115	28°	200
Sandy SILT (ML)	120	29°	150
Silty SAND (SM)	120	30°	0
Clayey GRAVEL (GM)	125	32°	50

Table 2 - Summary of Slope Stability Analyses for In-Situ Soil Conditions A to A'

Condition Analyzed	Factor of Safety
Section A-A' Southeast Facing Slope with Proposed Development	1.52 Static Minimum 50 Foot Slope Setback
	1.13 Pseudostatic (PGA = 0.418g, ½ PGA = 0.209 g) Minimum 65 Foot Slope Setback

The results of the quantitative slope stability modeling and analyses performed using the SLOPE/W computer program indicate that the factor of safety against slope instability under existing soil conditions at the subject site is greater than 1.5 for static conditions, and greater than 1.1 for seismic conditions, with the proposed development as we understand it. The analysis

indicates that the rear house footings should maintain a minimum footing-to-slope setback distance from the portion of the south facing slope which contains gradients steeper than twenty-five percent, of at least fifty feet for static conditions, and at least sixty-five feet for seismic conditions. The proposed development plan indicates that minimum setback distances will be achieved.

This analysis is based upon the conditions described above. Should actual loading increase from the assumed value of 1,500 psf, or the house location encroach within the distances noted above, GeoPacific should be contacted to re-evaluate slope stability.

CONCLUSIONS AND RECOMMENDATIONS

Our site investigation indicated that the proposed construction is geotechnically feasible, provided that the recommendations of this report are incorporated into the design and construction phases of the project. The primary geotechnical concerns associated with development of the site are 1) thick organic horizons, and soft soils in the upper two to three feet of the ground surface, and 2) maintaining adequate footing-to-slope setback distances from the steep, southern portions of the lot.

Site Preparation Recommendations

Areas of proposed construction and areas to receive fill should be cleared of vegetation, stockpiled soils, and any organic and inorganic debris. Inorganic debris and organic materials from clearing should be removed from the site. Organic-rich soils and root zones should then be stripped from construction areas of the site or where engineered fill is to be placed. Depth of stripping of organic soils is estimated to be approximately 18 to 24 inches across the majority of the site, however depth of organic soil layers may increase in areas where trees are present. The final depth of soil removal will be determined on the basis of a site inspection after the stripping/excavation has been performed. Stripped topsoil should be removed from the site. Any remaining topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative. Prior to placement of engineered fill, subgrade soils should be aerated and recompacted.

The site contains existing structures which will be demolished. If encountered, undocumented fills and any subsurface structures (dry wells, basements, driveway and landscaping fill, old utility lines, septic leach fields, etc.) should be completely removed and the excavations backfilled with engineered fill.

Engineered Fill

All grading for the proposed construction should be performed as engineered grading in accordance with the applicable building code at the time of construction with the exceptions and additions noted herein. Areas proposed for fill placement should be prepared as described in the site preparation section. Surface soils should then be scarified and recompacted prior to placement of structural fill. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 95 percent of the maximum dry density determined by ASTM D698 (Standard Proctor) or equivalent. Field density testing should conform to ASTM D2922 and D3017, or D1556. All engineered fill should be observed and tested by the project geotechnical engineer or his representative. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more testing. Because testing is performed on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency. Site earthwork will be impacted by soil moisture and shallow groundwater conditions.

Excavating Conditions and Utility Trench Backfill

We anticipate that on-site soils can be excavated using conventional heavy equipment. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions. All temporary cuts in excess of 4 feet in height should be sloped in accordance with U.S. Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1926), or be shored. The existing soils classify as Type B Soil and temporary excavation side slope inclinations as steep as 1H:1V may be assumed for planning purposes. This cut slope inclination is applicable to excavations above the water table only.

Shallow, perched groundwater may be encountered during the wet weather season and should be anticipated in excavations and utility trenches. Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321 and City of West Linn standards. We recommend that structural trench backfill be compacted to at least 95 percent of the maximum dry density obtained by the Modified Proctor (ASTM D1557) or equivalent. Initial backfill lift thicknesses for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

Adequate density testing should be performed during construction to verify that the recommended relative compaction is achieved. Typically, at least one density test is taken for every 4 vertical feet of backfill on each 200-lineal-foot section of trench.

Erosion Control Considerations

During our field exploration program, we did not observe soil conditions that would be considered highly susceptible to erosion. In our opinion, the primary concern regarding erosion potential will occur during construction in areas that have been stripped of vegetation. Erosion at the site during

construction can be minimized by implementing the project erosion control plan, which should include judicious use of straw waddles, fiber rolls, and silt fences. If used, these erosion control devices should remain in place throughout site preparation and construction.

Erosion and sedimentation of exposed soils can also be minimized by quickly re-vegetating exposed areas of soil, and by staging construction such that large areas of the project site are not denuded and exposed at the same time. Areas of exposed soil requiring immediate and/or temporary protection against exposure should be covered with either mulch or erosion control netting/blankets. Areas of exposed soil requiring permanent stabilization should be seeded with an approved grass seed mixture, or hydroseeded with an approved seed-mulch-fertilizer mixture.

Wet Weather Earthwork

Soils underlying the site are likely to be moisture sensitive and may be difficult to handle or traverse with construction equipment during periods of wet weather. Earthwork is typically most economical when performed under dry weather conditions. Earthwork performed during the wet-weather season will probably require expensive measures such as cement treatment or imported granular material to compact areas where fill may be proposed to the recommended engineering specifications. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions when soil moisture content is difficult to control, the following recommendations should be incorporated into the contract specifications.

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean engineered fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic;
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water;
- Material used as engineered fill should consist of clean, granular soil containing less than 5 percent passing the No. 200 sieve. The fines should be non-plastic. Alternatively, cement treatment of on-site soils may be performed to facilitate wet weather placement;
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials;
- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed and suitable compaction and site drainage is achieved; and
- Geotextile silt fences, straw waddles, and fiber rolls should be strategically located to control erosion.

If cement or lime treatment is used to facilitate wet weather construction, GeoPacific should be contacted to provide additional recommendations and field monitoring.

Spread Foundations

The proposed residential structure may be supported on a shallow foundation bearing on stiff, competent undisturbed, native soils and/or engineered fill, appropriately designed and constructed as recommended in this report. Foundation design, construction, and setback requirements should conform to the applicable building code at the time of construction. For maximization of bearing strength and protection against frost heave, spread footings should be embedded at a minimum depth of 18 inches below exterior grade. Foundations should be designed by a licensed structural engineer. Due to the presence of soft soil identified within the upper two to three feet of the ground surface, we recommend either extending the footings to a minimum depth of 2 to 2½ feet bgs, or removal of the soft soils to the noted depth, and replacement with compacted crushed aggregate.

The anticipated allowable soil bearing pressure is 1,500 lbs/ft^2 for footings bearing on competent, native soil and/or engineered fill. The anticipated allowable soil bearing pressure is 2,000 lbs/ft^2 for footings bearing on a minimum of 24 inches of compacted crushed aggregate, placed on stiff native soils which were identified at depths of 2 to 2½ feet bgs within our test pit explorations. The recommended maximum allowable bearing pressure may be increased by 1/3 for short-term transient conditions such as wind and seismic loading. For heavier loads, the geotechnical engineer should be consulted. If heavier loads than described above are proposed, it may be necessary to over-excavate point load areas and replace with compacted crushed aggregate. The coefficient of friction between on-site soil and poured-in-place concrete may be taken as 0.42, which includes no factor of safety. The maximum anticipated total and differential footing movements (generally from soil expansion and/or settlement) are 1 inch and ¾ inch over a span of 20 feet, respectively. We anticipate that the majority of the estimated settlement will occur during construction, as loads are applied. Excavations near structural footings should not extend within a 1H:1V plane projected downward from the bottom edge of footings.

Footing excavations should penetrate through topsoil and any disturbed soil to competent subgrade that is suitable for bearing support. All footing excavations should be trimmed neat, and all loose or softened soil should be removed from the excavation bottom prior to placing reinforcing steel bars. Due to the moisture sensitivity of on-site native soils, foundations constructed during the wet weather season may require over-excavation of footings and backfill with compacted, crushed aggregate.

Our recommendations are for residential construction incorporating raised wood floors and conventional spread footing foundations. After site development, a Final Soil Engineer's Report should either confirm or modify the above recommendations.

Concrete Slab-on-Grade

Preparation of areas beneath concrete slab-on-grade floors should be performed as recommended in the *Site Preparation Recommendations* section. Care should be taken during excavation for foundations and floor slabs, to avoid disturbing subgrade soils. If subgrade soils have been adversely impacted by wet weather or otherwise disturbed, the surficial soils should be scarified to a minimum depth of 8 inches, moisture conditioned to within about 3 percent of optimum moisture content, and compacted to engineered fill specifications. Alternatively, disturbed soils may be removed and the removal zone backfilled with additional crushed rock.

For evaluation of the concrete slab-on-grade floors using the beam on elastic foundation method, a modulus of subgrade reaction of 150 kcf (87 pci) should be assumed for the stiff, fine-grained soils anticipated to be present in the upper four feet at the site. This value assumes the concrete slab system is designed and constructed as recommended herein, with a minimum thickness of 12 inches of 1½"-0 crushed aggregate beneath the slab. The total thickness of crushed aggregate will be dependent on the subgrade conditions at the time of construction, and should be verified visually by proof-rolling. Under-slab aggregate should be compacted to at least 95 percent of its maximum dry density as determined by ASTM D1557 (Modified Proctor) or equivalent.

In areas where moisture will be detrimental to floor coverings or equipment inside the proposed structure, appropriate vapor barrier and damp-proofing measures should be implemented. A commonly applied vapor barrier system consists of a 10-mil polyethylene vapor barrier placed directly over the capillary break material. Other damp/vapor barrier systems may also be feasible. Appropriate design professionals should be consulted regarding vapor barrier and damp proofing systems, ventilation, building material selection and mold prevention issues, which are outside GeoPacific's area of expertise.

Drainage

The outside edge of the house footings shall be provided with a drainage system consisting of 3-inch diameter, slotted, flexible plastic pipe embedded in a minimum of 1 ft^3 per lineal foot of clean, free-draining gravel or 1½" - ¾" drain rock. A typical perimeter footing drain detail is presented in Figure 5. The drain pipe and surrounding drain rock should be wrapped in non-woven geotextile (Mirafi 140N, or approved equivalent) to minimize the potential for clogging and/or ground loss due to piping. Water collected from the footing drains should be directed into the local storm drain system or other suitable outlet. A minimum 1 percent fall should be maintained throughout the drain and non-perforated pipe outlet. The footing drains should include clean-outs to allow periodic maintenance and inspection. In our opinion, footing drains may outlet at the curb, or on the back sides of lots where sufficient fall is not available to allow drainage to the street.

Construction should include typical measures for controlling subsurface water beneath the homes, including positive crawlspace drainage to an adequate low-point drain exiting the foundation, visqueen covering the exposed ground in the crawlspace, and crawlspace ventilation (foundation vents). The building owners should be informed and educated that some slow flowing water in the crawlspaces is considered normal and not necessarily detrimental to the structures given these other design elements incorporated into its construction. Appropriate design professionals should be consulted regarding crawlspace ventilation, building material selection and mold prevention issues, which are outside GeoPacific's area of expertise.

Down spouts and roof drains should collect roof water in a system separate from the footing drains in order to reduce the potential for clogging. Roof drain water should be directed to an appropriate discharge point well away from structural foundations. Grades should be sloped downward and away from buildings to reduce the potential for ponded water near structures.

Permanent Below-Grade Walls

Lateral earth pressures against below-grade retaining walls will depend upon the inclination of any adjacent slopes, type of backfill, degree of wall restraint, method of backfill placement, degree of backfill compaction, drainage provisions, and magnitude and location of any adjacent surcharge loads. At-rest soil pressure is exerted on a retaining wall when it is restrained against rotation. In contrast, active soil pressure will be exerted on a wall if its top is allowed to rotate or yield a distance of roughly 0.001 times its height or greater.

If the subject retaining walls will be free to rotate at the top, they should be designed for an active earth pressure equivalent to that generated by a fluid weighing 35 pcf for level backfill against the wall. For restrained wall, an at-rest equivalent fluid pressure of 55 pcf should be used in design, again assuming level backfill against the wall. These values assume that the recommended drainage provisions are incorporated, and hydrostatic pressures are not allowed to develop against the wall.

During a seismic event, lateral earth pressures acting on below-grade structural walls will increase by an incremental amount that corresponds to the earthquake loading. Based on the Mononobe-Okabe equation and peak horizontal accelerations appropriate for the site location, seismic loading should be modeled using the active or at-rest earth pressures recommended above, plus an incremental rectangular-shaped seismic load of magnitude 6.5H, where H is the total height of the wall.

We assume relatively level ground surface below the base of the walls. As such, we recommend passive earth pressure of 300 pcf for use in design, assuming wall footings are cast against competent native soils or engineered fill. If the ground surface slopes down and away from the base of any of the walls, a lower passive earth pressure should be used and GeoPacific should be contacted for additional recommendations.

A coefficient of friction of 0.42 may be assumed along the interface between the base of the wall footing and subgrade soils. The recommended coefficient of friction and passive earth pressure values do not include a safety factor, and an appropriate safety factor should be included in design. The upper 12 inches of soil should be neglected in passive pressure computations unless it is protected by pavement or slabs on grade.

The above recommendations for lateral earth pressures assume that the backfill behind the subsurface walls will consist of properly compacted structural fill, and no adjacent surcharge loading. If the walls will be subjected to the influence of surcharge loading within a horizontal distance equal to or less than the height of the wall, the walls should be designed for the additional horizontal pressure. For uniform surcharge pressures, a uniformly distributed lateral pressure of 0.3 times the surcharge pressure should be added. Traffic surcharges may be estimated using an additional vertical load of 250 psf (2 feet of additional fill), in accordance with local practice.

The recommended equivalent fluid densities assume a free-draining condition behind the walls so that hydrostatic pressures do not build-up. This can be accomplished by placing a 12 to 18-inch wide zone of sand and gravel containing less than 5 percent passing the No. 200 sieve against the walls. A 3-inch minimum diameter perforated, plastic drain pipe should be installed at the base of

the walls and connected to a suitable discharge point to remove water in this zone of sand and gravel. The drain pipe should be wrapped in filter fabric (Mirafi 140N or other as approved by the geotechnical engineer) to minimize clogging.

Wall drains and perimeter drains are recommended to prevent detrimental effects of surface water runoff on foundations – not to dewater groundwater. Drains should not be expected to eliminate all potential sources of water entering a basement or beneath a slab-on-grade. An adequate grade to a low point outlet drain in the crawlspace is required by code. Underslab drains are sometimes added beneath the slab when placed over soils of low permeability and shallow, perched groundwater. At present we are not recommending underslab drains.

Water collected from the wall drains and perimeter drains should be directed into the local storm drain system or other suitable outlet. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. Down spouts and roof drains should not be connected to the wall drains in order to reduce the potential for clogging. The drains should include clean-outs to allow periodic maintenance and inspection. Grades around the proposed structure should be sloped such that surface water drains away from the building.

GeoPacific should be contacted during construction to verify subgrade strength in wall keyway excavations, to verify that backslope soils are in accordance with our assumptions, and to take density tests on the wall backfill materials.

Structures should be located a horizontal distance of at least 1.5H away from the back of the retaining wall, where H is the total height of the wall. GeoPacific should be contacted for additional foundation recommendations where structures are located closer than 1.5H to the top of any wall.

Flexible Pavement Design

We understand that development at the site will include construction of a private driveway, and may include street improvements to Robin's View Drive. For public pavement sections which may be incorporated into the project, we conservatively assume that the subgrade will exhibit a resilient modulus of at least 7,500, which correlates to a CBR value of 5. Based upon the anticipated traffic on Robin's View Drive, we assumed an anticipated 18-kip ESAL count of approximately 50,000 over 20 years, accounting for projected population growth. Table 1 presents our flexible pavement design input parameters. Table 2 presents our recommended minimum dry-weather pavement section for the proposed roadway, supporting 20 years of vehicle traffic per City of West Linn standards.

Table 1 – Flexible Pavement Section Design Input Parameters for Robin's View Drive

Input Parameter	Design Value
18-kip ESAL Initial Performance Period (20 Years)	50,000
Initial Serviceability	4.2
Terminal Serviceability	2.5
Reliability Level	90 Percent
Overall Standard Deviation	0.5
Roadbed Soil Resilient Modulus (PSI)	7,500
Structural Number	**2.16**

Table 2 - Recommended Minimum Dry-Weather Pavement Section for Robin's View Drive

Material Layer	Robins View Drive	Structural Coefficient	Compaction Standard
Asphaltic Concrete (AC)	3.5 in.	.42	91%/ 92% of Rice Density AASHTO T-209
Crushed Aggregate Base ¾"-0 (leveling course)	2 in.	.10	95% of Modified Proctor AASHTO T-180
Crushed Aggregate Base 1½"-0	6 in.	.10	95% of Modified Proctor AASHTO T-180
Subgrade	12 in.	7,500 PSI	95% of Standard Proctor AASHTO T-99 or equivalent
Total Calculated Structural Number		**2.27**	

The subgrade should be ripped or tilled to a depth of 12 inches, moisture conditioned, root-picked, and compacted in-place prior to the placement of crushed aggregate base for pavement. Any pockets of organic debris or loose fill encountered during ripping or tilling should be removed and replaced with engineered fill (see *Site Preparation Recommendations* section). In order to verify subgrade strength, we recommend proof-rolling directly on subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas that pump, rut, or weave should be stabilized prior to paving.

If pavement areas are to be constructed during wet weather, the subgrade and construction plan should be reviewed by the project geotechnical engineer at the time of construction so that condition specific recommendations can be provided. The moisture sensitive subgrade soils make the site a difficult wet weather construction project. General recommendations for wet weather pavement sections are provided below.

During placement of pavement section materials, density testing should be performed to verify compliance with project specifications. Generally, one subgrade, one base course, and one asphalt compaction test is performed for every 100 to 200 linear feet of paving.

Wet Weather Construction Pavement Section

This section presents our recommendations for wet weather pavement section and construction for new pavement sections at the project. These wet weather pavement section recommendations

are intended for use in situations where it is not feasible to compact the subgrade soils to project requirements, due to wet subgrade soil conditions, and/or construction during wet weather.

Based on our site review, we recommend a wet weather section with a minimum subgrade deepening of 6 to 12 inches to accommodate a working subbase of additional 1½"-0 crushed rock. Geotextile fabric, Mirafi 500x or equivalent, should be placed on subgrade soils prior to placement of base rock.

In some instances, it may be preferable to use a subbase material in combination with overexcavation and increasing the thickness of the rock section. GeoPacific should be consulted for additional recommendations regarding use of additional subbase in wet weather pavement sections if it is desired to pursue this alternative. Cement treatment of the subgrade may also be considered instead of overexcavation. For planning purposes, we anticipate that treatment of the onsite soils would involve mixing cement powder to approximately 6 percent cement content and a mixing depth on the order of 12 to 18 inches.

With implementation of the above recommendations, it is our opinion that the resulting pavement section will provide equivalent or greater structural strength than the dry weather pavement section currently planned. However, it should be noted that construction in wet weather is risky and the performance of pavement subgrades depend on a number of factors including the weather conditions, the contractor's methods, and the amount of traffic the road is subjected to. There is a potential that soft spots may develop even with implementation of the wet weather provisions recommended in this letter. If soft spots in the subgrade are identified during roadway excavation, or develop prior to paving, the soft spots should be overexcavated and backfilled with additional crushed rock.

During subgrade excavation, care should be taken to avoid disturbing the subgrade soils. Removals should be performed using an excavator with a smooth-bladed bucket. Truck traffic should be limited until an adequate working surface has been established. We suggest that the crushed rock be spread using bulldozer equipment rather than dump trucks, to reduce the amount of traffic and potential disturbance of subgrade soils.

Care should be taken to avoid overcompaction of the base course materials, which could create pumping, unstable subgrade soil conditions. Heavy and/or vibratory compaction efforts should be applied with caution. Following placement and compaction of the crushed rock to project specifications (95 percent of Modified Proctor), a finish proof-roll should be performed before paving.

The above recommendations are subject to field verification. GeoPacific should be on-site during construction to verify subgrade strength and to take density tests on the engineered fill, base rock and asphaltic pavement materials.

Seismic Design

The Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon HazVu: 2015 Statewide GeoHazards Viewer indicates that the site is located in an area considered to be at risk for *severe* shaking during a seismic event. Structures should be designed to resist earthquake

loading in accordance with the methodology described in the 2012 International Building Code (IBC) with applicable Oregon Structural Specialty Code (OSSC) revisions (current 2014). We recommend Site Class D be used for design per the OSSC, Table 1613.5.2 and as defined in ASCE 7, Chapter 20, Table 20.3-1. Design values determined for the site using the USGS (United States Geological Survey) *2012 Seismic Design Maps Summary Report* are summarized in Table 3.

Table 3 - Recommended Earthquake Ground Motion Parameters (USGS 2016)

Parameter	Value
Location (Lat, Long), degrees	45.394, -122.639
Probabilistic Ground Motion Values, 2% Probability of Exceedance in 50 yrs	
Peak Ground Acceleration	0.418 g
Short Period, S_s	0.969 g
1.0 Sec Period, S_1	0.415 g
Soil Factors for Site Class D:	
F_a	1.113
F_v	1.585
$SD_s = 2/3 \times F_a \times S_s$	0.718 g
$SD_1 = 2/3 \times F_v \times S_1$	0.438 g
Seismic Design Category	D

Soil Liquefaction

The Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon HazVu: 2015 Statewide GeoHazards Viewer indicates that the site is in an area considered to be at *high* risk for soil liquefaction during an earthquake. Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a liquid in response to ground shaking caused by strong earthquakes. Soil liquefaction is generally limited to loose, sands and granular soils located below the water table, and fine-grained soils with a plasticity index less than 15. The site was observed to be underlain by medium stiff, fine-grained, low to moderately plastic soils consisting of Lean CLAY, Sandy SILT, Silty SAND, and Clayey GRAVEL, located above the static groundwater table. Based upon the lack of groundwater observed within the subsurface profile at the time of our site investigation, it is our opinion that the risk of soil liquefaction during a seismic event at the subject site should be considered to be low.

UNCERTAINTIES AND LIMITATIONS

We have prepared this report for the owner and his/her consultants for use in design of this project only. The conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

Within the limitations of scope, schedule and budget, GeoPacific executed these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

REGISTERED OREGON BENJAMIN L COOK 3246 GEOLOGIST

EXP 12-31-16

REGISTERED PROFESSIONAL ENGINEER 14743PE OREGON JAN. 23, 1990 JAMES D. IMBRIE

EXPIRES: 06/30/2017

Benjamin L. Cook, R.G.
Senior Geologist

James D. Imbrie, G.E., C.E.G.
Principal Geotechnical Engineer

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FIGURES

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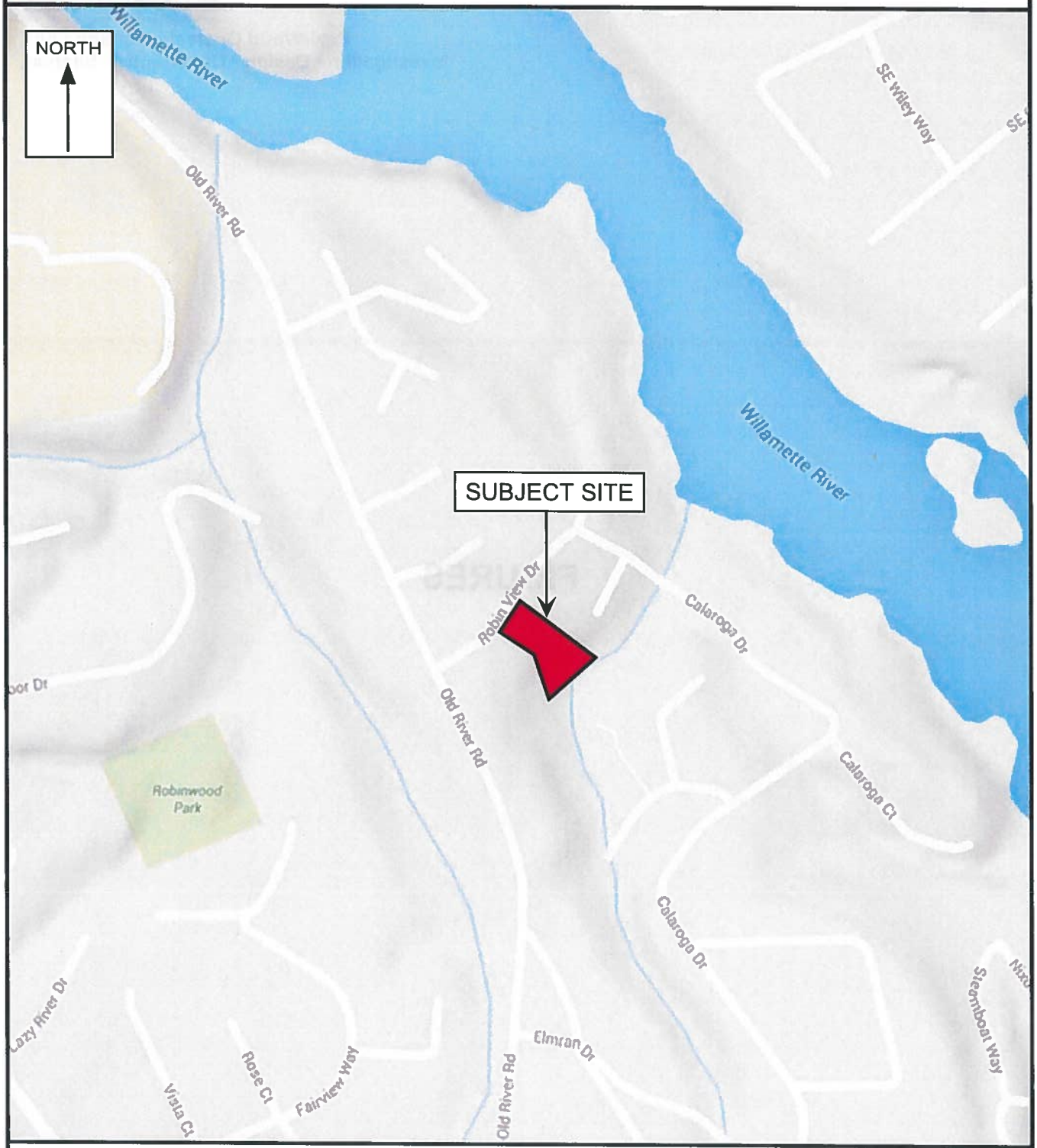
VICINITY MAP



Base map: Google Maps, 2016

Date: 3/16/2016
Drawn by: BLC

Project: Robins View Drive Tax Parcel 00297244 West Linn, Oregon	Project No. 16-4131	FIGURE 1

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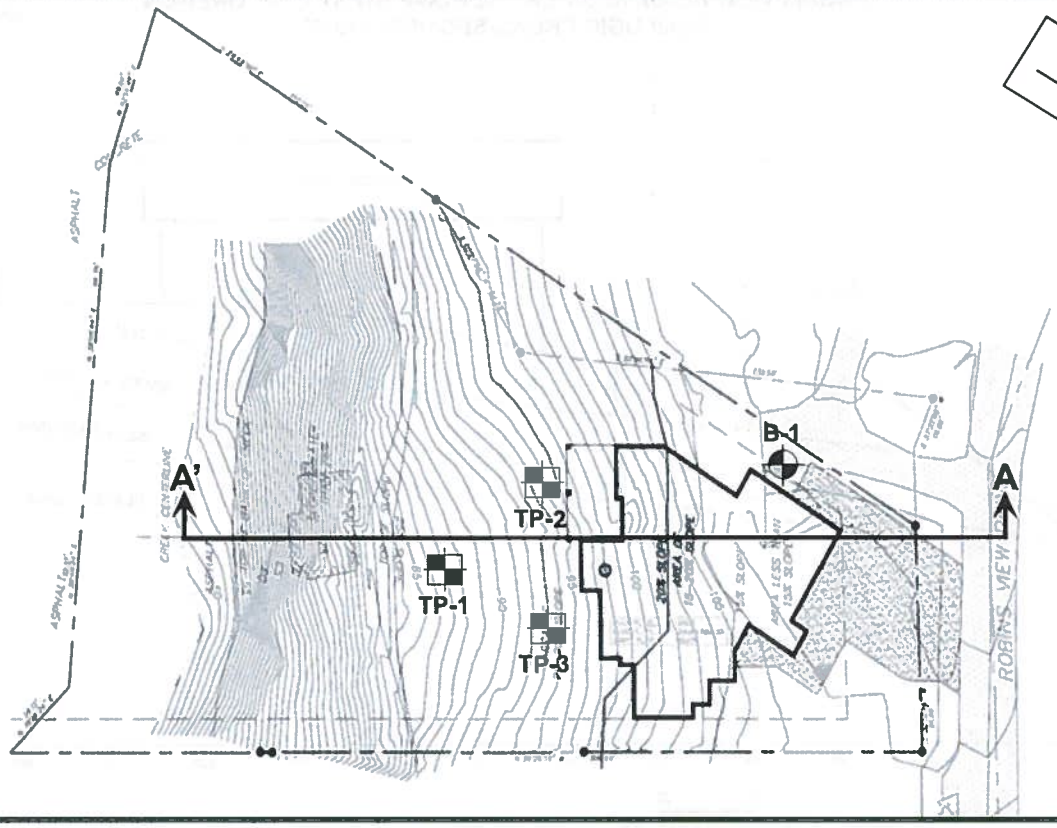
SITE PLAN AND EXPLORATION LOCATIONS



Legend:
- Test Pit Exploration Approximate Location
- Soil Boring Exploration Approximate Location
- Slope Cross Section

APPROXIMATE SCALE (FEET)
35 0 35 70

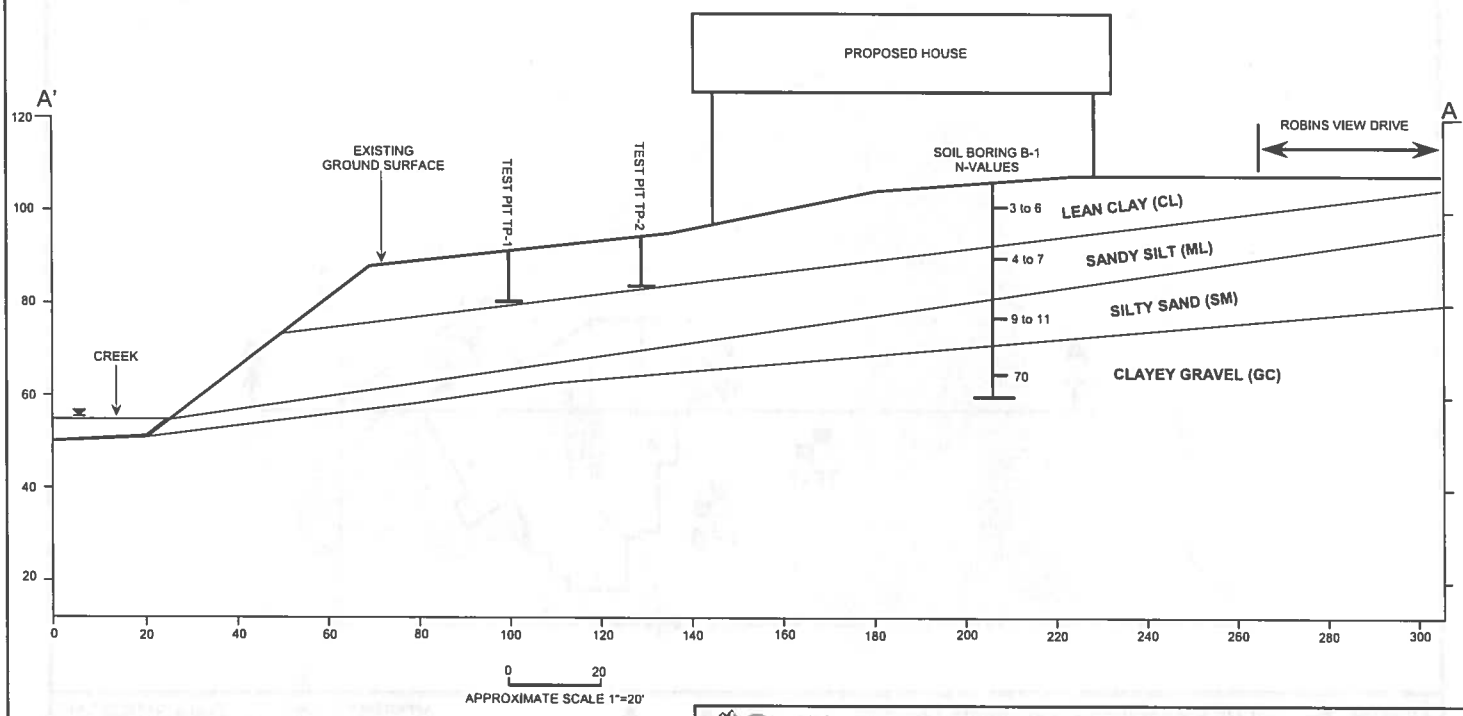
Date:3/16/2016
Drawn by: BLC

Project: Robins View Drive
Tax Parcel 00297244, West Linn, Oregon 97068

Project No. 16-4131

FIGURE 2

ROBINS VIEW ROAD, RESIDENTIAL HOME, WEST LINN, OREGON
GEOLOGIC CROSS-SECTION A to A'



Note: Location of all geotechnical information is approximate.
Topographic data based on 1 foot contour site survey provided by client.
Soil conditions are based upon subsurface exploration conducted March 7, 2016.

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GEOLOGIC CROSS-SECTION

Project: Robins View Road, West Linn, Oregon	Project No. 16-4131	Drawn By: BLC 3/17/16	FIGURE 3

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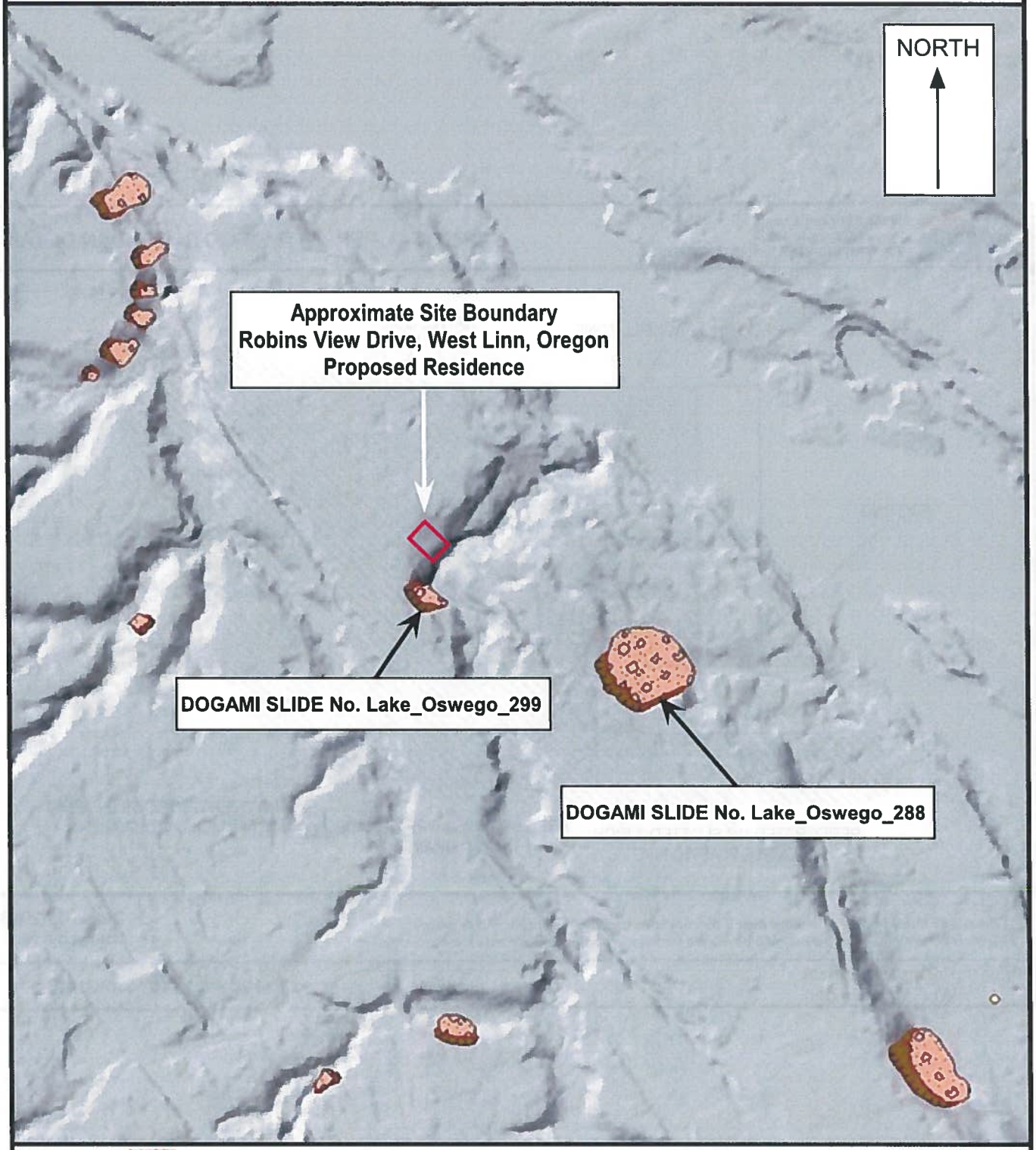
LANDSLIDE HAZARD MAP



Legend Mapped Landslide

0 600'

Date: 3/17/16
Drawn by: BLC

Map Source: *Oregon Department of Geology and Mineral Industries SLIDO: Statewide Landslide Information 2016 Website*

APPROXIMATE SCALE 1"=600'

Project: Robins View Drive West Linn, Oregon	Project No. 16-4131	FIGURE 4

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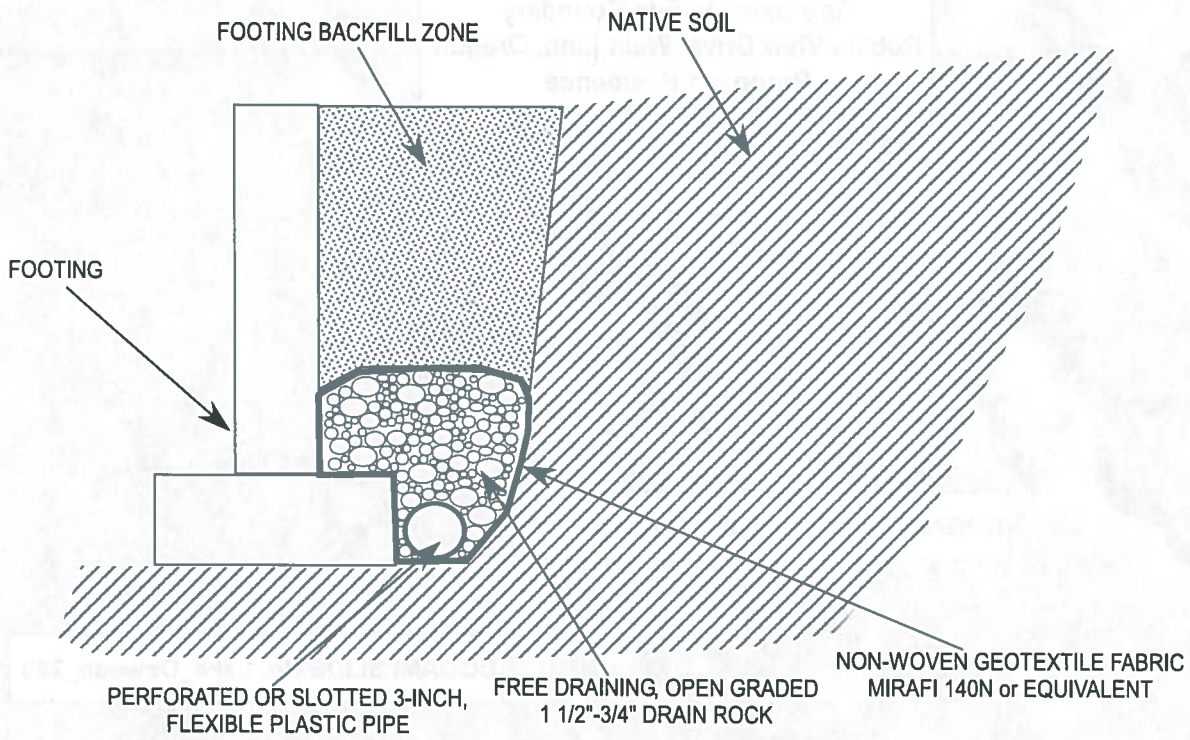
TYPICAL PERIMETER FOOTING DRAIN DETAIL



Notes:
1) Drain rock should contain no more than 5 percent fines passing the U.S. No. 200 Sieve.
2) Trench bottom and drain pipe should be sloped to drain to approved discharge location.

Date:3/17/2016
Drawn by: BLC

Project: Robins View Drive West Linn, Oregon	Project No. 16-4131	FIGURE 5

EXPLORATION LOGS

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BORING LOG

Project: Robins View Drive
West Linn, Oregon

Project No. 16-4131

Boring No. **B-1**

Depth (ft)	Sample Type	N-Value	% Passing the No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
						Asphalt Drive. 3 Inches A/C, 10 inches of 3/4"-0 crushed aggregate.
		6				Lean CLAY (CL), brown, very moist, soft to medium stiff, low to moderate plasticity.
5		3	62.2	36.0		
		3				
10		4	69.5	30.3		Sandy SILT (ML), brown, very moist, soft to medium stiff, fine sand portion, low plasticity.
15		6	53.7	23.6		
20		7	41.9	19.9		
25		9				Silty SAND (SM), light brown, damp to moist, loose to medium dense, fine to medium sand portion, low plasticity.
30		11	41.9	16.3		
35		6				**Soil boring terminated at -41.5 feet bgs.** **No groundwater encountered.** **Drill Rig: Trailer-mounted, solid-stem drill rig, Dan Fischer Excavating**
40		70				Clayey GRAVEL (GC), red brown to orange and black, Lean CLAY matrix with angular basalt, and subgrounded andesite, partial cementation, moist, dense,

LEGEND

Bag Sample (100 to 1,000 g) | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table (10-20-99) | Water Bearing Zone

Date Drilled: 3/7/2016
Logged By: B. Cook
Surface Elevation: 106 Feet

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TEST PIT LOG

Project: Robins View Drive
West Linn, Oregon

Project No. 16-4131

Test Pit No. **TP-1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5					Topsoil. Heavily vegetated area, organic Lean CLAY (OL-CL), dark brown, very moist, with roots extending to approximately 24 inches bgs.
2	0.5	100 to 1,000 g				
3	1.5					Lean CLAY (CL), brown, very moist, soft to medium stiff, low to moderate plasticity.
4	2.5	100 to 1,000 g				
5						
6		100 to 1,000 g				
7						
8		100 to 1,000 g				
9						
10						Test pit terminated at 10 feet bgs. No groundwater seepage observed.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Date Excavated: 3/7/2016
Logged By: B. Cook
Surface Elevation: 87 feet

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TEST PIT LOG

Project: Robins View Drive
West Linn, Oregon

Project No. 16-4131

Test Pit No. **TP-2**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5					Topsoil. Heavily vegetated area, organic Lean CLAY (OL-CL), dark brown, very moist, with roots extending to approximately 24 inches bgs.
2	0.5					
3	1.5					Lean CLAY (CL), brown, very moist, soft to medium stiff, low to moderate plasticity.
4	2.5					
5						
6						
7						
8						
9						
10						Test pit terminated at 10 feet bgs. No groundwater seepage observed.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 3/7/2016
Logged By: B. Cook
Surface Elevation: 94 feet

GeoPacific Engineering, Inc.
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TEST PIT LOG

Project: Robins View Drive
West Linn, Oregon

Project No. 16-4131

Test Pit No. **TP-3**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5					Topsoil. Heavily vegetated area, organic Lean CLAY (OL-CL), dark brown, very moist, with roots extending to approximately 24 inches bgs.
2	0.5					
3	1.5					Lean CLAY (CL), brown, very moist, soft to medium stiff, low to moderate plasticity.
4	2.5					
5						
6						
7						
8						
9						
10						Test pit terminated at 10 feet bgs. No groundwater seepage observed.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 3/7/2016
Logged By: B. Cook
Surface Elevation: 93 feet

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LABORATORY TEST RESULTS

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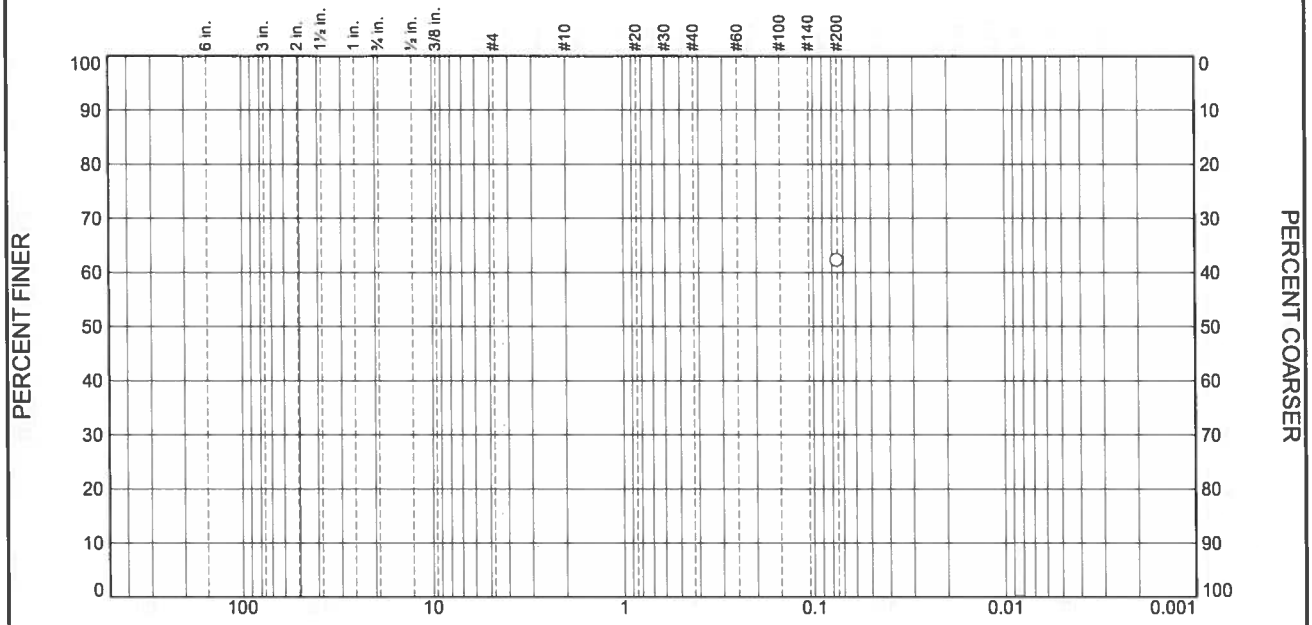
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						62.2	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	62.2		

* (no specification provided)

Material Description

Lean Clay

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture 36.0%

Date Received: **Date Tested:** 3.11.2016

Tested By: SJC

Checked By:

Title:

Location: B-1.1
Sample Number: S16-069 **Depth:** 5'

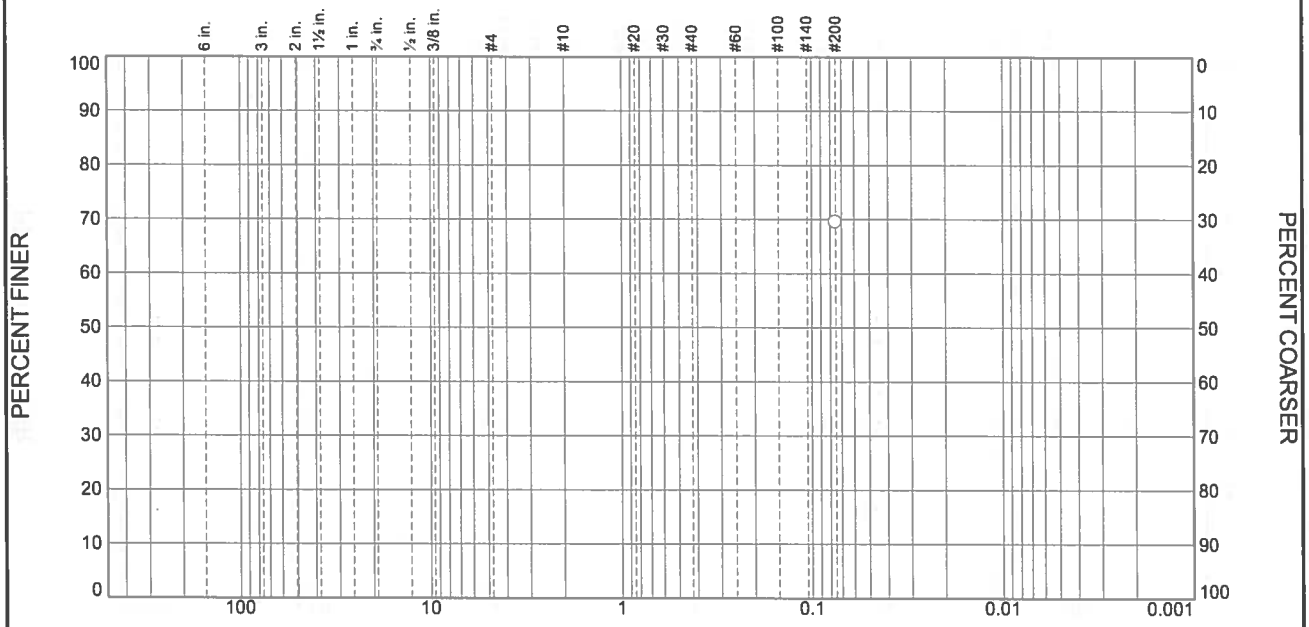
Date Sampled: 3.7.2016 BLC

GEOPACIFIC ENGINEERING, INC.

Client: BC Custom Homes Corporation
Project: Robins View Drive

Project No: 16-4131 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						69.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	69.5		

* (no specification provided)

Material Description

Sandy Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture 30.3%

Date Received: **Date Tested:** 3.11.2016

Tested By: SJC

Checked By:

Title:

Location: B-1.2
Sample Number: S16-070 **Depth:** 10'

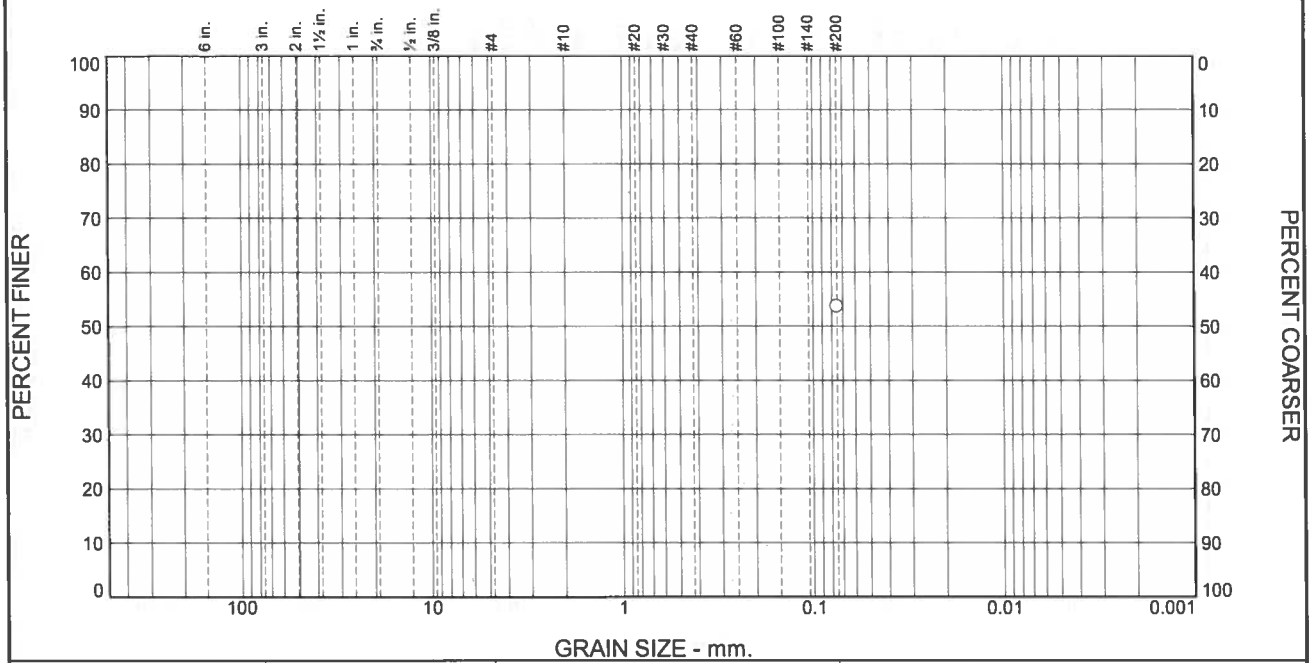
Date Sampled: 3.7.2016 BLC

GEOPACIFIC ENGINEERING, INC.

Client: BC Custom Homes Corporation
Project: Robins View Drive

Project No: 16-4131 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						53.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	53.7		

* (no specification provided)

Material Description

Sandy Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture 23.6%

Date Received: **Date Tested:** 3.11.2016

Tested By: SJC

Checked By:

Title:

Location: B-1.3
Sample Number: S16-071 **Depth:** 15'

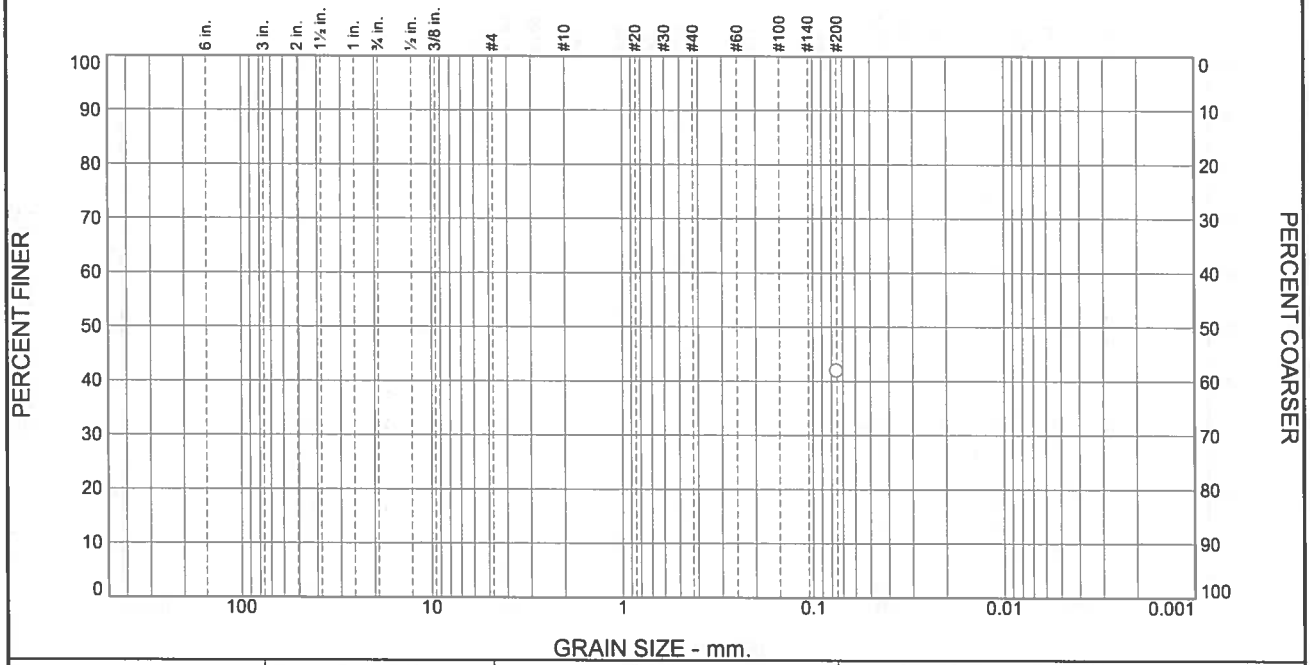
Date Sampled: 3.7.2016 BLC

GEOPACIFIC ENGINEERING, INC.

Client: BC Custom Homes Corporation
Project: Robins View Drive

Project No: 16-4131 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						41.9	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	41.9		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture 19.9%

Date Received: **Date Tested:** 3.11.2016

Tested By: SJC

Checked By:

Title:

Location: B-1.4
Sample Number: S16-072 **Depth:** 20'

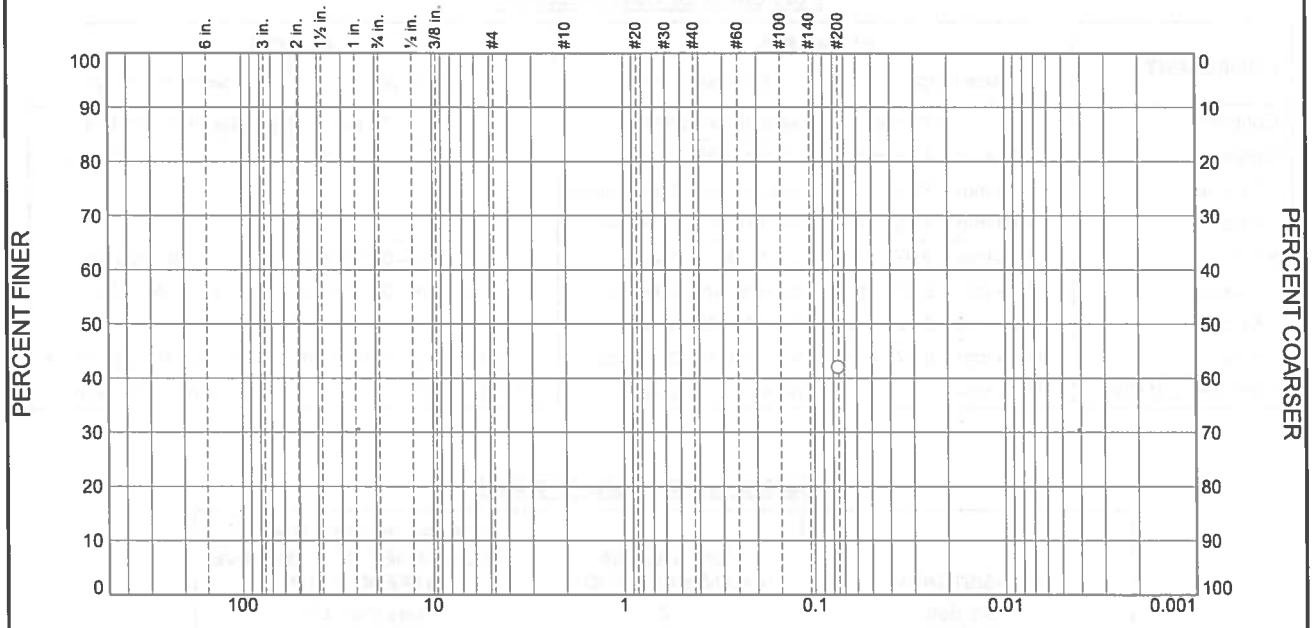
Date Sampled: 3.7.2016 BLC

GEOPACIFIC ENGINEERING, INC.

Client: BC Custom Homes Corporation
Project: Robins View Drive

Project No: 16-4131 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						41.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	41.9		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture 16.3%

Date Received: **Date Tested:** 3.11.2016

Tested By: SJC

Checked By:

Title:

Location: B-1.6
Sample Number: S16-073 **Depth:** 30'

Date Sampled: 3.7.2016 BLC

GEOPACIFIC ENGINEERING, INC.

Client: BC Custom Homes Corporation
Project: Robins View Drive

Project No: 16-4131 **Figure**

SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

COMPONENT	ASTM/USCS		AASHTO	
	size range	sieve size range	size range	sieve size range
Cobbles	> 75 mm	greater than 3 inches	> 75 mm	greater than 3 inches
Gravel	75 mm – 4.75 mm	3 inches to No. 4 sieve	75 mm – 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm – 19.0 mm	3 inches to 3/4-inch sieve	-	-
Fine	19.0 mm – 4.75 mm	3/4-inch to No. 4 sieve	-	-
Sand	4.75 mm – 0.075 mm	No. 4 to No. 200 sieve	2.00 mm – 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm – 2.00 mm	No. 4 to No. 10 sieve	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve	-	-
Fine	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	< 0.075 mm	Passing No. 200 sieve	< 0.075 mm	Passing No. 200 sieve

Consistency for Cohesive Soil

CONSISTENCY	SPT N-VALUE (BLOWS PER FOOT)	POCKET PENETROMETER (UNCONFINED COMPRESSIVE STRENGTH, tsf)
Very Soft	2	less than 0.25
Soft	2 to 4	0.25 to 0.50
Medium Stiff	4 to 8	0.50 to 1.0
Stiff	8 to 15	1.0 to 2.0
Very Stiff	15 to 30	2.0 to 4.0
Hard	30 to 60	greater than 4.0
Very Hard	greater than 60	-

Relative Density for Granular Soil

RELATIVE DENSITY	SPT N-VALUE (BLOWS PER FOOT)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	more than 50

Moisture Designations

TERM	FIELD IDENTIFICATION
Dry	No moisture. Dusty or dry.
Damp	Some moisture. Cohesive soils are usually below plastic limit and are moldable.
Moist	Grains appear darkened, but no visible water is present. Cohesive soils will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grains. Sand and silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is much wetter than optimum moisture content and is above plastic limit.

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 Percent or Less Passing .075 mm)			Silt-Clay Materials (More than 35 Percent Passing 0.075)			
Group Classification	A-1	A-3	A-2	A-4	A-5	A-6	A-7
Sieve analysis, percent passing:							
2.00 mm (No. 10)	-	-	-				
0.425 mm (No. 40)	50 max	51 min	-	-	-	-	-
0.075 mm (No. 200)	25 max	10 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)							
Liquid limit				40 max	41 min	40 max	41 min
Plasticity index	6 max	N.P.		10 max	10 max	11 min	11 min
General rating as subgrade	Excellent to good			Fair to poor			

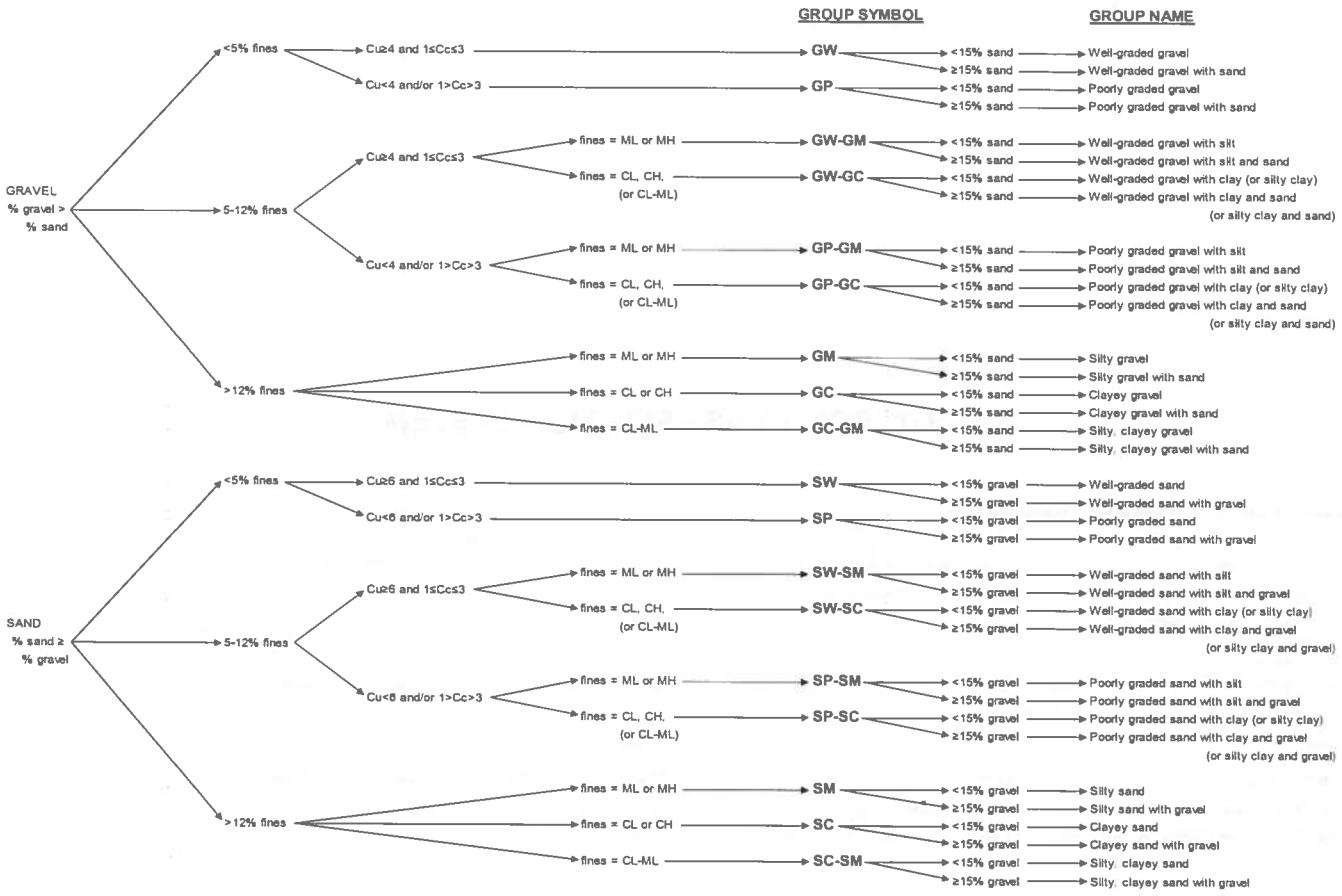
Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

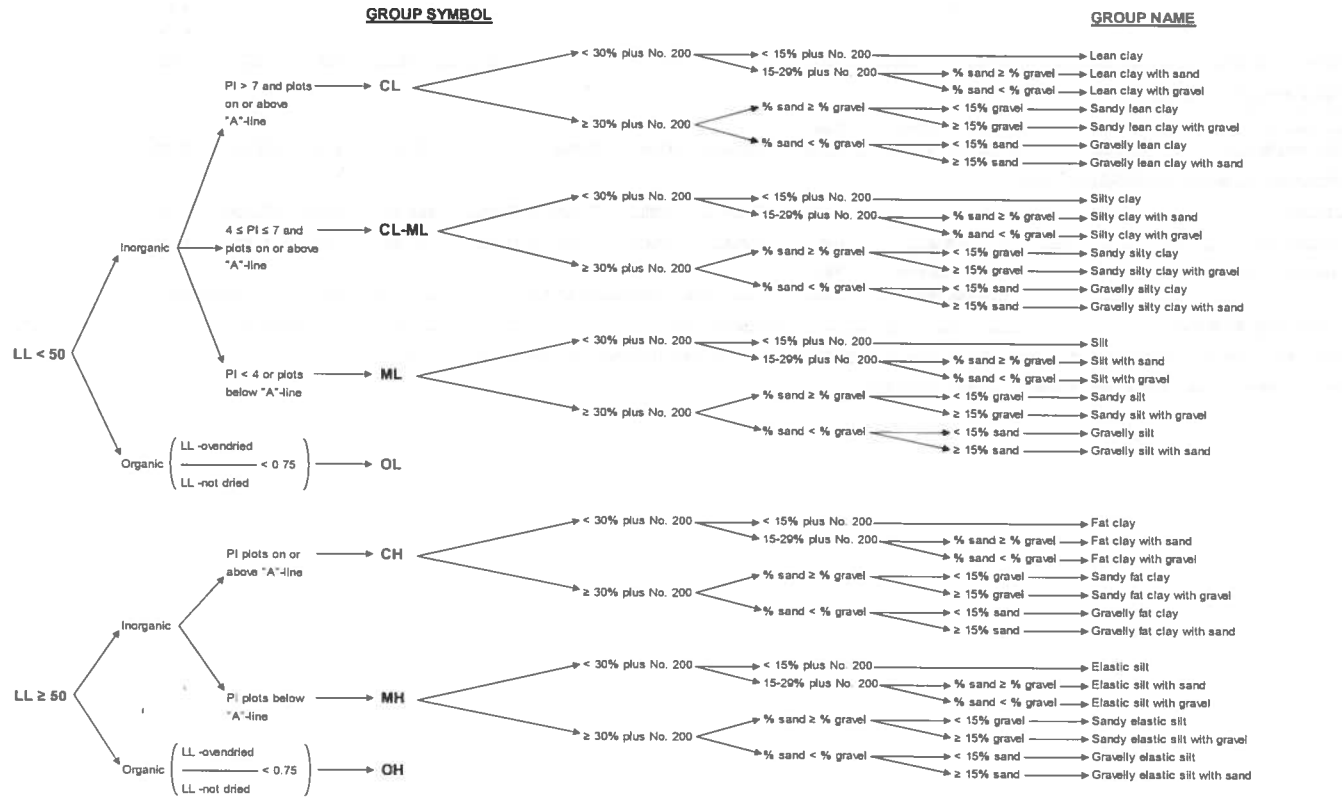
General Classification	Granular Materials (35 Percent or Less Passing 0.075 mm)							Silt-Clay Materials (More than 35 Percent Passing 0.075 mm)			
	A-1			A-2				A-7			
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5, A-7-6
Sieve analysis, percent passing:											
2.00 mm (No. 10)	50 max	-	-	-	-	-	-	-	-	-	-
0.425 mm (No. 40)	30 max	50 max	51 min	-	-	-	-	-	-	-	-
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11min
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General ratings as subgrade	Excellent to Good							Fair to poor			

Note: Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30 (see Figure 2).

AASHTO = American Association of State Highway and Transportation Officials



Flow Chart for Classifying Coarse-Grained Soils (More Than 50% Retained on No. 200 Sieve)



Flow Chart for Classifying Fine-Grained Soil (50% or More Passes No. 200 Sieve)

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SLOPE STABILITY CROSS-SECTIONS

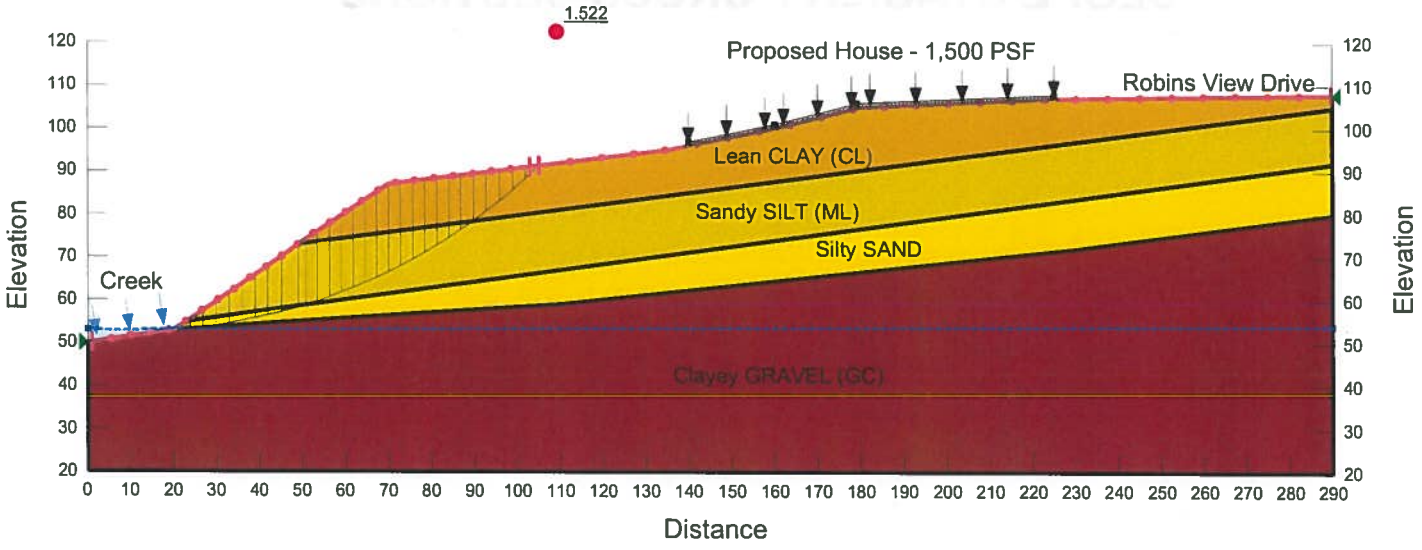
14835 SW 72nd Avenue
Portland, Oregon 97224

Tel (503) 598-8445
Fax (503) 941-9281

16-4131, Robins View Drive, Cross-Section A to A' - Static Condition

Name: Lean CLAY (CL) Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Sandy SILT (ML) Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 150 psf Phi': 29 ° Piezometric Line: 1
Name: Silty SAND Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Clayey GRAVEL (GC) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 50 psf Phi': 32 ° Piezometric Line: 1

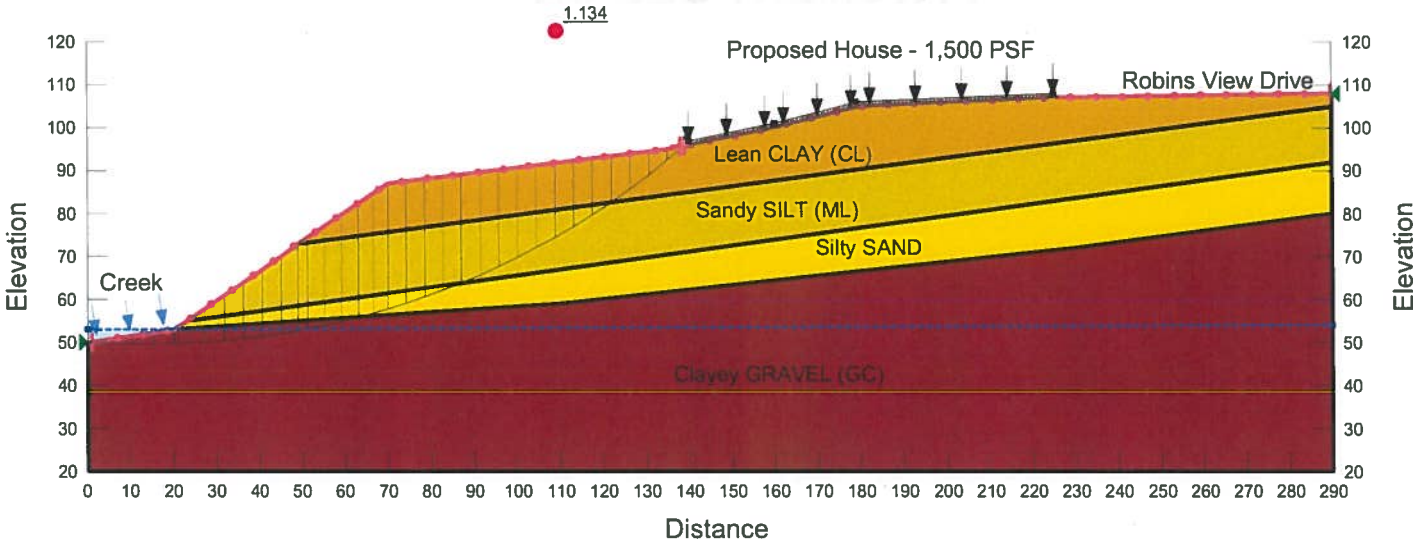
Static Factor of Safety: 1.522



16-4131, Robins View Drive, Cross-Section A to A' - Seismic Condition

Name: Lean CLAY (CL) Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Sandy SILT (ML) Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 150 psf Phi': 29 ° Piezometric Line: 1
Name: Silty SAND Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Clayey GRAVEL (GC) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 50 psf Phi': 32 ° Piezometric Line: 1

Pseudostatic Factor of Safety: 1.134
PGA = 0.418, 1/2 PGA = 0.209



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PAVEMENT DESIGN

14835 SW 72nd Avenue
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==========

DARWin(tm) - Pavement Design

A Proprietary AASHTOWARE(tm)
Computer Software Product

Flexible Structural Design Module

Project Description
16-4131, Robins View Drive, Public Pavement Section, 20 Year Design Life

Flexible Structural Design Module Data

18-kip ESALs Over Initial Performance Period:	50,000
Initial Serviceability:	4.2
Terminal Serviceability:	2.5
Reliability Level (%):	90
Overall Standard Deviation:	.5
Roadbed Soil Resilient Modulus (PSI):	7,500
Stage Construction:	1
Calculated Structural Number:	2.16

Specified Layer Design

Layer:	1
Material Description:	A/C
Structural Coefficient (Ai):	.42
Drainage Coefficient (Mi):	1
Layer Thickness (Di) (in):	3.50
Calculated Layer SN:	1.47
Layer:	2
Material Description:	3/4"-0 Crushed Aggregate
Structural Coefficient (Ai):	.1
Drainage Coefficient (Mi):	1
Layer Thickness (Di) (in):	2.00
Calculated Layer SN:	.20
Layer:	3
Material Description:	1.5"-0 Crushed Aggregate
Structural Coefficient (Ai):	.1
Drainage Coefficient (Mi):	1
Layer Thickness (Di) (in):	6.00
Calculated Layer SN:	.60
Total Thickness (in):	11.50
Total Calculated SN:	2.27

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SITE RESEARCH

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Soil Map—Clackamas County Area, Oregon

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 10, Sep 18, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 26, 2014—Sep 5, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1B	Aloha silt loam, 3 to 6 percent slopes	0.2	0.7%
91B	Woodburn silt loam, 3 to 8 percent slopes	15.2	45.3%
91C	Woodburn silt loam, 8 to 15 percent slopes	17.6	52.6%
W	Water	0.5	1.4%
Totals for Area of Interest		**33.4**	**100.0%**

USGS Design Maps Summary Report

User-Specified Input

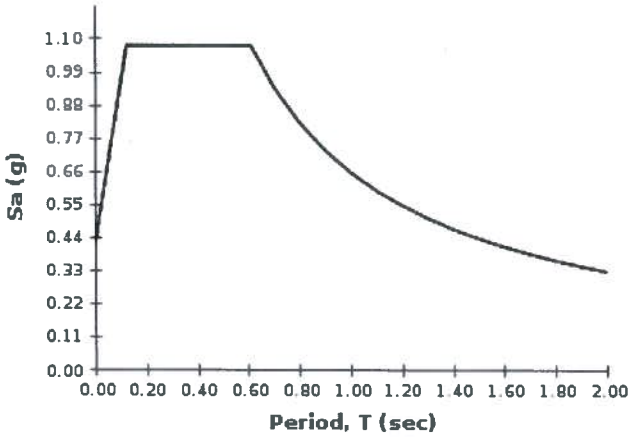
Report Title	16-4131, Robins View Drive Thu March 17, 2016 19:10:20 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	45.39499°N, 122.63981°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS-Provided Output

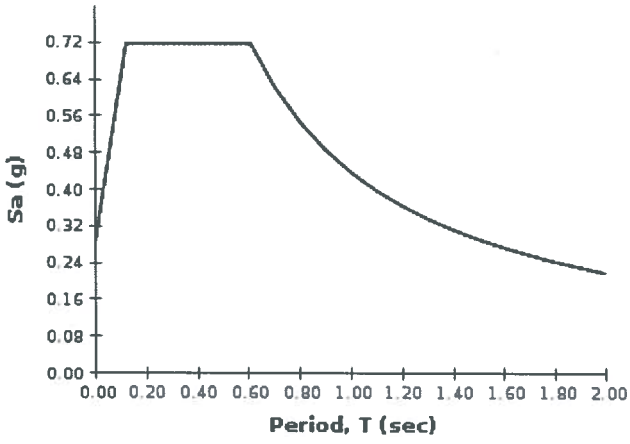
S_S =	0.969 g	S_{MS} =	1.078 g	S_{DS} =	0.718 g
S_1 =	0.415 g	S_{M1} =	0.657 g	S_{D1} =	0.438 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (45.39499°N, 122.63981°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 0.969 g
From Figure 22-2 [2]	S_1 = 0.415 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content w ≥ 40%, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 0.969 g, F_a = 1.113

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.415 g, F_v = 1.585

Equation (11.4–1): $S_{MS} = F_a S_S = 1.113 \times 0.969 = 1.078$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 1.585 \times 0.415 = 0.657$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

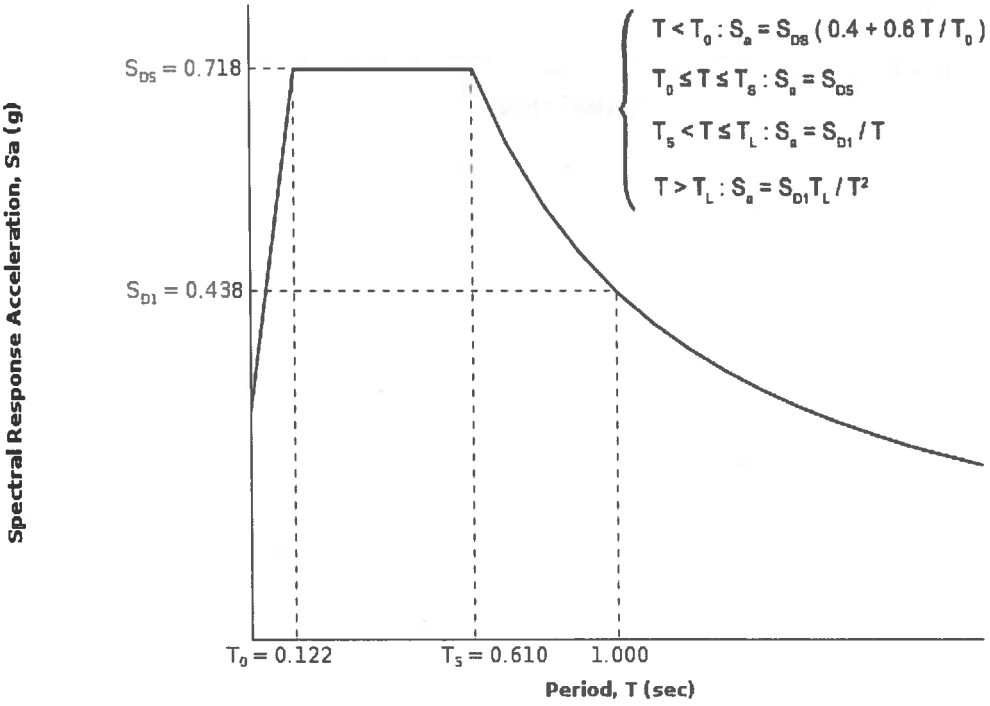
Equation (11.4–3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.078 = 0.718$ g

Equation (11.4–4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.657 = 0.438$ g

Section 11.4.5 — Design Response Spectrum

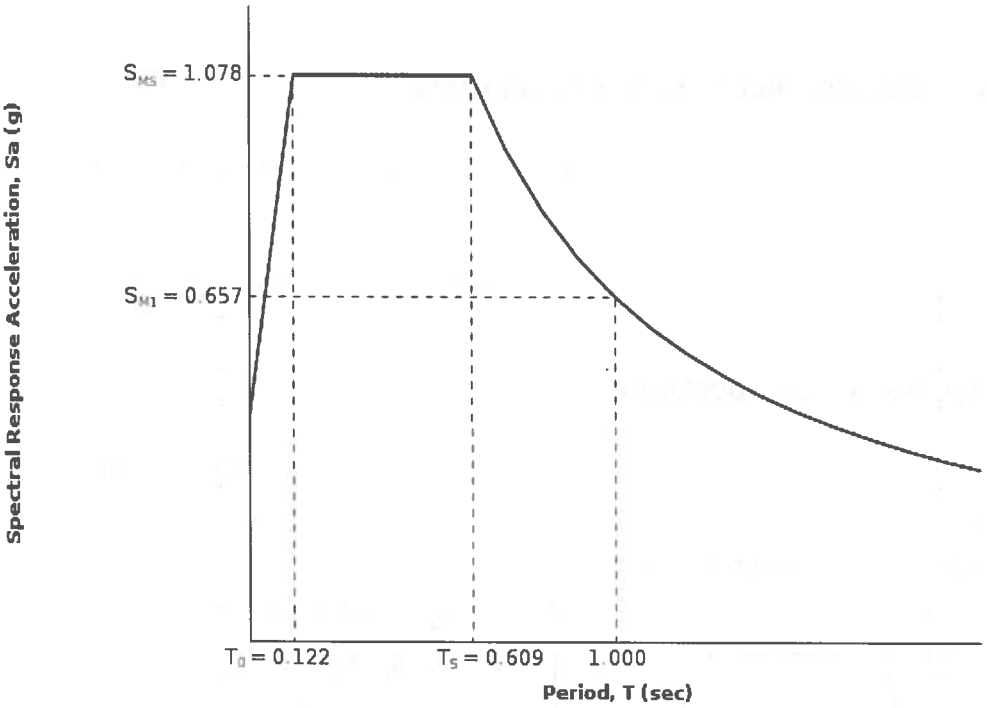
From Figure 22-12 [3] $T_L = 16$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.418

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.082 \times 0.418 = 0.452$ g

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.418 g, F_{PGA} = 1.082

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.907

From Figure 22-18 [6] C_{R1} = 0.874

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.718 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.438 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

PHOTOGRAPHIC LOG

14835 SW 72nd Avenue
Portland, Oregon 97224

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Fax (503) 941-9281

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Facing South, Front of Property

Drilling Soil Boring in Building Location

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Split Spoon Sample, Soil Boring B-1, Depth = 5 Feet

Split Spoon Sample, Soil Boring B-1, Depth = 10 Feet

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Split Spoon Sample, Soil Boring B-1, Depth = 15 Feet

Split Spoon Sample, Soil Boring B-1, Depth = 20 Feet

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Split Spoon Sample, Soil Boring B-1, Depth = 25 Feet

Split Spoon Sample, Soil Boring B-1, Depth = 30 Feet

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Split Spoon Sample, Soil Boring B-1, Depth = 40 Feet

Test Pit TP-1

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Test Pit TP-1

Test Pit TP-2

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Test Pit TP-2

Steeply Sloping Area, South End of Property

ROBINS VIEW DRIVE
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

South Portion of Property Slopes Greater than 25 Percent to the Creek

Proposed Home Location, Slopes Approximately 20 to 25 percent

Exhibit E

Reduced Preliminary Site Plans

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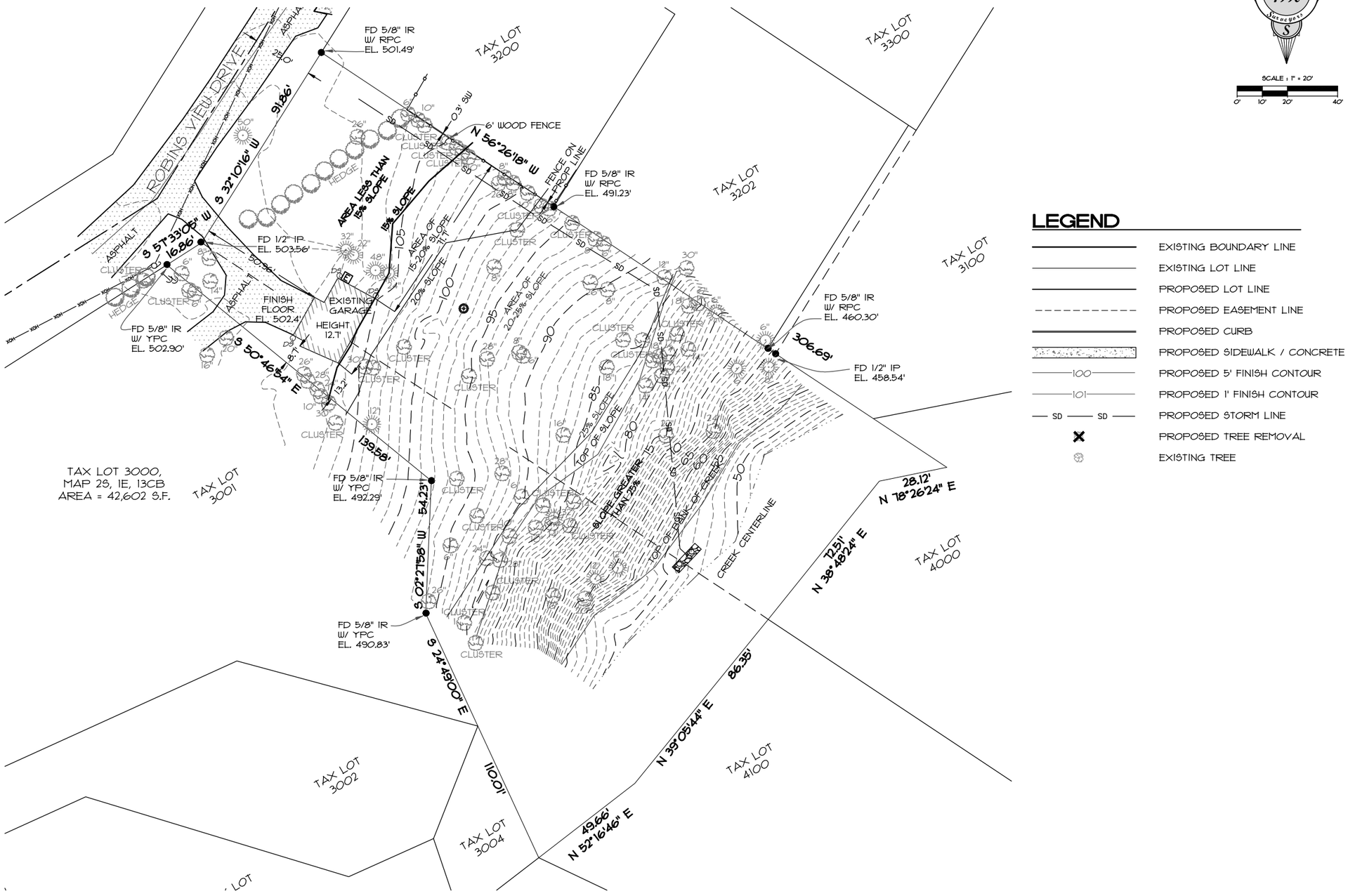
ROBIN VIEW DRIVE

TENTATIVE SITE PLAN

VICINITY MAP



TAX LOT 3000,
MAP 2S, 1E, 13CB
AREA = 42,602 S.F.

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING LOT LINE
- PROPOSED LOT LINE
- PROPOSED EASEMENT LINE
- PROPOSED CURB
- PROPOSED SIDEWALK / CONCRETE
- PROPOSED 5' FINISH CONTOUR
- PROPOSED 1' FINISH CONTOUR
- PROPOSED STORM LINE
- PROPOSED TREE REMOVAL
- EXISTING TREE

NOTE:
THIS IS A PRELIMINARY DRAWING. NOT TO BE USED FOR CONSTRUCTION

SCALE : 1" = 20'
0' 10' 20' 40'

SHEET 1 OF 4

BY	DATE	NO.	REVISION
-	-	-	-

DESIGNED: RXN
DRAWN: RXN
CHECKED: RLM
APPROVED: RLM

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 29, 1977
RAY L. MOORE
RENEWAL DATE: 12/31/2019

SCALE: VERT: N/A HORIZ: 1"=20'
DATE: 01-20-16
FILE: 16-054 Planning.dwg
SECTION: 13 TWP.: 2S RANGE: 1E
LEGAL

PROJECT:
ROBIN VIEW DRIVE
TOPOGRAPHY AND SLOPE ANALYSIS

LOCATION:
ROBIN VIEW DRIVE, WEST LINN, OREGON

Surveyors & Planners, Inc.
Surveying, Planning and Civil Engineering
P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
Fax: (503) 668-7730

DATE OF PLOT: 01-20-16

CLIENT:
BC CUSTOM CONSTRUCTION INC
ATTN:
BILL WINKENBACK
410 HIGH STREET
OREGON CITY, OR 97045
PHONE: 503-122-8100
MOBILE: 503-780-1438

ROBIN VIEW DRIVE

TENTATIVE SITE PLAN

VICINITY MAP

LEGEND

- EXISTING BOUNDARY LINE
- EXISTING LOT LINE
- PROPOSED LOT LINE
- PROPOSED EASEMENT LINE
- PROPOSED CURB
- PROPOSED SIDEWALK / CONCRETE
- PROPOSED 5' FINISH CONTOUR
- PROPOSED 1' FINISH CONTOUR
- PROPOSED STORM LINE
- PROPOSED TREE REMOVAL
- EXISTING TREE

SCALE : 1" = 20'

0' 10' 20' 40'

NOTE:
THIS IS A PRELIMINARY DRAWING. NOT TO BE USED FOR CONSTRUCTION

SHEET 2 OF 4

BY	REVISION	NO.	DATE
-	-	-	-

DESIGNED: RXN
DRAWN: RXN
CHECKED: RLM
APPROVED: RLM

REGISTERED PROFESSIONAL ENGINEER 49710 OREGON JULY 29, 1994 RAY L. MOSER
RENEWAL DATE: 12/31/2017

SCALE: VERT: N/A HORIZ: 1"=20'
DATE: 01-20-16
FILE: 16-054 Planning.dwg

SECTION	TWP.	RANGE
LEGAL 13	2S	1E

PROJECT:
ROBIN VIEW DRIVE
PRELIMINARY PLANNING

LOCATION:
ROBIN VIEW DRIVE, WEST LINN, OREGON

All County Surveyors & Planners, Inc.
Surveying, Planning and Civil Engineering
P.O. Box 955, Sandy, OR 97055
Phone: (503) 668-3151
Fax: (503) 668-4730

DATE OF PLOT: 01-20-16

CLIENT:
BC CUSTOM CONSTRUCTION INC
ATTN:
BILL WINKENBACK
410 HIGH STREET
OREGON CITY, OR 97045
PHONE: 503-722-8700
MOBILE: 503-780-1438

ROBIN VIEW DRIVE

HABITAT CONSERVATION AREA

VICINITY MAP

SCALE : 1" = 20'

0' 10' 20' 40'

HABITAT CONSERVATION AREA (HCA)

- HABITAT AND IMPACT AREAS NOT DESIGNATED AS HCA
- MODERATE
- HIGH

NOTE:
HABITAT CONSERVATION AREAS ARE BASED OFF OF METRO 2005 HCA MAPS PROVIDED BY THE CITY OF WEST LINN

SHEET 3 OF 4

BY	REVISION	NO.	DATE
-	-	-	-

DESIGNED: RXN
DRAWN: RXN
CHECKED: RLM
APPROVED: RLM

REGISTERED PROFESSIONAL LAND SURVEYOR — OREGON — JULY 29, 2005 — RAY L. MOSER — RENEWAL DATE: 12/31/2017

SCALE
VERT: N/A
HORIZ: 1"=20'
DATE: 01-20-16
FILE: 16-054 Planning.dwg

LEGAL	SECTION	TWP.	RANGE
	13	2S	1E

PROJECT:
ROBIN VIEW DRIVE
HCA OVERLAY

LOCATION:
ROBIN VIEW DRIVE, WEST LINN, OREGON

Surveyors & Planners, Inc.
Surveying, Planning and Civil Engineering
P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
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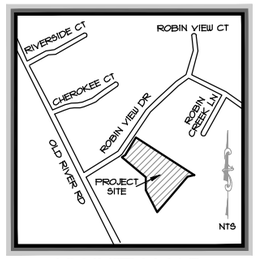
DATE OF PLOT 01-20-16

CLIENT:
BC CUSTOM CONSTRUCTION INC
ATTN:
BILL WINKENBACK
410 HIGH STREET
OREGON CITY, OR 97045
PHONE: 503-122-8700
MOBILE: 503-180-1438

ROBIN VIEW DRIVE

MITIGATION PLAN



VICINITY MAP

TOTAL DISTURBED AREA OUTSIDE WRA/HCA = 7,150 SF

TOTAL DISTURBED AREA WRA/HCA = 350 SF

NOTE: ALL DISTURBED AREAS WITHIN THE WRA/HCA ARE PROPOSED TO BE REPLANTED WITH NATIVE VEGETATION BY A LANDSCAPER.

NOTE:
1. ALL NEW PLANTS, TREES, AND GROUND COVER WILL MEET REQUIREMENTS SET FORTH IN CITY OF WEST LINN CDC 32.100 RE-VEGETATION PLAN REQUIREMENTS

2. RESPONSIBLE PARTIES
OWNER: BILL WINKENBACH
ARCHITECT: BARCLAY HOME DESIGNS
CONTRACTOR: BILL WINKENBACH
LANDSCAPER: TBD

SCALE : 1" = 20'
0' 10' 20' 40'

SHEET 4 OF 4

BY	REVISION	NO.	DATE
-	-	-	-

DESIGNED: RXN
DRAWN: RXN
CHECKED: RLM
APPROVED: RLM

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 29, 1977
RAY L. MOSER
RENEWAL DATE: 12/31/2017

SCALE
VERT: N/A
HORIZ: 1"=20'
DATE: 01-20-16
FILE: 16-054 Planning.dwg

SECTION	TWP.	RANGE
13	2S	1E

PROJECT:
ROBIN VIEW DRIVE
MITIGATION PLAN

LOCATION:
ROBIN VIEW DRIVE, WEST LINN, OREGON

Surveyors & Planners, Inc.
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P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
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DATE OF PLOT: 01-20-16

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