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 Jennifer Arnold | PROJECT NO(S). SUB-17-04 | |
| NON-REFUNDABLE FEE(S) | REFUNDABLE DEPOSIT(S) $5,800 - | TOTAL $5800 - |

**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) Expedited Land Division
- ☐ Temporary Uses *
- ☐ Time Extension *
- ☐ Variance (VAR)
- ☐ Water Resource Area Protection/Single Lot (WAP)
- ☐ Water Resource Area Protection/Wetland (WAP)
- ☐ Willamette & Tualatin River Greenway (WRG)
- ☐ 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:** | Assessor's Map No.: | 21E36BA |
|---|---|---|
| 4096 Cornwall St.<br>West Linn, OR | Tax Lot(s): | 6300 |
| | Total Land Area: | 2.18 acres |

**Brief Description of Proposal:**
Expedited land division to divide the property into six lots. The existing home will be replaced and five additional single-family homes will be built.

| | | | |
|---|---|---|---|
| **Applicant Name:** (please print) | Icon Construction and Development, LLC | Phone: | (503) 657-0406 |
| Address: | 1980 Willamette Falls Drive, Suite 200 | Email: | mark@iconconstruction.net |
| City State Zip: | West Linn, OR 97068 | | |
| **Owner Name** (required): (please print) | Same as applicant. | Phone: | |
| Address: | | Email: | |
| City State Zip: | | | |
| **Consultant Name:** (please print) | Rick Givens, Planning Consultant | Phone: | 503-479-0097 |
| Address: | 18680 Sunblaze Dr. | Email: | rickgivens@gmail.com |
| City State Zip: | Oregon City, OR 97045 | | |

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

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CITY OF WEST LINN
INT. TIME

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 _____

**WILLOW RIDGE**

**Six-Lot Expedited Land Division Application**

**Icon Construction & Development, LLC**

**November 2017**

**Proposal:** This application requests approval of a 6-lot Expedited Land Division to be developed on property located at 4096 Cornwall St. in West Linn. The property is located on the west side of, and at the terminus of, the Cornwall Street right-of-way. Landis Street is stubbed to the west property line of the subject site.

The subject property is described as Tax Lot 6300 of Assessor's Map 21E36BA. The site is 2.18 acres (94,808 square feet) in area. It is presently developed with a single-family detached home. This home will be removed to allow for the construction of the extension of Landis Street to Cornwall Street. The subject property is zoned R-10.

Figure 1: Vicinity Map

Figure 2: Aerial Photograph

We are requesting that this application be processed as an Expedited Land Division pursuant to ORS 197.360-197.365. The proposed subdivision satisfies the definitional requirements for and expedited land division set forth in ORS 197.360 as follows:

*197.360*
*(1) As used in this section:*
*(a) "Expedited land division" means a division of land under ORS 92.010 to 92.192, 92.205 to 92.245 or 92.830 to 92.845 by a local government that:*

*(A) Includes only land that is zoned for residential uses and is within an urban growth boundary.*

Comment: The subject property is within the Urban Growth Boundary and within the city limits of the City of West Linn. The property is zoned Single-Family Residential Detached, R-10, which allows residential uses. This criterion is met.

*(B) Is solely for the purposes of residential use, including recreational or open space uses accessory to residential use.*

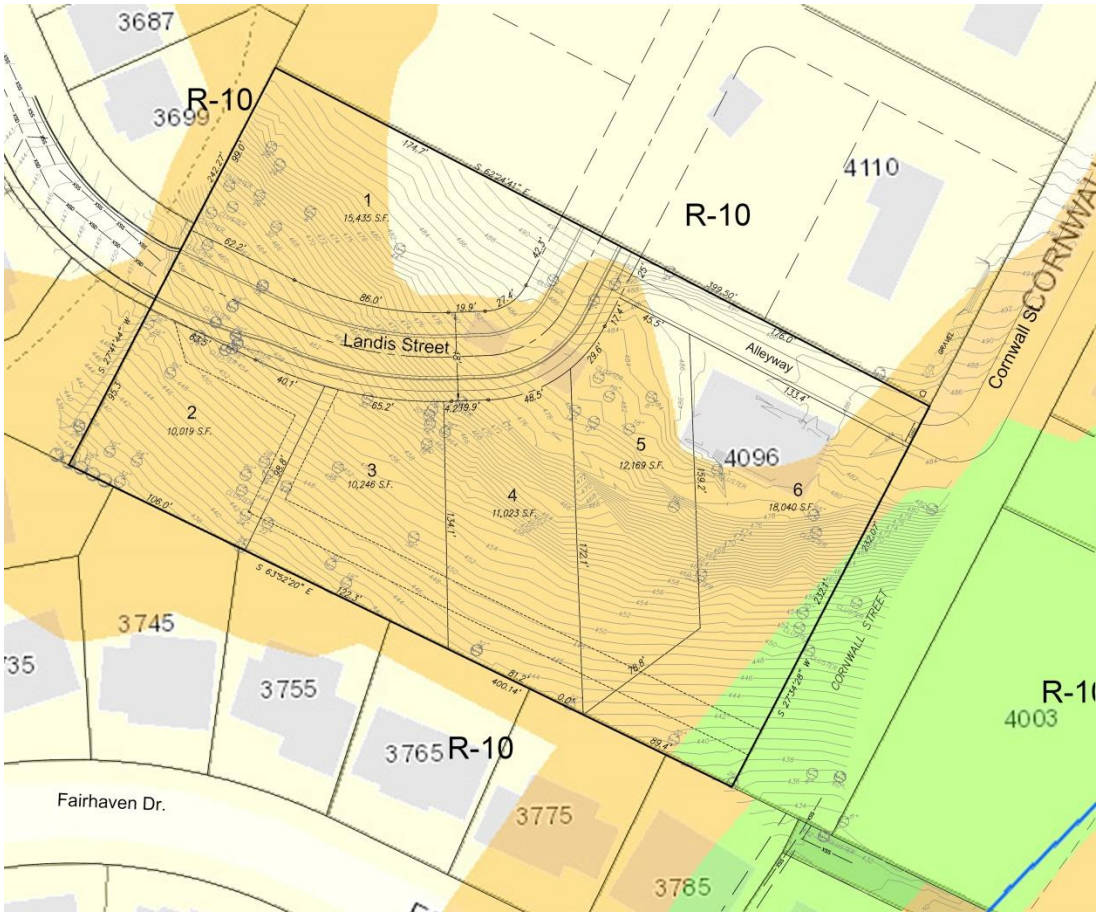
Comment: The proposed land division will create six lots, all of which will be used for the construction of single-family detached homes, consistent with the R-10 zone. This criterion is met.

*(C) Does not provide for dwellings or accessory buildings to be located on land that is specifically mapped and designated in the comprehensive plan and land use*

*regulations for full or partial protection of natural features under the statewide planning goals that protect:*

*(i) Open spaces, scenic and historic areas and natural resources;*
*(ii) The Willamette River Greenway;*
*(iii) Estuarine resources;*
*(iv) Coastal shorelands; and*
*(v) Beaches and dunes.*

Comment: The map below from the City of West Linn Map Optix GIS system shows a small area of Habitat Conservation Area (shaded in green) on the subject property. The tan area indicates areas with tree cover where development is allowed subject to the City of West Linn's tree conservation provisions.




The mapped HCA is associated with a stream corridor on the east side of Cornwall Street. A site evaluation prepared by Schott and Associates and attached to this application has determined that the HCA does not extend onto the subject property. Further, even if the HCA did involve the mapped area of the site, no homes would be built in that area. The building site for Lot 6 is in the north portion of the property near where the existing home is located. The subject property is not located within the Willamette River Greenway. The property does not have estuarine resources, coastal shorelands or beaches and dunes. This criterion is met.

*(D) Satisfies minimum street or other right-of-way connectivity standards established by acknowledged land use regulations or, if such standards are not contained in the applicable regulations, as required by statewide planning goals or rules.*

Comment: The proposed subdivision layout provides for the extension of Landis Street through to the north boundary of the property so that the street system will ultimately connect to Cornwall Street when the adjacent property is developed at some time in the future. This future connection is consistent with the West Linn Transportation Systems Plan. The Landis street extension is designed in accordance with West Linn local street standards. This criterion is met.

*(E) Will result in development that either:*
*(i) Creates enough lots or parcels to allow building residential units at 80 percent or more of the maximum net density permitted by the zoning designation of the site; or*
*(ii) Will be sold or rented to households with incomes below 120 percent of the median family income for the county in which the project is built.*

Comment: The proposed subdivision will provide six building sites on the subject property. As shown in the density calculations below, this is the maximum density for this site. This criterion is met.

**Density Calculations**

| | Area (sq. ft.) | Allowable Density | Units @1 per 10,000 sq.ft. |
|---|---|---|---|
| Gross Site Area | 94,808 | | |
| Land in a boundary street right-of-way, water course, or planned open space where density transfer is not requested: | 0 | | |
| Area in street right-of-way: | 17,627 | | |
| Net Site Area: | 77,181 | | |
| Area within Type I or II slopes where Developed: | 20,587 | 50% | 1.03 |
| Area within Type I or II slopes where Density Will be Transferred: | 0 | 75% | 0 |
| Area within Water Resource Area-all development transferred. | 0 | 50% | 0 |
| Open Space (Type III and IV Lands) | 0 | 100% | 0 |
| Type III & IV Land Developed: | 56,594 | 100% | 5.7 |
| Base Density Allowed: | | | 6 |
| Total Allowed Density: | | | 6 Units |

*(b) "Expedited land division" includes land divisions that create three or fewer parcels under ORS 92.010 to 92.192 and meet the criteria set forth in paragraph (a) of this subsection.*

Comment: Not applicable. The proposed land division creates more than three parcels.

The proposed development conforms to the applicable provisions of the CDC as follows:

DIVISION 8. LAND DIVISION

# Chapter 85
# GENERAL PROVISIONS

## 85.200 APPROVAL CRITERIA

*No tentative subdivision or partition plan shall be approved unless adequate public facilities will be available to provide service to the partition or subdivision area prior to final plat approval and the Planning Commission or Planning Director, as applicable, finds that the following standards have been satisfied, or can be satisfied by condition of approval.*

*A. Streets.*

Comment: The subject property fronts on Cornwall Street and Landis Street is stubbed to the west property line of the site. The development of the site will provide for the extension of Landis Street through the site to the north boundary of the property so that a local street connection to Cornwall Street can be provided when the adjacent property is redeveloped in the future. Both Landis and Cornwall are local streets intended to serve the immediate neighborhood.

A reserve strip will be provided at the north end of Landis Street. No stub streets are proposed to the properties to the south and west as those areas are already developed. An alleyway connection is proposed to be provided along the north border of Lot 1. In order to avoid cut-through traffic he applicant proposes that an emergency vehicle gate be installed at the connection to Cornwall Street until such time as Landis Street is extended to the north to connect with Cornwall Street. This will allow the alley to provide access to Lot 1 and will serve to provide for a second emergency vehicle access through the site.

The unbuilt right-of-way of Cornwall Street that extends to the southerly border of the subject property is too steep to allow for construction and existing development precludes its extension to the west. A pedestrian path is proposed to be provided down the hill within this right-of-way in order to provide for pedestrian connectivity to an existing path in City property that abuts Fairhaven Drive.

No cul-de-sac streets are proposed so the provisions of Section 85.200(A)11 are not applicable.

No new street names are proposed. The maximum street grade proposed is 15%, which is consistent with City standards. The minimum centerline curve radius will conform to West Linn Public Works Design Standards. The proposed extension of Landis Street will have sidewalks and planter strips, consistent with City standards. All proposed streets will be dedicated without any reservations or restrictions. All lots

in the subdivision have access to a public street, as shown on the Tentative Plan. No gated streets or special entry designs are proposed.

*B. Blocks and lots.*

Comment: No new blocks having a length of more than 800 feet are proposed. The proposed street simply extends Landis so that it can eventually connect through to Cornwall Street. Due to terrain and surrounding development patterns, it is not practicable to make blocks that are shorter. The proposed lots have property lines that are perpendicular to the street; contain sufficient area to meet the requirements of the R-10 zone, and provide for building envelopes that will meet required setbacks. The lots have buildable depths that do not exceed 2.5 times their width.

The development conforms to the provisions of Chapter 48, as discussed below in this report.

85.200(B) (5). No double frontage lots are proposed. The proposed lot lines within the development are approximately at right angles to the streets on which they front, as required by Section 85.200(B)(6). No flag lots are proposed. The proposed lots are not large enough to allow for future re-division under the provisions of the R-10 zone.

*C. Pedestrian and bicycle trails.*

Comment: A pedestrian connection within the unbuilt Cornwall Street right-of-way is proposed. This new pathway will connect to an existing path in City property fronting Fairhaven Drive. The new path will be too steep for bicycle use and no bicycle trails are proposed in this development. No bicycle improvements in this area are listed on the Bicycle Master Plan.

*D. Transit facilities.*

Comment: Not applicable. No transit facilities are proposed or required as there is no TriMet service in this area.

*E. Lot grading.*

Comment: Grading of the proposed building site will conform to City standards. Preliminary grading plans for the street area is shown on the Preliminary Grading Plan submitted with this application. Compliance for individual homes will be reviewed at the time of building permit application.

*F. Water.*

Comment: City water is available in both Landis Street and Cornwall Street. The waterline in Cornwall Street, however, is substandard and will need to be upgraded in conjunction with the proposed development. The applicant has agreed to provide this improvement concurrent with development of the site. The upgraded water line will be connected to the line in Landis Street to provide for a looped system, thereby improving water flows in this area.

G. *Sewer.*

Comment: As shown on the Preliminary Utility Plan, there is an existing public sewer line stubbed in Landis Street to the west boundary of the site. Lot 1 in the proposed subdivision will get sewer service from this line. There is also an existing sanitary sewer line in an easement at the southerly end of the Cornwall Street right-of-way. This sewer line will be extended north in Cornwall Street to the north boundary of the subject property to provide for future service to off-site properties along Cornwall Street. A sewer line will be extended from the Cornwall Street sewer through the rear yards of Lots 2 through 6 to provide for service to those lots. Please refer to the Preliminary Utility Plan for more details.

H. Storm.

Comment: As shown on the Preliminary Utility Plan, storm sewer for the extension of Landis Street will be provided from the existing storm line in that street. Storm sewer will be installed in Landis Street to collect runoff from the street area and from the new home to be built on Lot 1. There is an existing underground detention system in Landis Street off-site to the west that has adequate capacity to provide for detention of runoff from this area. Storm water treatment and detention for runoff from roofs and foundations for the homes to be built on Lots 2 through 6 will be provided through individual rain gardens that will be built in the rear yard area of those lots. A new storm sewer line will be constructed in an easement across the rear yards of Lots 3 through 6 to provide for collection of overflow from the rain gardens during peak storm events. This storm sewer will outfall to the natural drainageway located in the City-owned tract on the north side of Fairhaven Street.

I. Utility easements. Utility easements are shown on the plans submitted with this application.

J. Supplemental provisions.

1. Wetland and natural drainageways. Comment: There are no wetlands or natural drainageways on or abutting the subject property. Please refer to the site assessment prepared by Schott & Associates.

2. Willamette and Tualatin Greenways. Comment: See discussion of Chapter 48, below

3. Street trees. Comment: Street trees will be provided as required, as shown on the Tentative Plan.

4. Lighting. Comment: Prior to final plat approval, an analysis of existing street lighting will be conducted and, if necessary, improvements made to comply with these standards. The preliminary design for streetlight placement within the subdivision is shown on the preliminary utility plan. To reduce ambient light and glare, high or low pressure sodium light bulbs will be provided for all

streetlights within the subdivision. The lights will be shielded so that the light is directed downwards rather than omni-directional.

5. Dedications and exactions. Comment: No new dedications or exactions to service off-site properties are anticipated in conjunction with this application.

6. Underground utilities. Comment: All utilities within the development will be placed underground, as required by this section.

7. Density requirement. Comment: The density calculations submitted with this application demonstrate that the maximum density permitted on this site is 6 units. The proposed density of 6 units satisfies the minimum density standard.

8. Mix requirement. Comment: Not applicable. This requirement only applies in the R-2.1 and R-3 zones. The subject property is zoned R-10.

9. Heritage trees/significant tree and tree cluster protection. Comment: No heritage trees, as defined in the Municipal Code, are present on the site. Other existing trees are mapped on the Tree Plan, including those identified by the City Arborist as "significant". Please see discussion of Chapter 55, below.

10. Annexation and street lights. Comment: Not applicable. The subject property is within the city limits.

**Chapter 48 - ACCESS, EGRESS AND CIRCULATION**

**48.025 ACCESS CONTROL**

*B. Access control standards.*

*1. Traffic impact analysis requirements. The City or other agency with access jurisdiction may require a traffic study prepared by a qualified professional to determine access, circulation and other transportation requirements. (See also CDC 55.125, Traffic Impact Analysis.)*

Comment: The trip generation rate for single-family homes is approximately 10 vehicle trips per day according to Institute of Transportation Engineers data. One of these trips will occur in the am peak hour and one will occur in the pm peak hour. The proposed subdivision will add five new dwellings (the existing home on the property will be replaced with a new dwelling, which will generate the same traffic as the existing home would). A total of 50 new trips per day would be expected from this development, with 5 occurring in the am peak hour and 5 occurring in the pm peak hour.

*2. The City or other agency with access permit jurisdiction may require the closing or consolidation of existing curb cuts or other vehicle access points, recording of reciprocal access easements (i.e., for shared driveways), development of a frontage street, installation of traffic control devices, and/or other mitigation as a condition of granting an access permit, to ensure the safe and*

*efficient operation of the street and highway system. Access to and from off-street parking areas shall not permit backing onto a public street.*

Comment: Access to the site will be via extension of Landis Street to the north boundary of the site. The driveway serving the existing home on the property will be removed and it will take access via the proposed alley. No access will be provided from Cornwall Street other than for emergency vehicles. The gate shown on the site plan will be locked and only City and emergency personnel will be able to make use of this access until such time as Cornwall Street is improved as other off-site properties are redeveloped in the future.

*3. Access options. When vehicle access is required for development (i.e., for off-street parking, delivery, service, drive-through facilities, etc.), access shall be provided by one of the following methods (planned access shall be consistent with adopted public works standards and TSP). These methods are "options" to the developer/subdivider.*

*a) Option 1. Access is from an existing or proposed alley or mid-block lane. If a property has access to an alley or lane, direct access to a public street is not permitted.*

*b) Option 2. Access is from a private street or driveway connected to an adjoining property that has direct access to a public street (i.e., "shared driveway"). A public access easement covering the driveway shall be recorded in this case to assure access to the closest public street for all users of the private street/drive.*

*c) Option 3. Access is from a public street adjacent to the development lot or parcel. If practicable, the owner/developer may be required to close or consolidate an existing access point as a condition of approving a new access. Street accesses shall comply with the access spacing standards in subsection (B)(6) of this section.*

Comment: All lots will take access from Landis Street within the subdivision.

*4. Subdivisions fronting onto an arterial street. New residential land divisions fronting onto an arterial street shall be required to provide alleys or secondary (local or collector) streets for access to individual lots. When alleys or secondary streets cannot be constructed due to topographic or other physical constraints, access may be provided by consolidating driveways for clusters of two or more lots (e.g., includes flag lots and mid-block lanes).*

Comment: The site plan provides local street access for all lots. The site does not border an arterial street.

*5. Double-frontage lots. When a lot or parcel has frontage onto two or more streets, access shall be provided first from the street with the lowest classification. For example, access shall be provided from a local street before a collector or arterial street. When a lot or parcel has frontage opposite that of the adjacent lots or parcels, access shall be provided from the street with the lowest classification.*

Comment: No double-frontage lots are proposed.

*6. Access spacing.*

*a. The access spacing standards found in Chapter 8 of the adopted Transportation System Plan (TSP) shall be applicable to all newly established public street intersections and non-traversable medians.*

*b. Private drives and other access ways are subject to the requirements of CDC 48.060.*

Comment: No new street intersections are proposed. Driveway accesses onto Landis Street will conform to City standards and will be reviewed at the time of building permit application.

*7. Number of access points. For single-family (detached and attached), two-family, and duplex housing types, one street access point is permitted per lot or parcel, when alley access cannot otherwise be provided; except that two access points may be permitted corner lots (i.e., no more than one access per street), subject to the access spacing standards in subsection (B)(6) of this section. The number of street access points for multiple family, commercial, industrial, and public/institutional developments shall be minimized to protect the function, safety and operation of the street(s) and sidewalk(s) for all users. Shared access may be required, in conformance with subsection (B)(8) of this section, in order to maintain the required access spacing, and minimize the number of access points.*

Comment: Each proposed lot will have one access point, as specified in this section.

*8. Shared driveways. The number of driveway and private street intersections with public streets shall be minimized by the use of shared driveways with adjoining lots where feasible. The City shall require shared driveways as a condition of land division or site design review, as applicable, for traffic safety and access management purposes in accordance with the following standards:*

Comment: Not applicable. No shared accesses are proposed.

*C. Street connectivity and formation of blocks required. In order to promote efficient vehicular and pedestrian circulation throughout the City, land divisions and large site developments shall produce complete blocks bounded by a connecting network of public and/or private streets, in accordance with the following standards:*

*1. Block length and perimeter. The maximum block length shall not exceed 800 feet or 1,800 feet along an arterial.*

Comment: No new blocks are proposed. The development will simply extend Landis Street so as to allow the completion of the block when property to the north is developed.

*2. Street standards. Public and private streets shall also conform to Chapter 92 CDC, Required Improvements, and to any other applicable sections of the West Linn Community Development Code and approved TSP.*

Comment: Proposed streets will comply with the public street standards of Chapter 92 (see below).

*3. Exception. Exceptions to the above standards may be granted when blocks are divided by one or more pathway(s), in conformance with the provisions of CDC 85.200(C), Pedestrian and Bicycle Trails, or cases where extreme topographic (e.g., slope, creek, wetlands, etc.) conditions or compelling functional limitations preclude implementation, not just inconveniences or design challenges. (Ord. 1635 § 25, 2014; Ord. 1636 § 33, 2014)*

Comment: No exceptions to block length are necessary.

***48.030 MINIMUM VEHICULAR REQUIREMENTS FOR RESIDENTIAL USES***

*A. Direct individual access from single-family dwellings and duplex lots to an arterial street, as designated in the transportation element of the Comprehensive Plan, is prohibited for lots or parcels created after the effective date of this code where an alternate access is either available or is expected to be available by imminent development application. Evidence of alternate or future access may include temporary cul-de-sacs, dedications or stubouts on adjacent lots or parcels, or tentative street layout plans submitted at one time by adjacent property owner/developer or by the owner/developer, or previous owner/developer, of the property in question.*

Comment: All lots will take access from Landis Street. No arterial streets are located in this area.

*B. When any portion of any house is less than 150 feet from the adjacent right-of-way, access to the home is as follows:*

*1. One single-family residence, including residences with an accessory dwelling unit as defined in CDC 02.030, shall provide 10 feet of unobstructed horizontal clearance. Dual-track or other driveway designs that minimize the total area of impervious driveway surface are encouraged.*

*2. Two to four single-family residential homes equals a 14- to 20-foot-wide paved or all-weather surface. Width shall depend upon adequacy of line of sight and number of homes.*

*3. Maximum driveway grade shall be 15 percent. The 15 percent shall be measured along the centerline of the driveway only. Variations require approval of a Class II variance by the Planning Commission pursuant to Chapter 75 CDC. Regardless, the last 18 feet in front of the garage shall be under 12 percent grade as measured along the centerline of the driveway only. Grades elsewhere along the driveway shall not apply.*

*4. The driveway shall include a minimum of 20 feet in length between the garage door and the back of sidewalk, or, if no sidewalk is proposed, to the paved portion of the right-of-way.*

Comment: All lots will have individual driveways that conform to these standards. Driveways will be reviewed at the time of building permit application.

*C. When any portion of one or more homes is more than 150 feet from the adjacent right-of-way, the provisions of subsection B of this section shall apply in addition to the following provisions.*

*1. A turnaround may be required as prescribed by the Fire Chief.*

*2. Minimum vertical clearance for the driveway shall be 13 feet, six inches.*

*3. A minimum centerline turning radius of 45 feet is required unless waived by the Fire Chief.*

*4. There shall be sufficient horizontal clearance on either side of the driveway so that the total horizontal clearance is 20 feet.*

Comment: No lots will have portions of the homes located more than 150 feet for the adjacent right-of-way.

*D. Access to five or more single-family homes shall be by a street built to full construction code standards. All streets shall be public. This full street provision may only be waived by variance.*

Comment: All proposed streets will be built to full City standards for local streets.

*E. Access and/or service drives for multi-family dwellings shall be fully improved with hard surface pavement:*

Comment: Not applicable. No multi-family dwellings are proposed.

*F. Where on-site maneuvering and/or access drives are necessary to accommodate required parking, in no case shall said maneuvering and/or access drives be less than that required in Chapters 46 and 48 CDC.*

Comment: Not applicable. All lots are for single-family homes and all parking will be provided on the home's driveway.

*G. The number of driveways or curb cuts shall be minimized on arterials or collectors. Consolidation or joint use of existing driveways shall be required when feasible.*

Comment: No driveways onto arterial or collector streets are proposed.

*H. In order to facilitate through traffic and improve neighborhood connections, it may be necessary to construct a public street through a multi-family site.*

Comment: Not applicable. No multi-family development is proposed.

*I. Gated accessways to residential development other than a single-family home are prohibited. (Ord. 1408, 1998; Ord. 1463, 2000; Ord. 1513, 2005; Ord. 1584, 2008; Ord. 1590 § 1, 2009; Ord. 1636 § 34, 2014)*

Comment: Access to all of the homes proposed will be provided via an ungated City Street. An emergency vehicle gate is proposed for the alley in order to prevent unwanted through traffic to Cornwall Street until such time as Landis is connected through to Cornwall Street with future development of off-site properties. Access to the homes, however, will be provided from the ungated Landis Street.

**Chapter 55 - DESIGN REVIEW**

As required by this chapter, the applicant retained the services of an arborist (Multnomah Tree Experts) to identify the size, species, and condition of existing trees on the subject property. The trees were surveyed and mapped by Centerline Concepts, Inc., as shown on the Existing Conditions Map submitted with this application. Subsequently, the City Arborist visited the site and determined that 38 of these trees are significant trees. These trees are shown on the Tree Preservation Plan submitted with this application. The following provisions of Chapter 55.100B relating to tree preservation are applicable to this proposal:

*B. Relationship to the natural and physical environment.*

*1. The buildings and other site elements shall be designed and located so that all heritage trees, as defined in the municipal code, shall be saved. Diseased heritage trees, as determined by the City Arborist, may be removed at his/her direction.*

Comment: No heritage trees are located on the subject property.

*2. All heritage trees, as defined in the municipal code, all trees and clusters of trees ("cluster" is defined as three or more trees with overlapping driplines; however, native oaks need not have an overlapping dripline) that are considered significant by the City Arborist, either individually or in consultation with certified arborists or similarly qualified professionals, based on accepted arboricultural standards including consideration of their size, type, location, health, long term survivability, and/or numbers, shall be protected pursuant to the criteria of subsections (B)(2)(a) through (f) of this section. In cases where there is a difference of opinion on the significance of a tree or tree cluster, the City Arborist's findings shall prevail. It is important to acknowledge that all trees are not significant and, further, that this code section will not necessarily protect all trees deemed significant.*

*a. Non-residential and residential projects on Type I and II lands shall protect all heritage trees and all significant trees and tree clusters by either the dedication of these areas or establishing tree conservation easements. Development of Type I and II lands shall require the careful layout of streets, driveways, building pads, lots, and utilities to avoid heritage trees and significant trees and tree clusters, and other natural resources pursuant to this code. The method for delineating the protected trees or tree clusters ("dripline + 10 feet") is explained*

*in subsection (B)(2)(b) of this section. Exemptions of subsections (B)(2)(c), (e), and (f) of this section shall apply.*

Comment: Five of the significant trees identified by the City Arborist are located on Type I or II lands outside of the street right-of-way. These trees are located in the front yard areas of Lots 3 and 4 near Landis Street and fall within the fill slope of grading associated with the extension of Landis Street and must be removed. See comment on subsection 55.B.2.f, below.

b. *Non-residential and residential projects on non-Type I and II lands shall set aside up to 20 percent of the area to protect trees and tree clusters that are determined to be significant, plus any heritage trees. Therefore, in the event that the City Arborist determines that a significant tree cluster exists at a development site, then up to 20 percent of the non-Type I and II lands shall be devoted to the protection of those trees, either by dedication or easement. The exact percentage is determined by establishing the driplines of the trees or tree clusters that are to be protected. In order to protect the roots which typically extend further, an additional 10-foot measurement beyond the dripline shall be added. The square footage of the area inside this "dripline plus 10 feet" measurement shall be the basis for calculating the percentage (see figure below). The City Arborist will identify which tree(s) are to be protected. Development of non-Type I and II lands shall also require the careful layout of streets, driveways, building pads, lots, and utilities to avoid significant trees, tree clusters, heritage trees, and other natural resources pursuant to this code. Exemptions of subsections (B)(2)(c), (e), and (f) of this section shall apply. Please note that in the event that more than 20 percent of the non-Type I and II lands comprise significant trees or tree clusters, the developer shall not be required to save the excess trees, but is encouraged to do so.*

Comment: The Tentative Plan shows two areas being protected: the western portion of Lot 1 and in the rear yard areas of 2 to 6. These areas total 14,403 sq. ft. The site contains 71,556 sq. ft. of non-Type I and II lands. The areas set aside for protection of significant trees amounts to 20% of this area and meets the requirements of this section. A total of 38 significant trees are located on the property. The plan would retain 13 of these trees, or 32.5% of the total significant trees on the site.

c. *Where stubouts of streets occur on abutting properties, and the extension of those streets will mean the loss of significant trees, tree clusters, or heritage trees, it is understood that tree loss may be inevitable. In these cases, the objective shall be to minimize tree loss. These provisions shall also apply in those cases where access, per construction code standards, to a lot or parcel is blocked by a row or screen of significant trees or tree clusters.*

Comment: Landis Street is stubbed to the north property line of the subject property. No significant trees are located in the vicinity of the proposed street stub, however.

d. *For both non-residential and residential development, the layout shall achieve at least 70 percent of maximum density for the developable net area. The developable net area excludes all Type I and II lands and up to 20 percent of*

*the remainder of the site for the purpose of protection of stands or clusters of trees as defined in subsection (B)(2) of this section.*

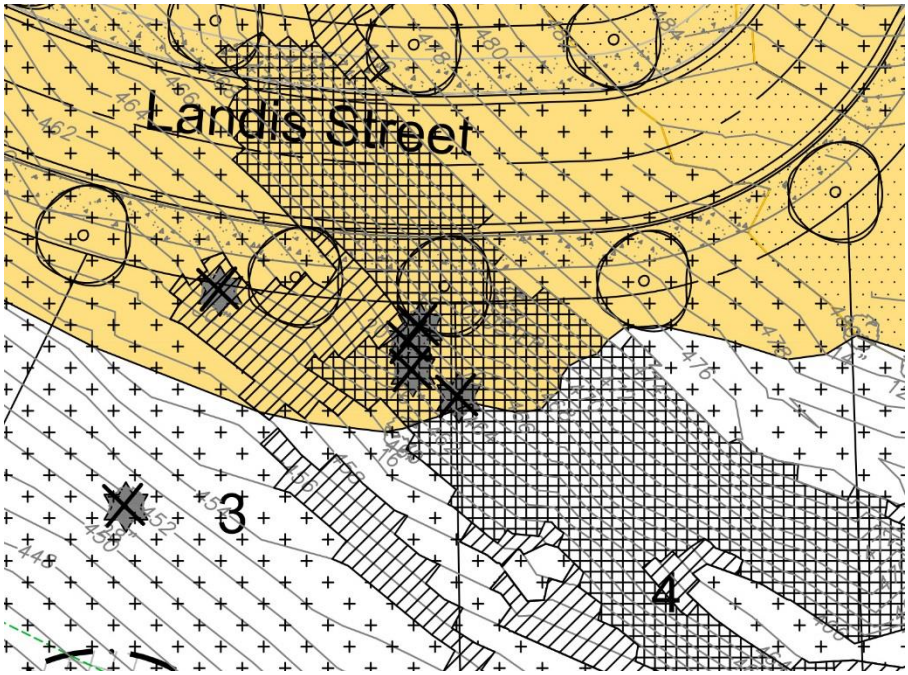
Comment: The density calculations submitted above in this narrative demonstrate that the project will achieve more than 70% of maximum density. The proposed six lots is the maximum density allowed for this site.

e. *For arterial and collector street projects, including Oregon Department of Transportation street improvements, the roads and graded areas shall avoid tree clusters where possible. Significant trees, tree clusters, and heritage tree loss may occur, however, but shall be minimized.*

Comment: Not applicable. The site does not abut an arterial or collector street.

f. *If the protection of significant tree(s) or tree clusters is to occur in an area of grading that is necessary for the development of street grades, per City construction codes, which will result in an adjustment in the grade of over or under two feet, which will then threaten the health of the tree(s), the applicant will submit evidence to the Planning Director that all reasonable alternative grading plans have been considered and cannot work. The applicant will then submit a mitigation plan to the City Arborist to compensate for the removal of the tree(s) on an "inch by inch" basis (e.g., a 48-inch Douglas fir could be replaced by 12 trees, each four-inch). The mix of tree sizes and types shall be approved by the City Arborist.*

Comment: As noted in subsection 55.100B.2.a., above, there are five significant trees located on Type I and II lands that the provisions of this section would require to be protected. These trees are shown within the tan-shaded grading limits line, below.



These trees are located in an area that is impacted by the grading for the extension of Landis Street. This street extension is mandated by the Transportation System Plan and there is no alternative except to grade for this street. A mitigation plan for these five trees will be submitted to the City Arborist during the final engineering phase of this project. Trees located in the other protected portions of the site will not be impacted by site grading.

**Chapter 92: REQUIRED IMPROVEMENTS**

***92.010 PUBLIC IMPROVEMENTS FOR ALL DEVELOPMENT***
*The following improvements shall be installed at the expense of the developer and meet all City codes and standards:*

*A. Streets within subdivisions.*
*1. All streets within a subdivision, including alleys, shall be graded for the full right-of-way width and improved to the City's permanent improvement standards and specifications which include sidewalks and bicycle lanes, unless the decision-making authority makes the following findings:*

Comment: As shown on the Tentative Plan, the developer proposes to construct Landis Street and the alleyway to full City standards.

*2. When the decision-making authority makes these findings, the decision-making authority may impose any of the following conditions of approval:*

Comment: Not applicable. This subsection applies only when an applicant is proposing to construct less than full standard streets.

*B. Extension of streets to subdivisions. The extension of subdivision streets to the intercepting paving line of existing streets with which subdivision streets intersect shall be graded for the full right-of-way width and improved to a minimum street structural section and width of 24 feet.*

Comment: As shown on the Grading Plan submitted with this application, this requirement is met.

*C. Local and minor collector streets within the rights-of-way abutting a subdivision shall be graded for the full right-of-way width and approved to the City's permanent improvement standards and specifications. The City Engineer shall review the need for street improvements and shall specify whether full street or partial street improvements shall be required. The City Engineer shall also specify the extent of storm drainage improvements required. The City Engineer shall be guided by the purpose of the City's systems development charge program in determining the extent of improvements which are the responsibility of the subdivider.*

Comment: As shown on the Grading Plan submitted with this application, the proposed streets will be graded for the full right-of-way and improved to City standards.

*D. Monuments. Upon completion of the first pavement lift of all street improvements, monuments shall be installed and/or reestablished at every street intersection and all*

*points of curvature and points of tangency of street centerlines with an iron survey control rod. Elevation benchmarks shall be established at each street intersection monument with a cap (in a monument box) with elevations to a U.S. Geological Survey datum that exceeds a distance of 800 feet from an existing benchmark.*

Comment: Monumentation will be installed and/or reestablished at street intersections in accordance with this subsection.

*E. Surface drainage and storm sewer system. A registered civil engineer shall prepare a plan and statement which shall be supported by factual data that clearly shows that there will be no adverse impacts from increased intensity of runoff off site of a 100-year storm, or the plan and statement shall identify all off-site impacts and measures to mitigate those impacts commensurate to the particular land use application. Mitigation measures shall maintain pre-existing levels and meet buildout volumes, and meet planning and engineering requirements.*

Comment: The project engineer has prepared a storm drainage plan, as shown on the Utility Plan, and a storm report for this project. Please refer to those documents.

*F. Sanitary sewers. Sanitary sewers shall be installed to City standards to serve the subdivision and to connect the subdivision to existing mains.*

1. *If the area outside the subdivision to be directly served by the sewer line has reached a state of development to justify sewer installation at the time, the Planning Commission may recommend to the City Council construction as an assessment project with such arrangement with the subdivider as is desirable to assure financing his share of the construction.*
2. *If the installation is not made as an assessment project, the City may reimburse the subdivider an amount estimated to be a proportionate share of the cost for each connection made to the sewer by property owners outside of the subdivision for a period of 10 years from the time of installation of the sewers. The actual amount shall be determined by the City Administrator considering current construction costs.*

Comment: Sanitary sewers are available to this project from an existing line in Landis Street and in the City owned tract adjacent to the southern terminus of Cornwall Street. These sewers will be extended to service all lots within the development, as required by this subsection, and the sewer line in Cornwall Street will be stubbed to the northern limits of the site to provide for future service to other properties in this area.

*G. Water system. Water lines with valves and fire hydrants providing service to each building site in the subdivision and connecting the subdivision to City mains shall be installed. Prior to starting building construction, the design shall take into account provisions for extension beyond the subdivision and to adequately grid the City system. Hydrant spacing is to be based on accessible area served according to the City Engineer's recommendations and City standards. If required water mains will directly serve property outside the subdivision, the City may reimburse the developer an amount estimated to be the proportionate share of the cost for each connection made to the water mains by property owners outside the subdivision for a period of 10 years from the time of installation of the mains. If oversizing of water mains is required to areas outside the subdivision as a general improvement, but to which no*

*new connections can be identified, the City may reimburse the developer that proportionate share of the cost for oversizing. The actual amount and reimbursement method shall be as determined by the City Administrator considering current or actual construction costs.*

Comment: Water lines will be installed within the proposed development and will connect to the existing line in Landis St. Additionally, the developer will replace and upgrade the existing water line in Cornwall St. to City standards. Tying these lines together will improve the water system in this area by providing looping that will aid in maintaining appropriate flows and will avoid sedimentation associated with dead-end lines.

*H. Sidewalks.*

1. *Sidewalks shall be installed on both sides of a public street and in any special pedestrian way within the subdivision, except that in the case of primary or secondary arterials, or special type industrial districts, or special site conditions, the Planning Commission may approve a subdivision without sidewalks if alternate pedestrian routes are available. In the case of the double-frontage lots, provision of sidewalks along the frontage not used for access shall be the responsibility of the developer. Providing front and side yard sidewalks shall be the responsibility of the land owner at the time a request for a building permit is received. Additionally, deed restrictions and CC&Rs shall reflect that sidewalks are to be installed prior to occupancy and it is the responsibility of the lot or homeowner to provide the sidewalk, except as required above for double-frontage lots.*

   Comment: As required by this subsection, sidewalks will be installed along all street *frontages* in this development.

2. *On local streets serving only single-family dwellings, sidewalks may be constructed during home construction, but a letter of credit shall be required from the developer to ensure construction of all missing sidewalk segments within four years of final plat approval pursuant to CDC 91.010(A)(2).*

   Comment: Sidewalks will be constructed during home construction on each lot. The required letter of credit will be provided.

3. *The sidewalks shall measure at least six feet in width and be separated from the curb by a six-foot minimum width planter strip. Reductions in widths to preserve trees or other topographic features, inadequate right-of-way, or constraints, may be permitted if approved by the City Engineer in consultation with the Planning Director.*

   Comment: Sidewalks will be installed to City specifications.

4. *Sidewalks should be buffered from the roadway on high volume arterials or collectors by landscape strip or berm of three and one-half-foot minimum width.*

   Comment: Not applicable. The site does not abut an arterial or collector street.

5. *The City Engineer may allow the installation of sidewalks on one side of any street only if the City Engineer finds that the presence of any of the factors listed below justifies such waiver:*
   a. *The street has, or is projected to have, very low volume traffic density;*
   b. *The street is a dead-end street;*
   c. *The housing along the street is very low density; or*
   d. *The street contains exceptional topographic conditions such as steep slopes, unstable soils, or other similar conditions making the location of a sidewalk undesirable.*

Comment: Sidewalks are proposed on both sides of all streets within this subdivision.

I. *Bicycle routes. If appropriate to the extension of a system of bicycle routes, existing or planned, the Planning Commission may require the installation of separate bicycle lanes within streets and separate bicycle paths.*

Comment: No bicycle routes are called for on the local streets within this subdivision.

J. *Street name signs. All street name signs and traffic control devices for the initial signing of the new development shall be installed by the City with sign and installation costs paid by the developer.*

Comment: The developer will provide all required signs, consistent with City standards.

K. *Dead-end street signs. Signs indicating "future roadway" shall be installed at the end of all discontinued streets. Signs shall be installed by the City per City standards, with sign and installation costs paid by the developer.*

Comment: Not applicable. No dead-end streets are proposed.

L. *Signs indicating future use shall be installed on land dedicated for public facilities (e.g., parks, water reservoir, fire halls, etc.). Sign and installation costs shall be paid by the developer.*

Comment: Not applicable. No public dedications are proposed.

M. *Street lights. Street lights shall be installed and shall be served from an underground source of supply. The street lighting shall meet IES lighting standards. The street lights shall be the shoe-box style light (flat lens) with a 30-foot bronze pole in residential (non-intersection) areas. The street light shall be the cobra head style (drop lens) with an approximate 50-foot (sized for intersection width) bronze pole. The developer shall submit to the City Engineer for approval of any alternate residential, commercial, and industrial lighting, and alternate lighting fixture design. The developer and/or homeowners association is required to pay for all expenses related to street light energy and maintenance costs until annexed into the City.*

Comment: Street lights will be installed by the developer, consistent with the requirements of this subsection.

*N. Utilities. The developer shall make necessary arrangements with utility companies or other persons or corporations affected for the installation of underground lines and facilities. Electrical lines and other wires, including but not limited to communication, street lighting, and cable television, shall be placed underground.*

Comment: The developer will coordinate with utility companies for the installation of underground facilities for electrical, cable, natural gas, telephone, and street lighting. As required by this section.

*O. Curb cuts and driveways. Curb cuts and driveway installations are not required of the subdivider at the time of street construction, but, if installed, shall be according to City standards. Proper curb cuts and hard-surfaced driveways shall be required at the time buildings are constructed.*

Comment: Curb cuts will be installed at the time of home construction and will be installed to City standards.

*P. Street trees. Street trees shall be provided by the City Parks and Recreation Department in accordance with standards as adopted by the City in the Municipal Code. The fee charged the subdivider for providing and maintaining these trees shall be set by resolution of the City Council.*

Comment: The developer will coordinate with the City Parks and Recreation Department regarding installation of street trees and will be responsible for paying the appropriate fee.

*Q. Joint mailbox facilities shall be provided in all residential subdivisions, with each joint mailbox serving at least two, but no more than eight, dwelling units. Joint mailbox structures shall be placed in the street right-of-way adjacent to roadway curbs. Proposed locations of joint mailboxes shall be designated on a copy of the tentative plan of the subdivision, and shall be approved as part of the tentative plan approval. In addition, sketch plans for the joint mailbox structures to be used shall be submitted and approved by the City Engineer prior to final plat approval.*

Comment: The developer will coordinate with the US Postal Service and the City Engineer regarding the location of joint mailbox clusters and will install them in accordance with this section.

**CHAPTER 28 - WILLAMETTE AND TUALATIN RIVER PROTECTION**

City Planning staff indicate that they have adopted a new policy determining that the provisions of Chapter 28 are applicable to developments containing Habitat Conservation Areas shown on City mapping. The applicant disagrees with this interpretation. These provisions have never been applied to other developments outside of the Willamette River and Tualatin River Greenways, and we believe that this interpretation is in direct conflict with the plain language of that section.

***28.030 APPLICABILITY***

*A. The Willamette and Tualatin River Protection Area is an overlay zone. The zone boundaries are identified on the City's zoning map, and include:*
*1. All land within the City of West Linn's Willamette River Greenway Area.*
*2. All land within 200 feet of the ordinary low water mark of the Tualatin River, and all land within the 100-year floodplain of the Tualatin River.*
*3. In addition to the Willamette Greenway and Tualatin River Protection Area boundaries, this chapter also relies on the HCA Map to delineate where development should or should not occur. Specifically, the intent is to keep out of, or minimize disturbance of, the habitat conservation areas (HCAs). Therefore, if all, or any part, of a lot or parcel is in the Willamette Greenway and Tualatin River Protection Area boundaries, and there are HCAs on the lot or parcel, a Willamette and Tualatin River Protection Area permit shall be required unless the development proposal is exempt per CDC 28.040*.

Comment: The subject property is not within the identified Willamette River Greenway or within 200 feet of the ordinary low water mark of the Tualatin River. There is an area of Habitat Conservation Area identified on City and Metro mapping that extends into a portion of Lot 1. This HCA is associated with Cornwall Creek, which is located on the east side of Cornwall Street. A field investigation by Schott and Associates (attached) determined that the area of Lot 1 mapped as HCA contains only upland plants, primarily Himalayan blackberries. Because there are no riparian plants it is not a part of the HCA. Since the site is not within the Tualatin River or Willamette Greenway and is not within contains no HCAs, this chapter does not apply.

Willow Ridge

Cornwall and Landis

West Linn, Oregon

# DRAINAGE ANALYSIS

September 29, 2017


EXPIRES: 06/30/2019

SIGNATURE DATE: 9/29/17

Prepared By:

Bruce D. Goldson, PE

Theta, llc

PO Box 1345, Lake Oswego, Oregon 97035

# 2014-129L

**INDEX**



**PURPOSE:**

The purpose is to demonstrate that the storm water system for the Tanner's Stonegate development was designed to accommodate the Willow Ridge project.

**NARRATIVE ASSUMPTIONS**

The Tanner's Stonegate project construction drawings show a storm sewer line to the westerly property line of the proposed Willow Ridge project. The plans also show a tentative roadway extension into the Willow Ridge property with a note *"future expansion". Within the roadway of Tanner's Stonegate there is 370 lineal feet of 60-inche reinforced concrete detention pipe with a control manhole having orifices to regulate flow. Downstream of the control manhole is a water quality facility prior to discharge into the natural drainage course. North of the Tanner's Stonegate project the extension of Landis Street is also labeled "future expansion". Inspection* of the construction plans reveal that only the houses on the easterly side of Landis Street, Landis Street, and Stonegate Lane plus to land east of the houses on Landis Street could be collected in this storm system. Detail 7/C3.2, flow control MH illustrates a water quality orifice at 3.5-inches and a flow control orifice at 4.0"

Checking in the field the water quality riser is open at the top And effectively becomes a 8-inch orifice when the volume reaches that elevation. Stains in the control manhole Indicate that the volume has never been significantly above the overflow level of the water quality riser.

The original storm report could not be found and therefore this analysis has been undertaken to determine if there is sufficient capacity in the existing detention system to accommodate the proposed Willow Ridge project. Only the new public street area, from the proposed Willow

Ridge project will be directed to the Tanner's Stonegate facility. The impervious roof areas on the Willow Ridge would be directed on-site rain gardens with overflow to the drainage way on the easterly side of the property.

## Regulatory

2.0013 Minimum Design Criteria

A. Storm Detention Facilities

2. Storms to be evaluated shell include to 2, 5, 10, 25, and 100-year event. Allowable post-development discharge rates for the 2, 5, 10, and 25-year events hall be that of the pre-development rate. An outfall structure such as a "V-North" weir of single of multiple orifice structure shall be designed to control the release rate for the above events. No flow control orifice smaller than 1 in. shall be allowed. If the maximum release cannot be met with all the site drainage controlled by a single 1 in. orifice, the allowable release rate provided by the 1 in. orifice will be considered adequate as approved by the City Engineer. The detention volume was calculated to be 7265 CF.

## References Regulatory


1. King County Department of Public Works, Surface Water Management Division, Hydrographic Programs, Version 4.21B
2. Tanner's Stonegate construction plans by Otak (8-21-2001)
3. City of Portland Sewer & Drainage Facilities Design Manual, Chart 1
4. City of West Linn Public Works Design Standards (2010) Section two-storm Facilities Design Maual


### Summary

| Event | Pre flow | Post flow | With Orifices |
|---|---|---|---|
| 2-year | 0.73 cfs | 1.07 cfs | 0.90 cfs |
| 5-year | 1.11 cfs | 1.38 cfs | 1.11 cfs |
| 10-year | 1.25 cfs | 1.64 cfs | 1.28 cfs |
| 25-year | 1.55 cfs | 1.97 cfs | 1.55 cfs |

#### Time of concentration

**Pre** $T= 0.42((nL))^{0.8}/(p)^{.5}(s)^{.4} = 0.42((.24)(167))^{.8}/(2.6)^{.5}(0.08)^{.4} = 13.7$ min.

**Post** $T_1= 0.42((nL))^{0.8}/(p)^{.5}(s)^{.4} = 0.42((.01)(170))^{.8}/(2.6)^{.5}(0.03)^{.4} = 1.6$ min.

$T_2 = L/60(k)(s)^{.5} = 167/(60)(42)(0.01)^{.5} = 6.6$ min & $T_3 = 233/(60)(42)90.065)^{.5} = 0.1$ min

$T_{post} = 1.6+6.6+0.1 = 8.3$ min

**Areas:**

The areas used are shown on the storm analysis drawing.

Tanner's Stonegate basin = 105, 995 SF + Willow ridge street = 10,324 SF for total = 116,319 SF

## HYDROGRAPH RESULTS (DETENTION, WATER QUALITY, INFILTRATION)

KING COUNTY DEPARTMENT OF PUBLIC WORKS
Surface Water Management Division
HYDROGRAPH PROGRAMS
Version 4.21B

1 - INFO ON THIS PROGRAM
2 - SBUHYD
3 - MODIFIED SBUHYD
4 - ROUTE
5 - ROUTE2
6 - ADDHYD
7 - BASEFLOW
8 - PLOTHYD
9 - DTATA
10 - REFAC
11 - RETURN TO DOS

ENTER OPTION:
2
SBUH/SCS METHOD FOR COMPUTING RUNOFF HYDROGRAPH
STORM OPTIONS:
1 - S.C.S. TYPE-1A
2 - 7-DAY DESIGN STORM
3 - STORM DATA FILE
SPECIFY STORM OPTION:
1
S.C.S. TYPE - 1A RAINFALL DISTRIBUTION
ENTER; FREQ(YEAR), DURATION(HOUR), PRECIP(INCHES)
25,24,3.9
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XXXXXXXXXXXX 25-YEAR 24-HOUR STORM xxxx 3.90 "TOTAL PRECIP Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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ENTER: A(PERV),CN(PERV),A(IMPERV),CN(IMPERV),TC FOR BASIN NO. 1
1.97,86,0.92,98,8.3
DATA PRINT OUT:

| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
|---|---|---|---|---|---|
| | A | CN | A | CN | |
| 2.7 | 1.8 | 81.0 | 0.9 | 98.0 | 8.3 |

| PEAK-Q(CFS) | T-PEAK(HRS) | VOL(CU-FT) |
|---|---|---|
| 1.97 | 7.83 | 27834 |

ENTER [dk:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:
C:25post
SPECIFY: C - CONTINUE, N - NEWSTORM, P -PRINT, S - STOP

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C

ENTER: A(PERV),CN(PERV),A(IMPERV),CN(IMPERV),TC FOR BASIN NO. 1
2,67,86,0.0,98,13.7
DATA PRINT OUT:

| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
|---|---|---|---|---|---|
| | A | CN | A | CN | |
| 2.7 | 2.7 | 86.0 | .0 | 98.0 | 13.7 |
| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 1.55 | 7.83 | | 23762 | | |

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C:25pre
SPECIFY: C - CONTINUE, N - NEWSTORM, P -PRINT, S – STOP
N

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1 - S.C.S. TYPE-1A
2 - 7-DAY DESIGN STORM
3 - STORM DATA FILE
SPECIFY STORM OPTION:
1
S.C.S. TYPE - 1A RAINFALL DISTRIBUTION
ENTER; FREQ(YEAR), DURATION(HOUR), PRECIP(INCHES)
2,24,2.5
Xxxxxxxxxxxxxxxxxxxxxx S.C.S.TYPE-1A DISTRIBUTION xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
XXXXXXXXXXXX 2-YEAR 24-HOUR STORM xxxx 2.50 "TOTAL PRECIP Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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1.97,86,0.92,98,8.3
DATA PRINT OUT:

| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
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| | A | CN | A | CN | |
| 2.7 | 1.8 | 81.0 | 0.9 | 98.0 | 8.3 |
| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 1.07 | 7.83 | | 15478 | | |

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C:2ce
SPECIFY: C - CONTINUE, N - NEWSTORM, P -PRINT, S - STOP

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C
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2,67,86,0.0,98,13.7
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| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
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| 2.7 | 2.7 | 86.0 | .0 | 98.0 | 13.7 |
| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 0.73 | 7.83 | | 12028 | | |

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N

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2 - 7-DAY DESIGN STORM
3 - STORM DATA FILE
SPECIFY STORM OPTION:
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S.C.S. TYPE - 1A RAINFALL DISTRIBUTION
ENTER; FREQ(YEAR), DURATION(HOUR), PRECIP(INCHES)
5,24,3.0
Xxxxxxxxxxxxxxxxxxxxxx S.C.S.TYPE-1A DISTRIBUTION xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
XXXXXXXXXXXX 5-YEAR 24-HOUR STORM xxxx 3.50 "TOTAL PRECIP Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
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| | A | CN | A | CN | |
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| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 1.38 | 7.83 | | 19800 | | |

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C
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2,67,86,0.0,98,13.7
DATA PRINT OUT:

| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
|---|---|---|---|---|---|
| | A | CN | A | CN | |
| 2.7 | 2.7 | 86.0 | .0 | 98.0 | 13.7 |
| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 1.11 | 7.83 | | 16107 | | |

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SPECIFY: C - CONTINUE, N - NEWSTORM, P -PRINT, S – STOP
N

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1 - S.C.S. TYPE-1A
2 - 7-DAY DESIGN STORM
3 - STORM DATA FILE
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S.C.S. TYPE - 1A RAINFALL DISTRIBUTION

ENTER; FREQ(YEAR), DURATION(HOUR), PRECIP(INCHES)
10,24,3.4
Xxxxxxxxxxxxxxxxxxxxxx S.C.S.TYPE-1A DISTRIBUTION xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
XXXXXXXXXXXX 10-YEAR 24-HOUR STORM xxxx 3.40 "TOTAL PRECIP Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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1.97,86,0.92,98,8.3
DATA PRINT OUT:

| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
|---|---|---|---|---|---|
| | A | CN | A | CN | |
| 2.7 | 1.8 | 81.0 | 0.9 | 98.0 | 8.3 |
| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 1.64 | 7.83 | | 23338 | | |

ENTER [dk:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:
C:10ce
SPECIFY: C - CONTINUE, N - NEWSTORM, P -PRINT, S - STOP

---

C
ENTER: A(PERV),CN(PERV),A(IMPERV),CN(IMPERV),TC FOR BASIN NO. 1
2,67,86,0.0,98,13.7
DATA PRINT OUT:

| AREA(ACRES) | PERVIOUS | | IMPERVIOUS | | TC(MINUTES) |
|---|---|---|---|---|---|
| | A | CN | A | CN | |
| 2.7 | 2.7 | 86.0 | .0 | 98.0 | 13.7 |
| PEAK-Q(CFS) | T-PEAK(HRS) | | VOL(CU-FT) | | |
| 1.25 | 7.83 | | 19447 | | |

ENTER [dk:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:
C:10cp
SPECIFY: C - CONTINUE, N - NEWSTORM, P -PRINT, S – STOP
s

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**DETENTION**

KING COUNTY DEPARTMENT OF PUBLIC WORKS
Surface Water Management Division
HYDROGRAPH PROGRAMS
Version 4.21B
1 - INFO ON THIS PROGRAM
2 - SBUHYD
3 - MODIFIED SBUHYD
4 - ROUTE
5 - ROUTE2
6 - ADDHYD
7 - BASEFLOW
8 - PLOTHYD
9 - DTATA

10 - REFAC
11 - RETURN TO DOS

10
R/D FACILITY DESIGN ROUTINE
SPECIFY TYPE OF R/D FACULTY
1 - POND 4 - INFILTRATION POND
2 - TANK 5 - INFILTRATION TANK
3 -VAULT 6 - GRAVEL TRENCH/BED
2
ENTER: TANK DIAMETER (ft), EFFECTIVE STORAGE DEPTH (ft)
5,5
ENTER [d:][path]filename[.ext] OF PRIMARY DESIGN INFLOW HYDROGRAPH:
C:25post
PRELIMINARY DESIGN INFLOW PEAK = 1,97 CFS
ENTER PRIMARY DESIGN RELEASE RATE(cfs)
1.55
ENTER NUMBER OF INFLOW HYDROGRAPHS TO BE TESTED FOR PERFORMANCE (5 MAXIMUM)
3
ENTER [d:][path] filename[.ext] OF HYDROGRAPH 1:
C:2CE
ENTER TARGET RELEASE RATE (cfs)
0.73
ENTER [d:][path] filename[.ext] OF HYDROGRAPH 2:
C:5CE
ENTER TARGET RELEASE RATE (cfs)
1.11
ENTER [d:][path] filename[.ext] OF HYDROGRAPH 3:
C:10CE
ENTER TARGET RELEASE RATE (cfs)
1.25

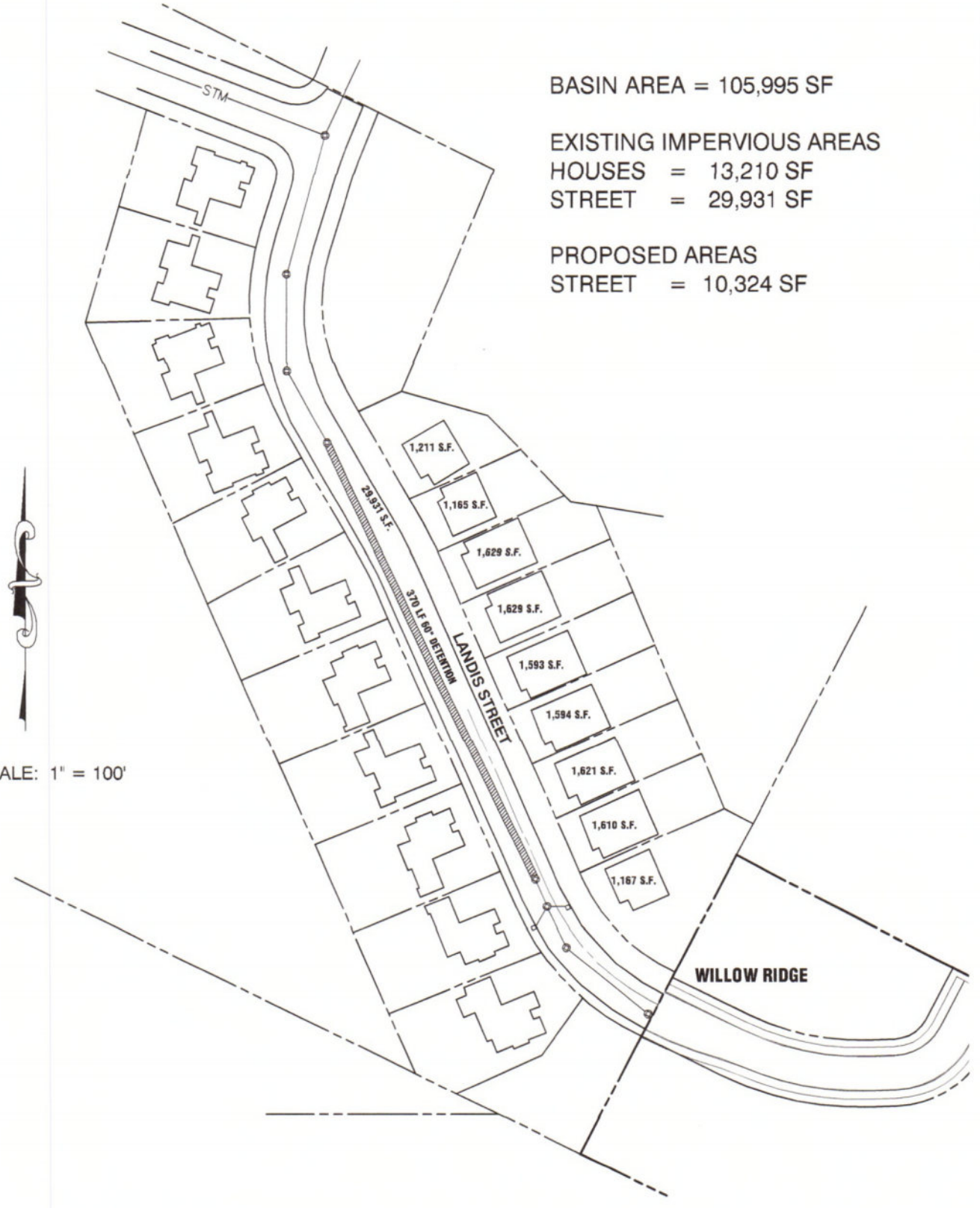
ENTER; NUMBER OF ORIFICES, RISER-HEAD (ft), RISER-DIAMETER(in)
2,5,12
RISER OVERFLOW DEPTH FOR PRIMARY PEAK INFLOW = .34FT
SPECIFY ITERATION DISPLAY: Y - YES, N – NO
N
SPECIFY: R - REVIEW/REVISE INPUT, C – CONTINUE
C
INITIAL STORAGE VALUE FOR ITERATION PURPOSES: 8295 CU-FT
BOTTOM ORIFICE : ENTER Q-MAX (cfs)
0.5
DIA. = 2.87 INCHES
TOP ORIFICE ENTER HEIGHT(ft)
0.5
DIA. = 4.27 INCHES

| PERFORMANCE: | INFLOW | TARGET-OUTFLOW | ACTUAL-OUTFLOW | PK-STAGE | STORAGE |
|---|---|---|---|---|---|
| DESIGN HYD: | 1.97 | 1.55 | 1.55 | 4.99 | 1145 |
| TEST HYD: 1 | 1.07 | .73 | .90 | 1.91 | 400 |
| TEST HYD: 2 | 1.38 | 1.11 | 1.11 | 2.73 | 640 |
| TEST HYD: 3 | 1.64 | 1.25 | 1.28 | 3.53 | 860 |

**CONCLUSION**

To replicate the original report would be impossible with the available information. Based on a field investigation it doesn't appear that the facility as constructed meets the City of West Linn storm water standards with the water quality riser overflow as constructed.
The above calculation indicate that there is excess capacity in the detention system to receive the Willow Ridge development, but the flow could be better controlled by raising the water quality flow riser to the same overflow height as the flow control riser and changing the water quality orifice to 2.87-inches and the quantity orifice to 4.27-inches.

Based on the available information and these calculations the Tanner's Stonegate project has provided sufficient detention volume to accommodate the Willow Ridge development




BASIN AREA = 105,995 SF

EXISTING IMPERVIOUS AREAS
HOUSES = 13,210 SF
STREET = 29,931 SF

PROPOSED AREAS
STREET = 10,324 SF

SCALE: 1" = 100'

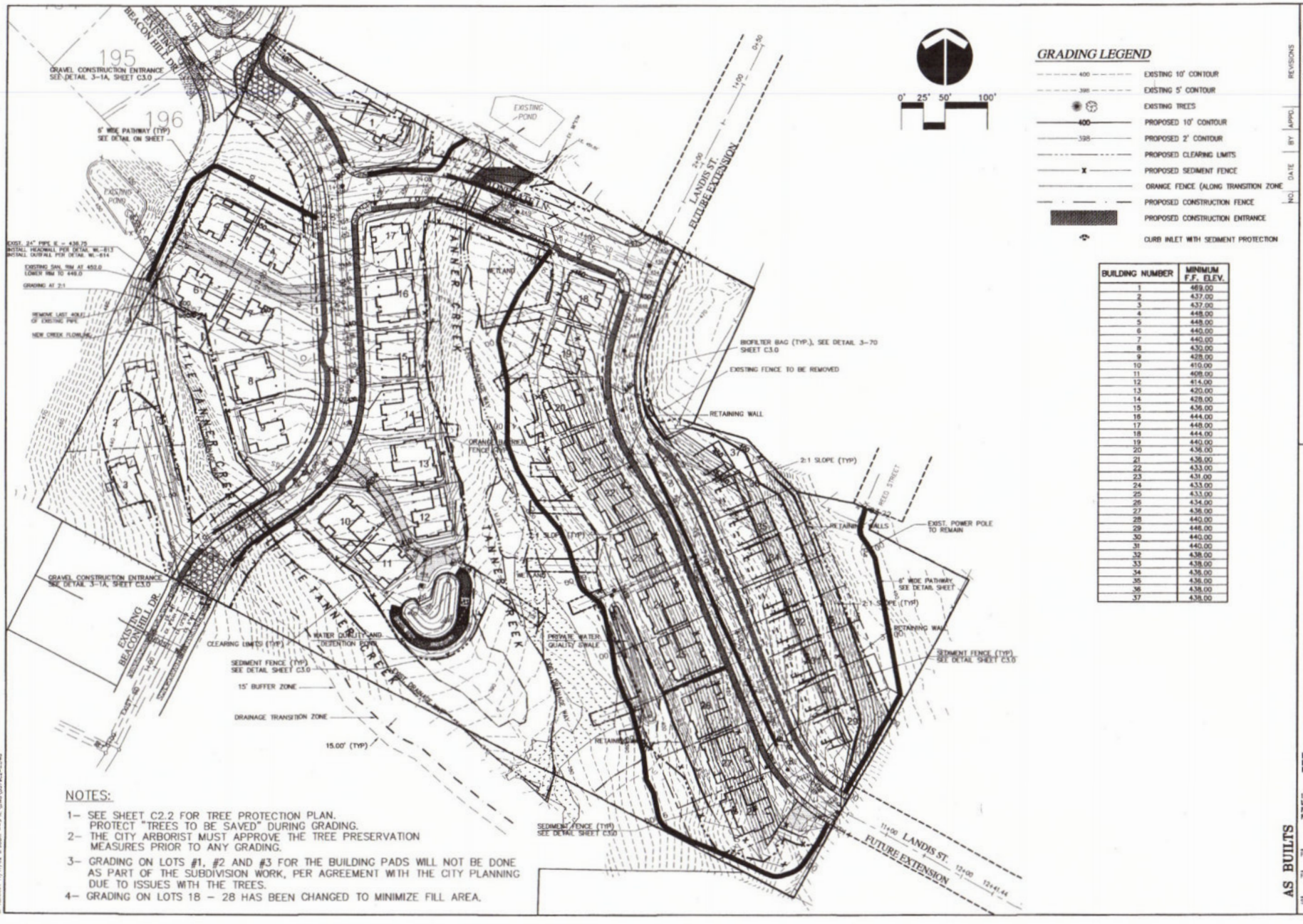
**2010-129L**

**STORM ANALYSIS**

Theta, llc
ENGINEERING - SURVEYING - PLANNING
PO Box 1345
Lake Oswego, Oregon 97035
503/481-8822
email: thetaeng@comcast.net

# WILLOW RIDGE

**West Linn, Oregon**




| BUILDING NUMBER | MINIMUM F.F. ELEV. |
|---|---|
| 1 | 469.00 |
| 2 | 437.00 |
| 3 | 437.00 |
| 4 | 448.00 |
| 5 | 448.00 |
| 6 | 440.00 |
| 7 | 440.00 |
| 8 | 430.00 |
| 9 | 428.00 |
| 10 | 410.00 |
| 11 | 408.00 |
| 12 | 414.00 |
| 13 | 420.00 |
| 14 | 428.00 |
| 15 | 436.00 |
| 16 | 444.00 |
| 17 | 448.00 |
| 18 | 444.00 |
| 19 | 440.00 |
| 20 | 436.00 |
| 21 | 426.00 |
| 22 | 433.00 |
| 23 | 431.00 |
| 24 | 433.00 |
| 25 | 433.00 |
| 26 | 434.00 |
| 27 | 436.00 |
| 28 | 440.00 |
| 29 | 446.00 |
| 30 | 440.00 |
| 31 | 440.00 |
| 32 | 438.00 |
| 33 | 438.00 |
| 34 | 436.00 |
| 35 | 436.00 |
| 36 | 438.00 |
| 37 | 438.00 |

08/21/2001
Date
AAH/BLW/JAH
Designed
AAH/BLW/JAH
Drawn
Checked By Date

REVISIONS
NO. DATE BY APPD.

REGISTERED PROFESSIONAL ENGINEER
OREGON
RENEWAL 06/30/2003

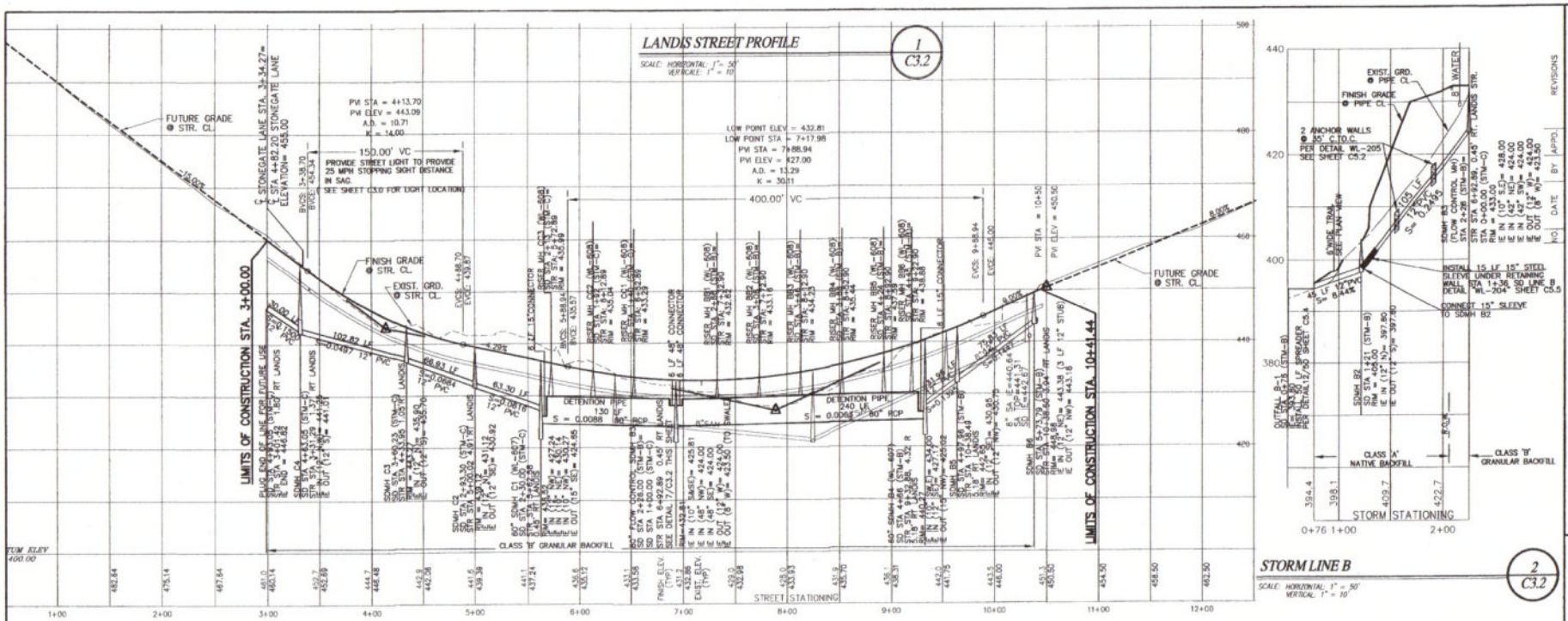
NORWAY DEVELOPMENT
P.O.Box 387
Oregon City, Oregon 97045
PHONE: (503) 656-7000
FAX: (503) 656-0866

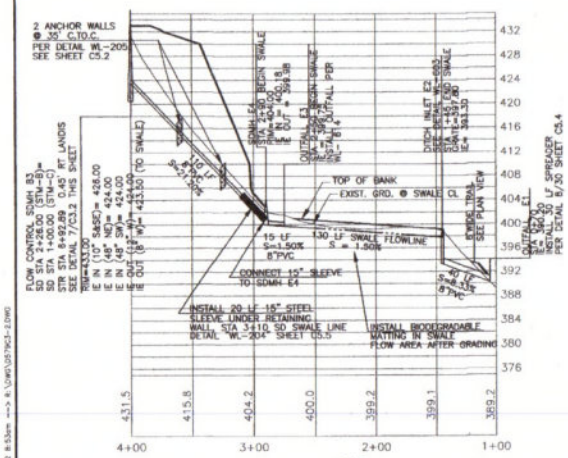
Tanner's Stonegate
CITY OF WEST LINN, OREGON
GRADING AND EROSION CONTROL PLAN

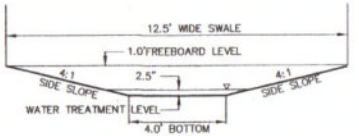
otak Incorporated
17355 SW Boones Ferry Road
Lake Oswego, OR 97035-5217
Phone: (503) 635-3618
FAX: (503) 635-5395

10579
Project No.
D579C2-0
File No.
C2.0
Sheet No.

AS BUILTS



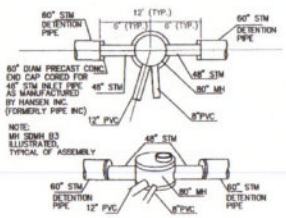



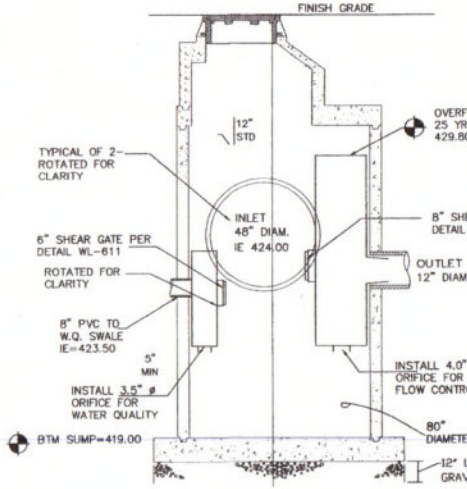




WATER QUALITY SWALE SHALL BE SEEDED IN ACCORDANCE WITH CITY OF PORTLAND B.E.S. MANUAL, SEPTEMBER 2000: HOBBS AND HOPKINS, PRO-TIME 840, NATIVE, BIO-FILTER MIX (OR APPROVED ALTERNATE):

| | |
|---|---|
| BLUE WILDRYE | 47.0% |
| NATIVE RED FESCUE | 40.0% |
| TUFTED HAIRGRASS | 10.0% |
| WESTERN MANNAGRASS | 2.0% |
| AMERICAN SLOUGHGRASS | 1.0% |

SWALE PLANTING NOTE
SCALE: N.T.S.
6
C3.2




08/21/2001
Date
AAH/BLW/JAH
Designed
AAH/BLW/JAH
Drawn
Checked By Date

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1978
ANDREW A. HOBLIT
RENEWAL: 06/30/2003

REVISIONS
NO. DATE BY APPD.

NORWAY DEVELOPMENT
P.O.Box 387
Oregon City, Oregon 97045
PHONE: (503) 656-7000
FAX: (503) 656-6665

# Tanner's Stonegate

CITY OF WEST LINN, OREGON

STREET AND STORM PROFILES

otak
Incorporated
17355 SW Boones Ferry Road
Lake Oswego, OR 97035-5827
Phone: (503) 635-3818
FAX: (503) 635-5395

10579
Project No.
D579C3-2
File No.
C3.2
Sheet No.

**SCHOTT & ASSOCIATES**
**Ecologists & Wetlands Specialists**
21018 NE Hwy 99E • P.O. Box 589 • Aurora, OR 97002 • (503) 678-6007 • FAX: (503) 678-6011

June 7, 2017

Rick Givens
Planning Consultant
18680 Sunblaze Dr.
Oregon City, OR 97045

Re: Willow Ridge at Cornwall Street Wetland Determination

Dear Rick Givens,

As per your request I was asked to conduct a site visit on the 2.17 acre subject property located at the street address of 4096 Cornwall Street, West Linn, Clackamas County, Oregon (T2S, R1E, Sec 36BA, TL 6300). The initial site visit was conducted on a very rainy day, making determining the area for wetlands very difficult. No wetlands were found, however a second visit was conducted with Dr. Martin Schott, Professional Wetland Scientist (PWS) to confirm no wetlands were present. Because no wetlands were identified on the property a full wetland delineation was not performed, therefore a wetland determination was conducted to document finding.

Oregon Department of State Lands provides a check list of 13 items that can be indicative of wetlands, but are not in and of themselves criteria for designation of wetlands. Only 3 actual wetland criteria are required to present in order for there to be wetlands; hydric vegetation, hydric soils and hydrology. A site visit was conducted on March 10, 2017. The *1987 Manual* and *Regional Supplement to the Corps of Engineers Delineation Manual: Western Mountains and Valleys* were used to determine presence or absence of State of Oregon wetland boundaries and the Federal jurisdictional wetlands. Schott and Associates found no wetlands present on the property, and therefore conducted an onsite determination to document findings.

The rectangular shaped subject property is situated at the terminus of Cornwall Street, west of Sussex Street and North of Fairhaven Drive. Residential houses are located on all sides of the project area. An existing house is located in the northeastern corner of the lot with associated outbuildings. The southern half of the lot is steeply sloped to the south.

The majority of the property consisted of the steep slopes in the southern half of the lot. The vegetation was dominated by Himalayan blackberry (*Rubus armeniacus*). There was a small patch of reed canary grass (*Phalaris arundinacea*) and rose (*Rosa pisocarpa*) was more prevalent at the southeastern extent of the lot where the slope levels out. A few larger trees were located on the property.

An unidentified tributary to Salamo Creek is located offsite to the east. The landscape surrounding the tributary was steeply sloped and dominated by non-native Himalayan blackberry. The tributary was approximately 170 feet off site to the southeast located at the bottom of a draw. Slopes within 50 feet of the creek were digitally measured and found to range from 16 to 28 percent.

The Natural Resource Conservation Service (NRCS) mapped two soil series on the site, Saum silt loam (3 to 8 percent slopes) and Saum silt loam (15 to 30 percent slopes). Neither soil is considered hydric.

Two sample plots were established to document conditions that would most likely identify as wetlands. Sample Plot 1 was mid slope where a small patch of reed canary grass (*Phalaris arundinacea*) was present. The soils had a 7.5YR 3/2 matrix to 11 inches in the pit. Below 11 inches the soils were a dark 7.5YR 3/1 with 7.5YR 3/6 redoximorphic features. Soils did not meet hydric soil indicators. Hydrology was present as surface flow, likely associated with recent rains and the hill slope to the north.

Sample Plot 2 was located to the southeast down slope of Sample Plot 1 within the road easement. Vegetation was dominated by Himalayan blackberry. Soils had a matrix color of 7.5YR 3/2 with no hydric indicators. No hydrology was present.

The Local Wetland Inventory (LWI) for the City of West Linn was completed in 2005 by Winterbrook Planning. The LWI does not identify any wetlands or waters within the study area boundary. Additionally, the National Wetland Inventory (NWI) does not identify any wetlands or waters within the study area.

For an area to be a wetland it has to meet all three wetland criteria; soils, hydrology, and vegetation. None of the sample plots met all three criteria.

Attached is a an aerial photograph showing the location of sample plots (Figure 1), a copy of the soils map (Figure 2), Local Wetland Inventory Map (Figure 3), ground level photographs and data forms. Please call if you have any questions or if we can be of further assistance.

Sincerely,

Jodi Reed

# Figure 1. Wetland Determination Map


4096 Cornwall Street
West Linn, Clackamas County, Oregon
T2S, R1E, Sec 36BA, TL#6300
S&A#2494

SCHOTT & ASSOCIATES, Inc.
21018 NE Hwy 99e • PO Box 589 • Aurora, Oregon 97002 p: 503.678.6007 f: 503.678.6011

Photo Point
Study Area
Sample Plots

Data plots recorded by Schott & Associates, Inc.
utilizing a Trimble GeoXT hand-held unit to a 3.0+/- foot accuracy.
Tax Lot boundaries provided by Clackamas County GIS.
Data files and maps are to be used for informational uses only and may not be suitable for legal, engineering or surveying purposes.
Projected Coordinate System: NAD_1983_UTM_Zone_10N

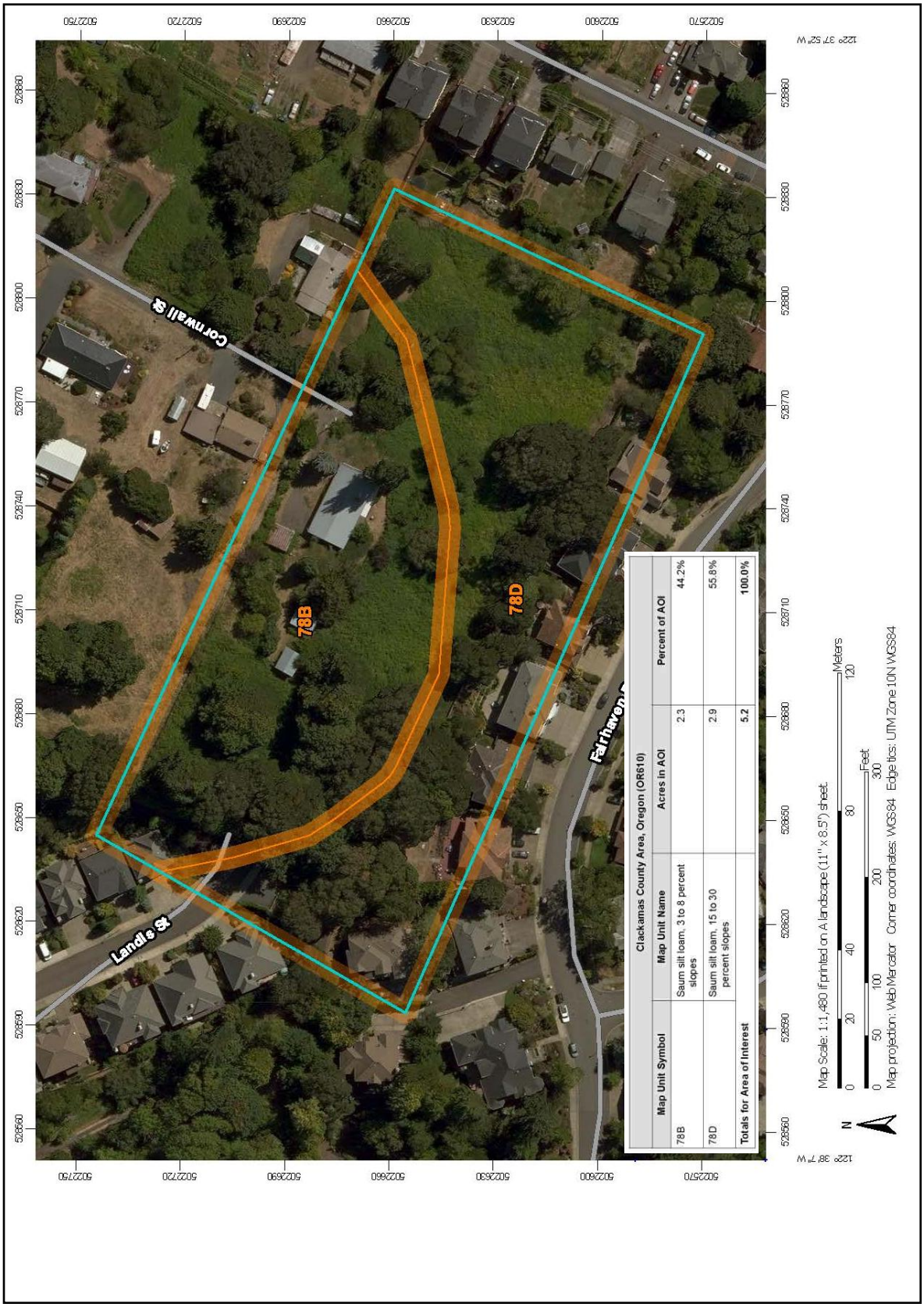



FIGURE 2. SOIL MAP
Cornwall Street
S&A# 2494

Schott & Associates
P.O. Box 589
Aurora, OR. 97002
503.678.6007

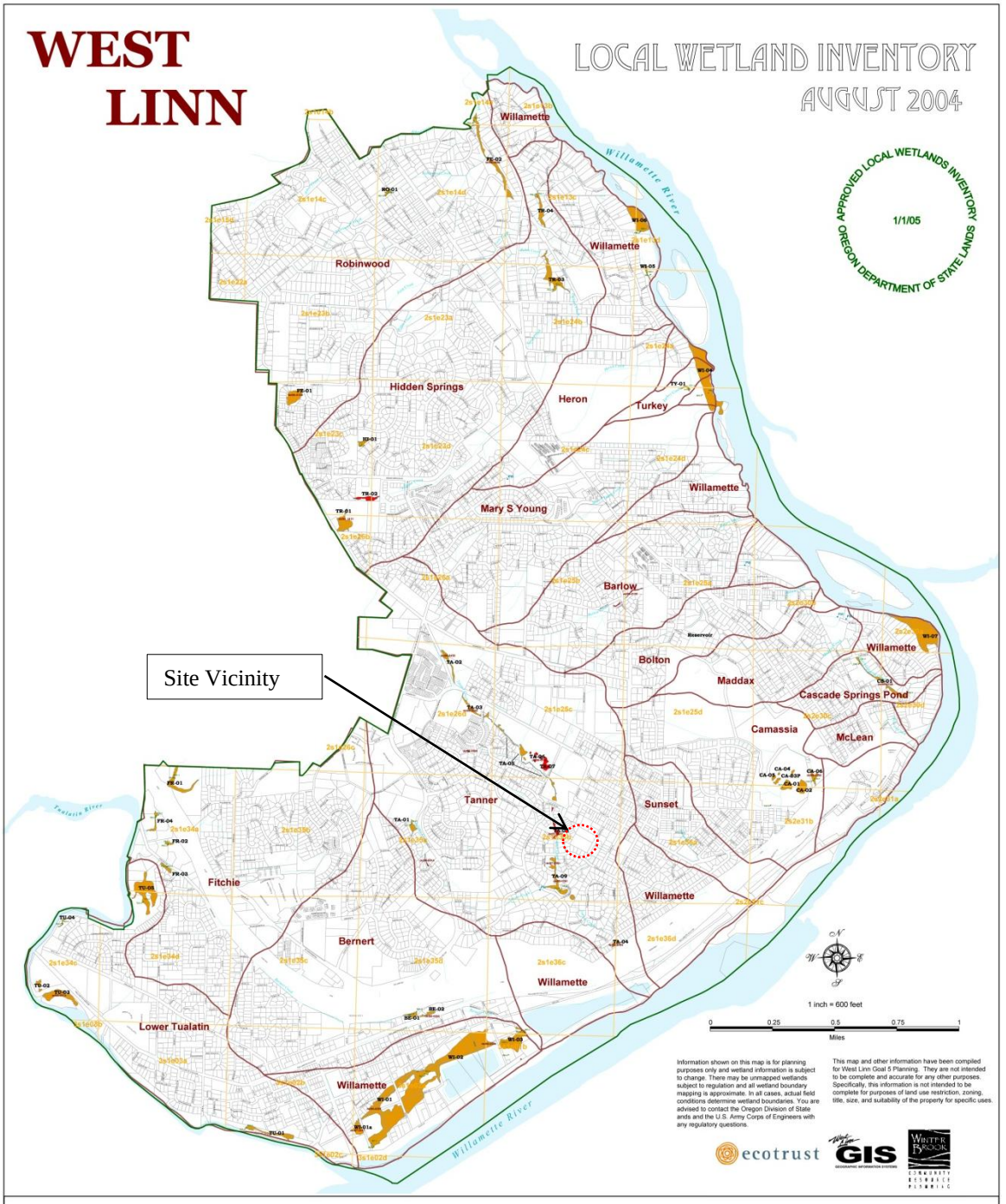



FIGURE 3. LOCAL WETLAND INVENTORY
Cornwall Street
S&A#2494

Schott & Associates
P.O. Box 589
Aurora, OR. 97002
503.678.6007

Photo Point. Facing southwest.



Schott & Associates
P.O. Box 589
Aurora, OR. 97002
503.678.6007

Photo Point. Facing Southwest.



Schott & Associates
P.O. Box 589
Aurora, OR. 97002
503.678.6007

## WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Cornwall Street | City/County: West Linn/Clackamas | Sampling Date: March 10th, 2017
Applicant/Owner: Rick Givens | State: OR | Sampling Point: 1
Investigator(s): MRS, JRR | Section, Township, Range: 36BA, T2S, R1E
Landform (hillslope, terrace, etc.): Hill slope | Local relief (concave, convex, none): Convex | Slope (%):
Subregion (LRR): A | Lat: 45.356770 | Long: -122.633111 | Datum: DD
Soil Map Unit Name: Saum silt loam (15 to 30 percent slopes) | NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ Significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ Naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | | |
|---|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes | X | No | |
| Hydric Soil Present? | Yes | | No | X |
| Wetland Hydrology Present? | Yes | X | No | |

**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X

Remarks: Soils do not meet hydric soil indicators. Hydrology was present as surface flow from upslope runoff, likely from recent rainfall.

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ___) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ___ = Total Cover | | |
| **Sapling/Shrub Stratum (Plot size: ___)** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ___ = Total Cover | | |
| **Herb Stratum (Plot size: 5'r)** | | | |
| 1. *Phalaris arundinacea* | 60 | X | FACW |
| 2. *Ranunculus repens* | 10 | | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 70 = Total Cover | | |
| **Woody Vine Stratum (Plot size: ___)** | | | |
| 1. | | | |
| 2. | | | |
| | ___ = Total Cover | | |

% Bare Ground in Herb Stratum 30

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

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

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks:

## SOIL

Sampling Point: 1

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Redox Features Type[1] | Redox Features Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-11 | 7.5YR 3/2 | 100 | | | | | SiL | |
| 11-18 | 7.5YR 3/1 | 95 | 7.5YR 3/1 | 3/6 | C | M | SiL | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

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

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if present):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** ___ **No** **X**

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

Surface Water Present? Yes X No ___ Depth (inches): Surf

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

**Wetland Hydrology Present?** **Yes** **X** **No** ___

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

Remarks: Surface flow is from upslope. Likely runoff from house and properties upslope from recent rains.

## WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Cornwall Street | City/County: West Linn/Clackamas | Sampling Date: March 10th, 2017
Applicant/Owner: Rick Givens | State: OR | Sampling Point: 2
Investigator(s): MRS, JRR | Section, Township, Range: 36BA, T2S, R1E
Landform (hillslope, terrace, etc.): Hill slope | Local relief (concave, convex, none): Convex | Slope (%):
Subregion (LRR): A | Lat: 45.356770 | Long: -122.633111 | Datum: DD
Soil Map Unit Name: Saum silt loam (15 to 30 percent slopes) | NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ Significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ Naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | | |
|---|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes | X | No | |
| Hydric Soil Present? | Yes | | No | X |
| Wetland Hydrology Present? | Yes | | No | X |

**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ___) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15'r) | | | |
|---|---|---|---|
| 1. *Rubus armeniacus* | 80 | X | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 80 = Total Cover | | |

| Herb Stratum (Plot size: ___) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | = Total Cover | | |

| Woody Vine Stratum (Plot size: ___) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum 20

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

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

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks:

## SOIL

Sampling Point: 2

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Redox Features Type[1] | Redox Features Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-16 | 7.5YR 3/2 | 100 | | | | | SiL | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

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

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if present):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** ___ **No** **X**

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

Surface Water Present? Yes ___ No ___ Depth (inches): _____

Water Table Present? Yes ___ No ___ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): _____

**Wetland Hydrology Present?** **Yes** ___ **No** **X**

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

Remarks:

**SCHOTT & ASSOCIATES**
Ecologists & Wetlands Specialists
21018 NE Hwy 99E • P.O. Box 589 • Aurora, OR 97002 • (503) 678-6007 • FAX: (503) 678-6011

# MEMO

RE: Willow Ridge at Cornwall Street HCA Mapped Boundaries

March 30, 2017

This memo is being provided as the applicant believes that the Metro HCA mapped boundaries are in error on the subject property containing Tax lot 6300 located at the street address of 4096 Cornwall Street, West Linn, Oregon.

The City of West Linn uses the Metro's Urban Growth Management Functional Plan (UGMFP) Title 13 Habitat Conservation Areas (HCA) map to identify habitat conservation areas in the City. The above subject property contains HCA mapped as Riparian Class II within the southeastern corner of the tax lot.

Per Chapter 28 Willamette and Tualatin River Protection 28.070 Planning Director Verification of Metro Habitat Protection Map Boundaries:

A) *The HCA Map is the basis for identifying and designating the habitat conservation areas in the City. It is inevitable, given the large area that Metro's HCA Map covers, that there may be some errors. In cases where, for example, three properties share the same contours and the same natural features but the map shows the middle lot with an HCA designation on it, it is reasonable to question the accuracy of that HCA designation. Using tree overstory as the sole basis for HCA designation will also allow a change in designation since trees are already protected in the municipal code and Chapters 55 and 85 CDC.*

B) *The planning director shall verify the appropriate HCA or non-HCA designation by site visits or consultations with Metro or by other means. Determination is based on whether the Metro criteria are met or whether the Metro designation was based solely on tree overstory in which case a re-designation is appropriate. In cases where the determination is that the map is incorrect, the Planning Director will make a written finding of this as well as the site conditions that led to that conclusion.*

   Metro designation was based solely on tree overstory and a boundary correction is appropriate. A site visit and delineation were completed by Schott & Associates, Inc. on March 10, 2017 on the subject property. The entire property was walked and a natural resource assessment was done to determine the actual extent of the HCA overlay.

   The rectangular shaped tax lot is situated at the terminus of Cornwall Street, west of Sessex Street and north of Fairhaven Drive. Residential houses are located on all sides of the project area. An

existing house is located in the northeastern corner of the lot, with associated outbuildings to the west. The southern half of the lot is steeply sloped to the south.

The vegetation in the undeveloped portion of the lot was dominated by Himalayan blackberry (*Rubus armeniacus*). There was a small patch of reed canary grass (*Phalaris arundinacea*) within the middle of the sloped hill in the southern half of the lot. Sample plots were taken and conditions did not meet the three wetland criteria; hydrophytic vegetation, hydric soils and wetland hydrology. For an area to be a wetland it has to meet all three criteria. The soils on this site were not hydric. Rose (*Rosa pisocarpa*) was prevalent along the southeastern extent of the lot where the slopes level out. A few larger locust trees were located on the property.

An unidentified tributary to Salamo Creek is located east of the site. The landscape surrounding the tributary was steeply sloped and dominated by non-native Himalayan blackberry. The tributary is approximately 170 feet off site to the southeast located in the bottom of a draw. Slopes within 50 feet of the creek were digitally measured and found to range from 16 to 28 percent.

Per Metro Title 13: Nature in Neighborhoods

*3.07.1340 (d.) Administering the Habitat Conservation Areas Map and Site Level Verification of Habitat Location*

*(4.) Habitat Boundaries*

*(A.)Locating riparian habitat and determining its habitat class is a five step process.*

*(i) Step 1. Locate the water feature that is the basis for identifying riparian habitat:*

*1) Locate the top of bank of all streams, rivers, and open water within 200feet of the property.*

No access was obtained for the adjacent property. The creek was identified as approximately 170 feet south east of the site, outside of the tax lot boundary.

*2) Locate all flood areas within 100 feet of the property.*

Slopes surrounding the creek ranged from 16 to 28 percent. No flood areas were identified within 100 feet of the property.

*3) Locate all wetlands within 150 feet of the property based on the local wetland inventory map (if completed) and on the Metro 2004 Wetland Inventory Map. Identified wetlands shall be further delineated consistent with methods currently accepted by the Oregon Division of State Lands and the US Army Corps of Engineers.*

No wetlands were located within the study area boundary. An unidentified tributary to Salamo Creek is located approximately 170 feet to the southeast of the site. The tributary is offsite and

identified on the Significant Riparian Corridors map for West Linn Goal 5 Inventory. The landscape surrounding the tributary was steeply sloped ranging from 16 to 28 percent slopes and dominated by non-native Himalayan blackberry.

*(ii.) Step 2. Identify the vegetative cover status of all areas on the property that are within 200 feet of the top of bank of streams, rivers and open water, are wetlands or are within 150 feet of wetlands, and are flood areas and within 100 feet of flood areas.*

Only a small portion of the property in the southeastern corner is identified as HCA habitat. The HCA defines the area as within 200 feet of the top of bank to the offsite stream. No wetlands were identified within the HCA mapped corner of the lot. The vegetation was dominated by Himalayan blackberry. The slopes were steep and sloped off site to the southeast.

*1.) Vegetative cover status shall be as identified on the Metro Vegetative Cover Map, attached hereto and incorporated herein by reference. The vegetative cover type assigned to any particular area was based on two factors: The type of vegetation observed in aerial photographs and the size of the overall continuous area of vegetative cover to which a particular piece of vegetation belonged. As an example of how the categories were assigned, in order to qualify as "forest canopy" the forested area had to be part of a larger patch of forest of at least one acre in size; and*

*2.) In terms of mapping the location of habitat, the only allowed corrections to the vegetative cover status of a property are those based on an area being developed prior to the local program effective date and those based on errors made at the time the vegetative cover status was determined based on analysis of the aerial photographs used to create the Metro Vegetative Cover Map (for the original map, the aerial photos used were Metro's summer 2002 photos) and application of the vegetative cover definitions provided in the footnotes to Table 3.07-13d.*

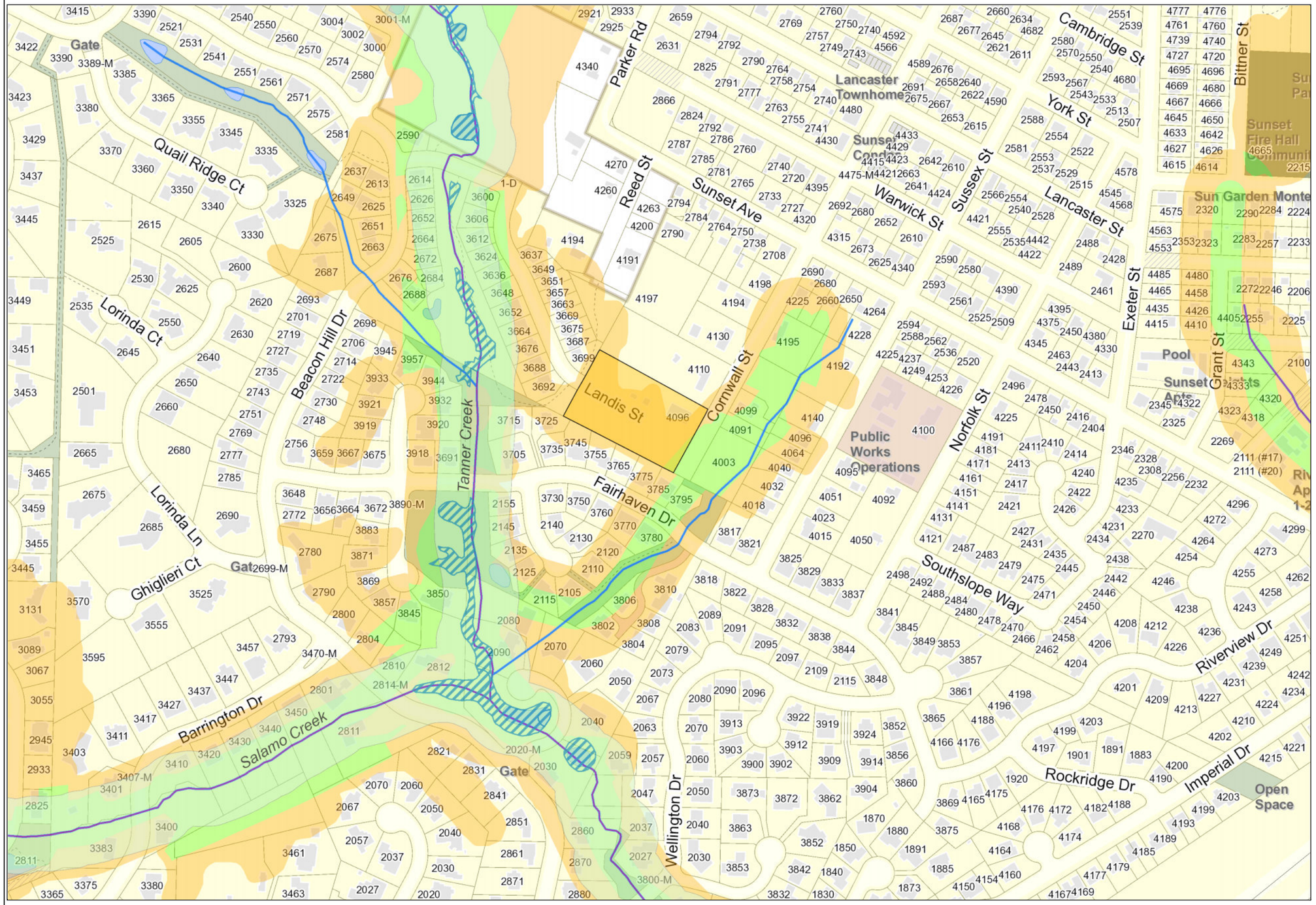
Through observation of the summer 2002 Google Earth aerials we believe the HCA boundary was mapped using the vegetative cover of the scrub/shrub canopy. The shape of the boundary basically matches the aerial (see Figure 1: Metro HCA, Figure 4: 2002 Aerial Photo). While the

mapping of the habitat may be scrub/shrub, the cover was predominantly Himalayan Blackberry, which is considered an invasive species and offers little ecological function. Additionally, the area was not found to be a Riparian Zone. Adjacent properties identified within the HCA overlay had existing buildings.

In conclusion, the mapped HCA is low quality due to the non-native, invasive vegetation and lack of significant tree cover. The tributary to Salamo Creek is approximately 170 feet from the eastern tax lot boundary. A request is being made to correct the boundary within the tax lot boundary based the lack of significant habitat and lack of tree habitat associated with the tributary to the southeast of the site. The vegetation is non-native, invasive and of very low value and these areas should not be mapped as HCA.

Attachements:
Figure 1. Metro HCA
Figure 2. HCA Stream Detail Area
Figure 3. Stream Detail with Topographic
Figure 4. Overall existing Conditions
Figure 5. 2002 Aerial Photograph

Figure 1. Metro HCA







Map created by: public
Date Created: 17-Mar-17 10:34 AM

**WEST LINN GIS**

DISCLAIMER: This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. Map scale is approximate. Source: West Linn GIS (Geographic Information System) MapOptix.

Figure 2. HCA Stream Detail Area

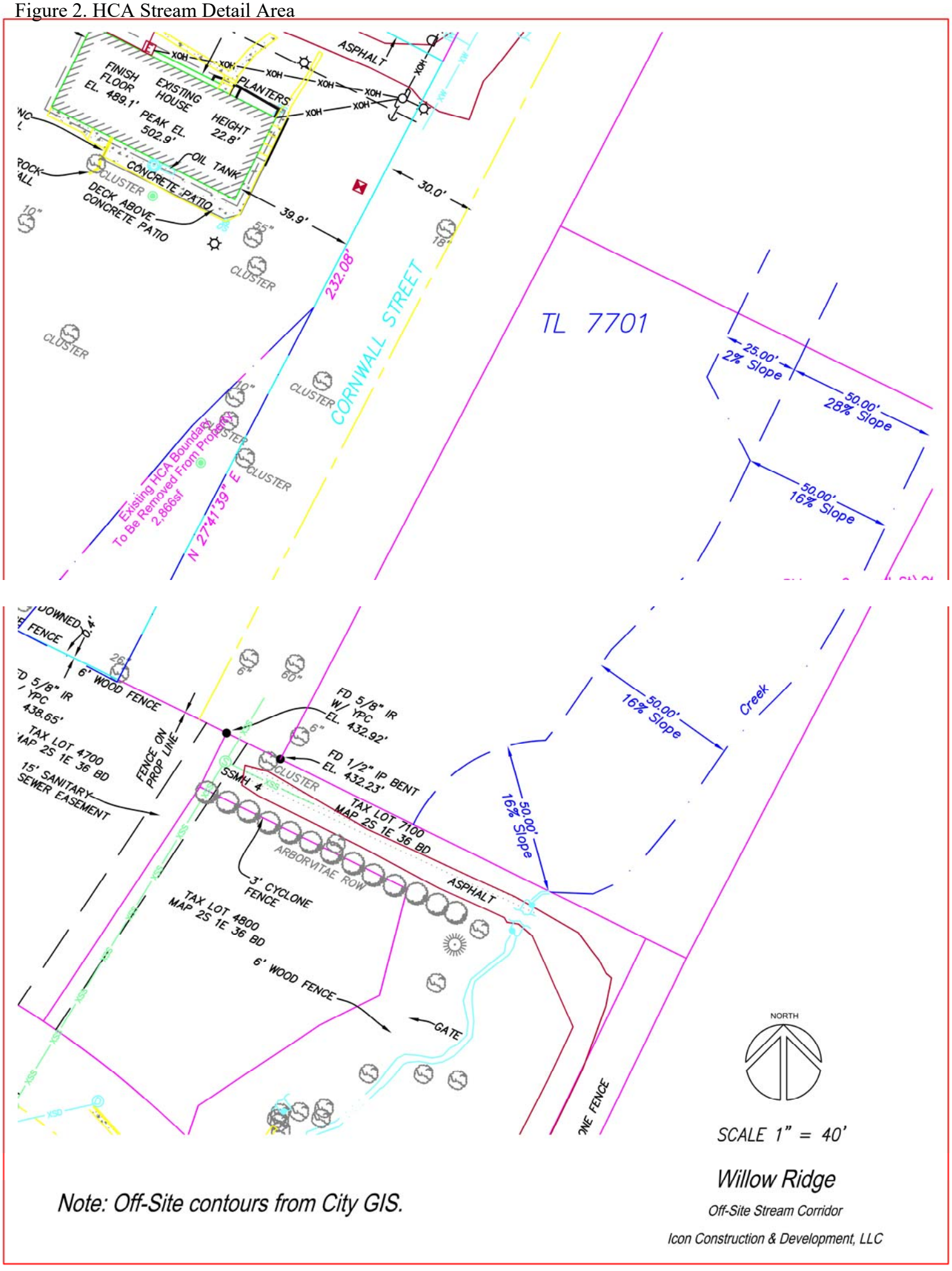


Figure 3. Stream Detail with Topographic


*Note: Off-Site contours from City GIS.*

*Willow Ridge*

*Off-Site Stream Corridor*

*Icon Construction & Development, LLC*

Figure 4. Overall Existing Conditions Map

TAX LOT 6300
LOCATED IN THE N.W. 1/4 SECTION 36, T.2S., R.1E., W.M.,
CITY OF WEST LINN, CLACKAMAS COUNTY, OREGON
JANUARY 20, 2016 SCALE 1"=30'

## SURVEY NOTES:

THE DATUM FOR THIS SURVEY IS BASED UPON A STATIC GPS OBSERVATION OF LOCAL CONTROL POINTS, PROCESSED THROUGH OPUS. DATUM IS NAVD 88.

A TRIMBLE S6-SERIES ROBOTIC INSTRUMENT WAS USED TO COMPLETE A CLOSED LOOP FIELD TRAVERSE.

THE BASIS OF BEARINGS FOR THIS SURVEY IS PER MONUMENTS FOUND AND HELD PER THE PLAT OF "TANNER CREEK ESTATES", RECORDS OF CLACKAMAS COUNTY.

THE PURPOSE OF THIS SURVEY IS TO RESOLVE AND DETERMINE THE PERIMETER BOUNDARY OF THE SUBJECT PROPERTY, TO SHOW ALL PERTINENT BOUNDARY ISSUES AND ENCROACHMENTS. NO PROPERTY CORNERS WERE SET IN THIS SURVEY.

NO WARRANTIES ARE MADE AS TO MATTERS OF UNWRITTEN TITLE, SUCH AS ADVERSE POSSESSION, ESTOPPEL, ACQUIESCENCE, ETC.

FIDELITY NATIONAL TITLE COMPANY OF OREGON PRELIMINARY TITLE REPORT NUMBER 45141521844, DATED DECEMBER 10, 2015 AS PROVIDED HAS BEEN USED AND REFERENCED IN PREPARATION OF THIS MAP. PLEASE REFER TO THIS DOCUMENT FOR DESCRIPTIONS OF EXCEPTIONS TO TITLE INSURANCE.

THE UNDERGROUND UTILITIES AS SHOWN ON THIS MAP HAVE BEEN LOCATED FROM FIELD SURVEY OF ABOVE GROUND STRUCTURES AND AS MARKED BY OTHERS. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES ARE IN THE EXACT LOCATION INDICATED, ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT. THIS SURVEY DOES NOT CONSTITUTE A TITLE SEARCH BY SURVEYOR.

## LEGEND:

Some Symbols shown may not be used on map

- DECIDUOUS TREE
- EVERGREEN TREE
- STORM SEWER MANHOLE
- CATCH BASIN
- SANITARY SEWER CLEANOUT
- SANITARY SEWER MANHOLE
- WATER VALVE
- WATER METER
- FIRE HYDRANT
- GAS VALVE
- GAS METER
- BOLLARD
- SIGN
- MAILBOX
- COMMUNICATIONS PEDESTAL
- COMMUNICATIONS MANHOLE
- COMMUNICATIONS BOX
- STORM OUTFALL
- FOUND MONUMENT
- DOWN SPOUT TO STORM SYSTEM
- ELECTRIC VAULT
- GAS STUB
- RADON VENT
- UTILITY AND LIGHT POLE
- UTILITY POLE
- LIGHT POLE
- GUY WIRE
- ELECTRIC BOX
- ELECTRIC METER
- ELECTRICAL POWER PEDESTAL
- ELECTRIC RISER
- HEAT PUMP
- OVERHEAD LINE
- GAS LINE
- ELECTRICAL LINE
- COMMUNICATIONS LINE
- SANITARY SEWER LINE
- STORM DRAIN LINE
- WATER LINE
- FENCELINE
- UTILITY RISER
- DOWN SPOUT TO SPLASH GUARD/GROUND
- ELECTRIC TRANSFORMER
- SATELLITE DISH
- STUMP

SANITARY STRUCTURE NOTES

SSMH 1
RIM 452.2'
8" CAP 442.7'
8" PVC NW 442.5'

SSMH 2
RIM 445.2'
8" PVC SE 435.9'
8" PVC NW 435.1'

SSMH 3
RIM 437.6'
8" PVC SE 423.8'

SSMH 4
RIM 432.9'
8" PVC NE 421.3'
8" PVC SE 421.2'
8" PVC SW 421.0'

SSMH 5
RIM 416.4'
8" PVC NE 409.0'
8" PVC NW 408.6'

4096 CORNWALL STREET
TAX LOT 6300
MAP 2S 1E 36BA
AREA = 94,976 S.F.
DEED DOC NO. 2009-066889

TAX LOT 6000 MAP 2S 1E 36 BA
TAX LOT 6400 MAP 2S 1E 36 BA
TAX LOT 6100 MAP 2S 1E 36 BA
TAX LOT 4442 MAP 2S 1E 36 BB
TAX LOT 4432 MAP 2S 1E 36 BB
TAX LOT 4431 MAP 2S 1E 36 BB
TAX LOT 4430 MAP 2S 1E 36 BB
TAX LOT 4429 MAP 2S 1E 36 BB
TAX LOT 4427 MAP 2S 1E 36 BB
TAX LOT 4428 MAP 2S 1E 36 BB
TAX LOT 4441 MAP 2S 1E 36 BB
TAX LOT 4000 MAP 2S 1E 36 BD
TAX LOT 4100 MAP 2S 1E 36 BD
TAX LOT 4200 MAP 2S 1E 36 BD
TAX LOT 4300 MAP 2S 1E 36 BD
TAX LOT 4400 MAP 2S 1E 36 BD
TAX LOT 4500 MAP 2S 1E 36 BD
TAX LOT 4600 MAP 2S 1E 36 BD
TAX LOT 4700 MAP 2S 1E 36 BD
TAX LOT 4800 MAP 2S 1E 36 BD
TAX LOT 7100 MAP 2S 1E 36 BD
TL 7701

LANDIS STREET
CORNWALL STREET
ARBORVITAE ROW

S 62°24'29" E 398.69'
S 63°52'20" E 398.84'
N 27°41'39" E 232.08'
TRACT 1 OF TRACT 2, GLENESK
S'LY 210 FEET OF

FD 1-1/4" BOLT EL. 484.23'
FD 5/8" IR W/ YPC EL. 459.32'
FD 5/8" IR W/ ALC EL. 455.38'
FD 5/8" IR EL. 431.58'
FD 5/8" IR W/ YPC EL. 434.58'
FD 5/8" IR W/ YPC EL. 437.69'
FD 5/8" IR W/ YPC EL. 442.51'
FD 5/8" IR W/ YPC EL. 443.34'
FD 5/8" IR W/ YPC EL. 438.65'
FD 5/8" IR W/ YPC EL. 432.92'
FD 1/2" IP BENT EL. 432.23'

4' WIRE FENCE
4' CYCLONE FENCE
6' WOOD FENCE
3' CYCLONE FENCE
FENCE ON PROP LINE
242.27'
ASPHALT PATH
CONCRETE SIDEWALK
ASPHALT
GRAVEL
APPROXIMATE WATE LINE PER WEST LINN ASBUILTS
APPROXIMATE GAS LINE PER NW NATURAL GAS WEBSITE
Existing HCA Boundary To Be Removed From Property 2,850sf
15' SANITARY SEWER EASEMENT

SHED
CARPORT
ASPHALT
PLANTERS
FINISH FLOOR EL. 489.1'
EXISTING HOUSE HEIGHT 22.8'
PEAK EL. 502.9'
OIL TANK
CONC WALL
CONCRETE PATIO
DECK ABOVE CONCRETE PATIO
ROCK WALL
CLUSTER

SIGNED ON: _____

REGISTERED
PROFESSIONAL
LAND SURVEYOR

OREGON
JULY 13, 2004
TOBY G. BOLDEN
60377LS

RENEWS: DECEMBER 31, 2017

GRAPHIC SCALE
30 0 15 30 60
( IN FEET )
1 INCH = 180

CENTERLINE CONCEPTS
LAND SURVEYING, INC.
729 MOLALLA AVE., SUITE 1 & 2
OREGON CITY, OREGON 97045
PHONE 503.650.0188 FAX 503.650.0189

Figure 5. 2002 Aerial Photograph

# Carlson Geotechnical

A Division of Carlson Testing, Inc.
Phone: (503) 601-8250
Fax: (503) 601-8254

**Bend Office** **(541) 330-9155**
**Eugene Office** **(541) 345-0289**
**Salem Office** **(503) 589-1252**
**Tigard Office** **(503) 684-3460**


**Report of**
**Geotechnical Investigation**
**Cornwall Street Subdivision**
**4096 Cornwall Street**
**West Linn, Oregon**

**CGT Project Number G1504283**

Prepared for

Mr. Darren Gusdorf
ICON Construction & Development
1980 Willamette Falls Drive, Suite 200
West Linn, Oregon 97068

January 7, 2016

# Carlson Geotechnical

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**Salem Office** **(503) 589-1252**
**Tigard Office** **(503) 684-3460**

January 7, 2016

Mr. Darren Gusdorf
ICON Construction & Development
1980 Willamette Falls Drive, Suite 200
West Linn, Oregon 97068

**Report of**
**Geotechnical Investigation**
**Cornwall Street Subdivision**
**4096 Cornwall Street**
**West Linn, Oregon**

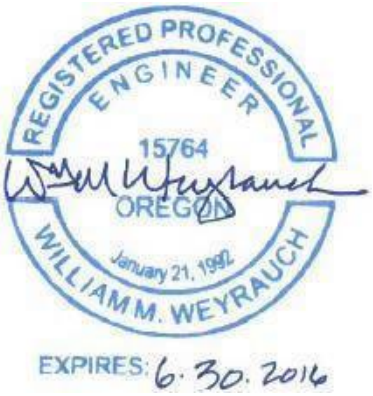
CGT Project Number G1504283

Dear Mr. Gusdorf:

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing our Geotechnical Investigation for the proposed Cornwall Street Subdivision project. The site is located at 4096 Cornwall Street in West Linn, Oregon. We performed our work in general accordance with CGT Proposal GP6901, dated December 3, 2015. Written authorization for our services was provided on December 3, 2015.

We appreciate the opportunity to work with you on this project. Please contact us at 503.601.8250 if you have any questions regarding this report.

Respectfully Submitted,
**CARLSON GEOTECHNICAL**




Kyle Smetana, EIT
Geotechnical Project Manager
ksmetana@carlsontesting.com

William M. Weyrauch, P.E., G.E.
Senior Geotechnical Engineer
bweyrauch@carlsontesting.com

## TABLE OF CONTENTS



## ATTACHMENTS



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## 1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing our Geotechnical Investigation for the proposed Cornwall Street Subdivision. The site is located at 4096 Cornwall Street in West Linn, Oregon, as shown on the attached Site Location, Figure 1.

### 1.1 Project Description

CGT developed an understanding of the proposed project based on our correspondence with ICON Construction & Development and a preliminary site plan prepared by Richard E. Givens, Planning Consultant, dated March 2015. Based on our review, we understand the project will include:

- Demolition and removal of the existing single-family residence and accessory structures.
- Partitioning the site into seven residential lots.
- Development within each lot will include construction of a single-family residence with appurtenant driveways and underground utilities. Although no lot-specific plans have been provided, we have assumed each structure will be two stories in height, wood-framed, and include daylight basements/garages. We anticipate the living space of the structures will incorporate post-and-beam floors (crawlspaces), while basements/garages will incorporate a slab-on-grade floor.
- Construction of extensions to Landis Street and Cornwall Street to provide vehicular access to the residential lots.
- Although no grading plans have been provided, we anticipate permanent grade changes at the site will include cuts and fills on the order of up to 5 feet within the new roadway.
- We understand infiltration testing is not needed as part of this assignment.

### 1.2 Scope of Work

The purpose of our work was to explore shallow subsurface conditions at the site in order to provide geotechnical recommendations for design and construction of the proposed development. Our scope of work included the following:

- Contact the Oregon Utilities Notification Center and subcontract a private utility locator to mark the locations of public utilities within a 20-foot radius of our explorations at the site.
- Explore subsurface conditions at the site by observing the excavation of seven test pits to depths of about 6 to 10 feet below ground surface (bgs).
- Classify the materials encountered in the explorations in accordance with American Society for Testing and Materials (ASTM) Soil Classification Method D2488 (visual-manual procedure).
- Collect representative soil samples from within the explorations in order to perform laboratory testing and to confirm our field classifications.
- Perform laboratory testing on selected samples collected during our subsurface exploration.
- Provide a technical narrative describing surface and subsurface deposits, and local geology of the site, based on the results of our explorations and published geologic mapping.
- Provide a site vicinity map and a site plan showing the locations of the explorations relative to existing site features.
- Provide logs of the explorations, including results of laboratory testing on selected soil samples.
- Provide preliminary geotechnical recommendations for site preparation and earthwork.
- Provide preliminary geotechnical engineering recommendations for design and construction of shallow spread foundations, retaining walls, floor slabs, and flexible pavements.

- Provide recommendations for the Seismic Site Class, mapped maximum considered earthquake spectral response accelerations, and site seismic coefficients.
- Provide a qualitative evaluation of seismic hazards at the site, including liquefaction potential, earthquake-induced settlement and landsliding, and surface rupture due to faulting or lateral spread.
- Provide this written report summarizing the results of our Geotechnical Investigation and preliminary recommendations for the project. This report is considered preliminary, as we have not reviewed final grading plans, finished floor elevations, and/or detailed structural information for the development. An addendum indicating that this report is final, and including supplemental recommendations, if warranted, can be issued after we have reviewed those items.

## 2.0 SITE INVESTIGATION

### 2.1 Site Geology

The site is located at the southeast end of the Tualatin Mountains. The Tualatin Mountains separate the Tualatin Valley to the west, the Portland Basin to the northeast, and the Willamette Valley to the southwest. Based on available geologic mapping of the area, the site is underlain by Columbia River Basalt. The Columbia River Basalt consists of numerous fine-grained lava flows that primarily erupted from fissures in present day eastern Washington and Oregon and western Idaho during the Miocene (23.8 to 5.3 million years ago). A thick, clay-rich residual soil often forms on the upper portion of the Columbia River Basalt from the in-place weathering of the rock. The Columbia River Basalt is several thousand feet thick in the vicinity of the site.

### 2.2 Site Surface Conditions

The site consists of one tax lot totaling approximately 2 acres. A single-family residence and accessory structures were located within the northeast portion of the site. The site was bordered by residential development on all sides. Landis Street and Cornwall Street terminate at the site boundaries. Vegetation on the northeastern portion of the site consists of grasses and scattered deciduous trees. The site generally descended to the south at maximum gradients up to about 2½ horizontal to 1 vertical (2½H:1V).

### 2.3 Field Investigation

#### 2.3.1 Test Pits

CGT observed the excavation of seven test pits (TP-1 through TP-7) at the site on December 10, 2015, to depths of up to about 10 feet bgs. The test pits were excavated using a John Deere 50G, tracked excavator provided and operated by ICON Construction. The approximate test pit locations are shown on the attached Site Plan, Figure 2. The test pits were located in the field using approximate measurements from existing site features shown on the Site Plan. Upon completion of logging, the test pits were loosely backfilled by ICON Construction with the excavated materials.

Pocket penetrometer readings were taken within the upper 4 feet of selected test pits, where fine-grained soils were present. The pocket penetrometer is a hand-held instrument that provides an approximation of the unconfined compressive strength of cohesive, fine-grained soils. The correlation between pocket penetrometer readings and the consistency of cohesive, fine-grained soils is provided on the attached Figure 3.

2.3.2 Soil Classification & Sampling

Members of CGT's staff logged the soils observed within the explorations in general accordance with the Unified Soil Classification System (USCS) and collected representative samples of the materials encountered. An explanation of the USCS is presented on the attached Soil Classification Criteria and Terminology, Figure 4. Rock encountered within the test pits was logged in accordance with the Oregon Department of Transportation (ODOT) Soil and Rock Classification Manual[1]. An explanation of the rock classification is shown on the attached ODOT Rock Classification Criteria and Terminology, Figure 5. The soil samples were stored in sealable plastic bags and transported to our laboratory for further examination and testing. Our staff visually examined all samples returned to our laboratory in order to refine the field classifications. Logs of the explorations are presented on the attached Exploration Logs, Figures 6 through 12. Surface elevations indicated on the logs and shown on the attached Figure 2 were estimated based on the topographic contours from the MetroMap web application. Elevations shown on the logs should be considered approximate.

## 2.4 Laboratory Testing

Laboratory testing was performed on samples collected in the field to refine our initial field classifications and determine in-situ parameters. Results of the laboratory tests are shown on the attached Exploration Logs, Figures 6 through 12. Laboratory testing included:

- Seven moisture content determinations (ASTM D2216)
- One Atterberg limits (plasticity index) test (ASTM D4318)

## 2.5 Subsurface Materials

The following paragraphs provide a description of each of the subsurface materials encountered at the site.

2.5.1 Silty Sand Fill (SM FILL)

Silty sand fill was encountered at the surface of TP-1 and TP-2. This material extended to depths of about 2 feet bgs. The silty sand fill was generally brown, moist, fine- to medium-grained, contained roots (less than 3-inch diameter), and contained fine to coarse angular gravel (up to 4-inch diameter).

2.5.2 Sandy Silt Fill (SM FILL)

Sandy silt fill was encountered beneath the silty sand fill within TP-1 and extended to a depth of about 4½ feet bgs. This material was generally gray, moist, exhibited low plasticity, contained fine to coarse angular gravel, and contained brick and asphalt debris (up to 2-inch diameter).

2.5.3 Native Silty Sand (SM)

Native silty sand was encountered beneath the sandy silt fill within TP-1 and at the surface of TP-3 and TP-4. This material extended to depths up to about 8½ feet bgs. The silty sand was generally medium dense, gray to brown, damp to moist, fine- to medium-grained, and contained gravel and boulders (up to 20-inch diameter).

[1] Oregon Department of Transportation, 1987. Soil and Rock Classification Manual.

### 2.5.4 Native Sandy Silt (ML)

Native sandy silt was encountered at the surface of TP-5 through TP-7 and extended to depths up to about 2 feet bgs. This material was generally medium stiff to stiff, gray to brown, moist, exhibited low plasticity, contained roots (up to 3-inch diameter), and contained gravel and cobbles (up to 10-inch diameter).

### 2.5.5 Native Lean Clay (CL)

Native lean clay was encountered beneath the silty sand fill within TP-2, beneath the native silty sand within TP-4, and beneath the sandy silt within TP-5 through TP-7. The lean clay extended to depths up to about 5 feet bgs within TP-2and TP-4through TP-76. The lean clay was generally medium stiff to very stiff, gray-brown, moist, exhibited medium plasticity, and contained sand, gravel, and cobbles (up to 9 inches in diameter).

### 2.5.6 Predominantly Weathered Basalt

Predominantly weathered basalt was encountered beneath the silty sand within TP-1 and TP-3, and beneath the lean clay within TP-2 and TP-4 through TP-7. The predominantly weathered basalt extended to the full depths explored within these test pits, up to about 10 feet bgs. The weathered basalt was generally very soft (R1), red, gray, brown, tan, and moist.

## 2.6 Groundwater

Groundwater was not encountered within depths explored on December 10, 2015. Based on our review of available groundwater mapping provided by the United States Geological Survey[2] (USGS), groundwater in the immediate vicinity of the site is estimated to be at a depth in excess of 200 feet bgs. We anticipate groundwater levels will fluctuate due to seasonal and annual variations in precipitation, changes in site utilization, or other factors. In addition, the native sandy silt (ML), native lean clay (CL), and weathered basalt are conducive to the formation of perched water tables.

# 3.0 SEISMIC CONSIDERATIONS

## 3.1 Seismic Design

Section 1613.3.2 of the 2014 Oregon Structural Specialty Code (2014 OSSC) requires that the determination of the seismic site class be based on subsurface data in accordance with Chapter 20 of the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE 7). Based on the results of the explorations and review of geologic mapping, we have assigned the site as Site Class D for the subsurface conditions encountered. Earthquake ground motion parameters for the site were obtained based on the United States Geological Survey (USGS) Seismic Design Values for Buildings - Ground Motion Parameter Web Application[3]. The site Latitude 45.356965° North and Longitude 122.633618° West were input as the site location. The following table shows the recommended seismic design parameters for the site.

[2] "USGS: Estimated Depth to Ground Water and Configuration of the Water Table in the Portland, Oregon Area" http://or.water.usgs.gov/projs_dir/puz/

[3] United States Geological Survey, 2015. Seismic Design Parameters determined using:, "U.S. Seismic Design Maps Web Application - Version 3.1.0," from the USGS website *http://geohazards.usgs.gov/designmaps/us/application.php.*

**Table 1 Seismic Ground Motion Values (Section 1613.5 of 2014 OSSC)**

| Parameter | | Value |
|---|---|---|
| Mapped Acceleration Parameters | Spectral Acceleration, 0.2 second ($S_s$) | 0.944g |
| | Spectral Acceleration, 1.0 second ($S_1$) | 0.407g |
| Coefficients (Site Class D) | Site Coefficient, 0.2 sec. ($F_A$) | 1.122 |
| | Site Coefficient, 1.0 sec. ($F_V$) | 1.593 |
| Adjusted MCE Spectral Response Parameters | MCE Spectral Acceleration, 0.2 sec. ($S_{MS}$) | 1.060g |
| | MCE Spectral Acceleration, 1.0 sec. ($S_{M1}$) | 0.648g |
| Design Spectral Response Accelerations | Design Spectral Acceleration, 0.2 seconds ($S_{DS}$) | 0.706g |
| | Design Spectral Acceleration, 1.0 second ($S_{D1}$) | 0.432g |
| Seismic Design Category | | D |

## 3.2 Seismic Hazards

### 3.2.1 Liquefaction

In general, liquefaction occurs when deposits of loose/soft, saturated, cohesionless soils, generally sands and silts, are subjected to strong earthquake shaking. If these deposits cannot drain quickly enough, pore water pressures can increase, approaching the value of the overburden pressure. The shear strength of a cohesionless soil is directly proportional to the effective stress, which is equal to the difference between the overburden pressure and the pore water pressure. When the pore water pressure increases to the value of the overburden pressure, the shear strength of the soil approaches zero, and the soil can liquefy. The liquefied soils can undergo rapid consolidation or, if unconfined, can flow as a liquid. Structures supported by the liquefied soils can experience rapid, excessive settlement, shearing, or even catastrophic failure.

For fine-grained soils, susceptibility to liquefaction is evaluated based on penetration resistance and plasticity, among other characteristics. Criteria for identifying non-liquefiable, fine-grained soils are constantly evolving. Current practice[4] to identify non-liquefiable, fine-grained soils is based on plasticity characteristics of the soils, as follows: (1) liquid limit greater than 47 percent, (2) plasticity index greater than 20 percent, and (3) moisture content less than 85 percent of the liquid limit. The susceptibility of sands, gravels, and sand-gravel mixtures to liquefaction is typically assessed based on penetration resistance, as measured using SPTs, CPTs, or Becker Hammer Penetration tests (BPTs).

Based on the shallow depth to weathered basalt, the relative plasticity of the clay soils and the estimated depth to groundwater, the soils encountered at the site are considered non-liquefiable within the depths explored.

### 3.2.2 Slope Instability

Due to the relatively minimal planned changes in site grade and the generally gently-sloping topography, we conclude the risk of seismically-induced slope instability at the site is low.

[4] Seed, R.B. et al., 2003. Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework. Earthquake Engineering Research Center Report No. EERC 2003-06.

3.2.3 Surface Rupture

*3.2.3.1 Faulting*

Although the site is situated in a region of the country with known active faults and historic seismic activity, no known faults exist on or immediately adjacent to the site. Therefore, the risk of surface rupture at the site due to faulting is considered low.

*3.2.3.2 Lateral Spread*

Surface rupture due to lateral spread can occur on sites underlain by liquefiable soils that are located on or immediately adjacent to slopes steeper than about 3 degrees (20H:1V), and/or adjacent to a free face, such as a stream bank or the shore of an open body of water. During lateral spread, the materials overlying the liquefied soils are subject to lateral movement downslope or toward the free face. Given the lack of liquefiable soils at the site and the absence of a free face, the risk of surface rupture due to lateral spread is considered negligible.

## 4.0 CONCLUSIONS

Based on the results of our field explorations and analyses, the site may be developed as described in Section 1.1 of this report, provided the recommendations presented in this report are incorporated into the design and development. The primary geotechnical considerations for this project include:

- Cobbles and Boulders at Foundation/Floor Slab/Pavement Subgrade: Based on our explorations, cobbles and boulders may be encountered at design subgrade elevations for shallow foundations, floor slabs, or pavements. Structural elements placed directly on boulders and cobbles can result in uneven ground response. To minimize this potential, CGT recommends:
  - Boulders encountered during foundation, floor slab, and pavement subgrade preparation be removed in their entirety and replaced with granular structural fill.
  - Foundation subgrades should be covered with a minimum of 6 inches of angular structural fill compacted to a well-keyed condition.
- Existing Structures: Existing structures should be removed prior to redevelopment of the site.
- Moisture Sensitive Soils: The near-surface, native, silty sand (SM), native sandy silt (ML), and native lean clay (CL) are sensitive to small changes in moisture content, and can pose challenges for earthwork performed during wet weather.

## 5.0 PRELIMINARY RECOMMENDATIONS

The following paragraphs present specific geotechnical recommendations for design and construction of the proposed residential structures at the site. The recommendations presented in this report are based on the information provided to us, results of the field investigation, laboratory data, and professional judgment. CGT has observed only a small portion of the pertinent subsurface conditions. The recommendations are based on the assumption that the subsurface conditions do not deviate appreciably from those found during the field investigation. CGT should be consulted for further recommendations if variations and/or undesirable geotechnical conditions are encountered at the site.

This report is considered preliminary, as we have not reviewed final grading plans, finished floor elevations, and detailed structural information for the development. An addendum indicating that this report is final, and including supplemental recommendations, if warranted, can be issued after we have reviewed those items.

## 5.1 Site Preparation

### 5.1.1 Site Stripping

Existing vegetation, topsoil, and fill (SM FILL and ML FILL) should be removed from within, and for a minimum 5-foot margin around, proposed building pad and pavement areas. Based on the results of our field explorations, stripping depths at the site are anticipated to be about 2 to 4½ foot bgs where fill is present and about ½ to 1 foot bgs where fill is not present. These materials may be deeper or shallower at locations away from the completed explorations. A geotechnical representative from CGT should provide recommendations for actual stripping depths based on observations during site stripping. Stripped surface vegetation and rooted soils should be transported off-site for disposal or stockpiled for later use in landscaped areas. Stripped pavements and demolition debris should be transported off site for disposal.

### 5.1.2 Grubbing

Grubbing of trees should include the removal of the root mass and roots greater than ½-inch in diameter. Grubbed materials should be transported off-site for disposal. Root masses from larger trees may extend greater than 3 feet bgs. Where root masses are removed, the resulting excavation should be properly backfilled with structural fill in conformance with Section 5.4 of this report.

### 5.1.3 Existing Utilities & Below-Grade Structures

All existing utilities at the site should be identified prior to excavation. Abandoned utility lines beneath new residential structures, pavements, and hardscaping should be completely removed or grouted full. Soft, loose, or otherwise unsuitable soils encountered in utility trench excavations should be removed and replaced with structural fill as described in Section 5.4 of this report. No below-grade structures were encountered in our explorations. If encountered during site preparation, buried structures (i.e. footings, foundation walls, slabs-on-grade, tanks, etc.) should be completely removed and disposed of off-site except for concrete which may, alternatively, be processed for re-use as described in Section 5.4.1.1. Resulting excavations should be backfilled with structural fill as described in Section 5.4 of this report, as needed to achieve design grades.

### 5.1.4 Erosion Control

Erosion and sedimentation control measures should be employed in accordance with applicable City, County and State regulations regarding erosion control.

## 5.2 Temporary Excavations

### 5.2.1 Overview

Conventional earthmoving equipment in proper working condition should be capable of making necessary excavations into the on-site soils. Excavations into the basalt, if needed, may require the use of special excavation methods and/or equipment. Please contact the geotechnical engineer for further evaluation if excavation into the basalt is anticipated based on final plans.

All excavations should be in accordance with applicable OSHA and state regulations. It is the contractor's responsibility to select the excavation methods, to monitor site excavations for safety, and to provide any shoring required to protect personnel and adjacent improvements. A “competent person”, as defined by OR-OSHA, should be on site during construction in accordance with regulations presented by OR-OSHA. CGT’s current role on the project does not include review or oversight of excavation safety.

5.2.2 OSHA Soil Class

For use in the planning and construction of temporary excavations up to 8 feet in depth at the site, an OSHA soil type "C" should be used for the native, silty sand (SM), native sandy silt (ML), and native lean clay (CL). Special consideration may be required where boulders are encountered during excavation or are present within excavation sidewalls.

5.2.3 Utility Trenches

Temporary trench cuts in native soils described earlier should stand near vertical to depths of approximately 4 feet. Caving should be expected where the native soils contain boulders. Some instability may occur if groundwater seepage is encountered. If seepage undermines the stability of the trench, or if caving of the sidewalls is observed during excavation, the sidewalls should be flattened or shored. Depending on the time of year trench excavations occur, trench dewatering may be required in order to maintain dry working conditions, particularly if the invert elevations of the proposed utilities are below the groundwater level. Pumping from sumps located within the trench will likely be effective in removing water resulting from seepage. If groundwater is present at the base of utility excavations, we recommend placing trench stabilization material at the base of the excavations. Trench stabilization material should be in conformance with Section 5.4.4 of this report.

5.2.4 Excavations Near Existing Foundations

Temporary excavations near existing footings should not extend within a 1½H:1V (horizontal to vertical) plane projected out and down from the outside, bottom edge of the footings. In the event that excavation needs to extend below the referenced plane, temporary shoring of the excavation and/or underpinning of the footing may be required. The geotechnical engineer should be consulted to review proposed excavation plans for this design case to provide specific recommendations.

## 5.3 Wet Weather Considerations

For planning purposes, the wet season should be considered to extend from late September to late June. It is our experience that dry weather working conditions should prevail between early July and the middle of September. Notwithstanding the above, soil conditions should be evaluated in the field by the geotechnical engineer or his representative at the initial stage of site preparation to determine whether the recommendations within this section should be incorporated into construction.

5.3.1 General Considerations

The near-surface, native, silty sand (SM), native sandy silt (ML), and native lean clay (CL) encountered within our explorations are susceptible to disturbance during wet weather. Trafficability of these soils may be difficult, and significant damage to subgrade soils will likely occur, if earthwork is undertaken without proper precautions at times when the exposed soils are more than a few percentage points above optimum moisture content. For construction that occurs during the wet season, methods to limit soil disturbance should be employed. Site preparation activities may need to be accomplished using track-mounted equipment, loading removed material onto trucks supported on granular haul roads. Soils that have been disturbed during site preparation activities should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill.

5.3.2 Geotextile Separation Fabric

We recommend placing geotextile separation fabric to serve as a barrier between the fine-grained subgrade and imported fill in areas of repeated or heavy construction traffic. The geotextile fabric should be in conformance with Section 02320 of the current Oregon Department of Transportation (ODOT) Standard Specification for Construction. Please refer to Table 02320-4 of the 2015 ODOT specifications for specific requirements.

5.3.3 Granular Working Surfaces (Haul Roads & Staging Areas)

Haul roads subjected to repeated heavy, tire-mounted, construction traffic (e.g. dump trucks, concrete trucks, etc.) will require a minimum of 18 inches of imported granular material. The prepared subgrade should be covered with geotextile fabric prior to placement of the imported granular material. The imported granular material should be placed in a single lift (up to 24 inches deep) and compacted using a smooth-drum, non-vibratory roller until well-keyed.

For light staging areas, 12 inches of imported granular material should be sufficient. Additional granular material or geo-grid reinforcement may be recommended based on site conditions and/or loading at the time of construction. The imported granular material should be in conformance with Section 5.4.2 of this report and have less than 5 percent material passing the U.S. Standard No. 200 Sieve.

5.3.4 Footing Subgrade Protection

A minimum of 3 inches of imported granular material is recommended to protect fine-grained, footing subgrades from foot traffic during inclement weather. The imported granular material should be in conformance with Section 5.4.2 of this report. The maximum particle size should be limited to 1 inch. The imported granular material should be placed in one lift over the prepared, undisturbed subgrade, and compacted using non-vibratory equipment until well keyed.

## 5.4 Structural Fill

The geotechnical engineer should be provided the opportunity to review all materials considered for use as structural fill a minimum of five business days prior to placement. If the gradation and proctor test results are not available or are more than three months old, samples of the proposed structural fill materials should be submitted to the geotechnical engineer for testing a minimum of five business day prior to use on site.

The geotechnical engineer or his representative should be contacted to evaluate compaction of structural fill as the material is being placed. Evaluation of compaction may take the form of in-place density tests and/or proof-roll tests with suitable equipment. Compaction of structural fill should be evaluated at intervals not exceeding every 2 vertical feet as the fill is being placed.

5.4.1 On-Site Soils (General Use)

*5.4.1.1 Concrete Debris*

Concrete debris resulting from the demolition of existing structures (foundations, floor slabs, etc.) can be re-used as structural fill if processed/crushed into material that is fairly well graded between coarse and fine particle sizes. The processed/crushed concrete should contain no organic matter, debris, or particles larger than 4 inches in diameter. Moisture conditioning (wetting) should be expected in order to achieve adequate compaction. When used as structural fill, this material should be placed and compacted in general accordance with Section 5.4.2 of this report. Such materials should be “capped” with a minimum of 12 inches

of ¾ -inch-minus (or finer) granular fill under all structural elements (footings, and, pavements, etc.). The capping material below slabs-on-grade (base rock) should consist of material as described in Section 5.4.3.

*5.4.1.2 Silty sand (SM), Sandy Silt (ML) and Lean Clay (CL)*

Re-use of on-site soils with fines contents over about 5 percent as structural fill may be difficult because these soils are sensitive to small changes in moisture content and are difficult, if not impossible, to adequately compact during wet weather. We anticipate the moisture content of these soils will be higher than the optimum moisture content for satisfactory compaction. Therefore, moisture conditioning (drying) should be expected in order to achieve adequate compaction. If used as structural fill, these soils should be free of organic matter, debris, and particles larger than 4 inches. Processing of the clay should include removal of boulders in excess of 4 inches in diameter. When used as structural fill, these soils should be placed in lifts with a maximum loose thickness of about 8 inches at moisture contents within –1 and +3 percent of optimum, and compacted to not less than 93 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). If these soils cannot be properly moisture-conditioned and processed, we recommend using imported granular material for structural fill.

5.4.2 Imported Granular Structural Fill (General Use)

Imported granular structural fill should consist of angular pit or quarry run rock, crushed rock, or crushed gravel that is fairly well graded between coarse and fine particle sizes. The granular fill should contain no organic matter, debris, or particles larger than 1½ inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. The percentage of fines can be increased to 12 percent of the material passing the U.S. Standard No. 200 Sieve if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary, for proper compaction. Granular fill material should be placed in lifts with a maximum loose thickness of about 12 inches, and compacted to not less than 93 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). Proper moisture conditioning and the use of vibratory equipment will facilitate compaction of these materials.

Compaction of granular fill materials with high percentages of particle sizes in excess of 1½ inches should be evaluated by periodic proof-roll observation or continuous observation by the CGT geotechnical representative during fill placement, since it cannot be tested conventionally using a nuclear densometer. Such materials should be "capped" with a minimum of 12 inches of 1½-inch-minus (or finer) granular fill under all structural elements (footings, concrete slabs, pavements, etc.).

5.4.3 Floor Slab Base Rock

Floor slab base rock should consist of well-graded granular material (crushed rock) containing no organic matter or debris, have a maximum particle size of ¾-inch, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. Floor slab base rock should be placed in one lift and compacted to not less than 90 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor).

5.4.4 Trench Base Stabilization Material

If groundwater is present at the base of utility excavations, stabilization material should be placed to help stabilize the base of the trench. Trench base stabilization material should consist of at least 1 foot of well-graded granular material with a maximum particle size of 4 inches and less than 5 percent material passing the U.S. Standard No. 4 Sieve. The material should be free of organic matter and other deleterious material, placed in one lift, and compacted until well-keyed.

5.4.5 Trench Backfill Material

Trench backfill for the utility pipe base and pipe zone should consist of granular material as recommended by the utility pipe manufacturer. Trench backfill above the pipe zone should consist of well-graded granular material containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. As a guideline, trench backfill should be placed in maximum 12-inch thick lifts. The earthwork contractor may elect to use alternative lift thicknesses based on their experience with specific equipment and fill material conditions during construction in order to achieve the required compaction. The following table presents recommended relative compaction percentages for utility trench backfill.

**Table 2 Utility Trench Backfill Compaction Recommendations**

| Backfill Zone | Recommended Minimum Relative Compaction | |
|---|---|---|
| | Structural Areas[1] | Landscaping Areas |
| Pipe Base and Within Pipe Zone | 90% ASTM D1557 or pipe manufacturer's recommendation | 85% ASTM D1557 or pipe manufacturer's recommendation |
| Above Pipe Zone | 92% ASTM D1557 | 88% ASTM D1557 |
| Within 3 Feet of Design Subgrade | 93% ASTM D1557 | 88% ASTM D1557 |
| [1]Includes proposed residential structures, driveways, hardscaping, roadways, etc. | | |

## 5.5 Permanent Slopes

5.5.1 Overview

Permanent cut or fill slopes constructed at the site should be graded at 2H:1V or flatter. Constructed slopes should be overbuilt by a few feet depending on their size and gradient so that they can be properly compacted prior to being cut to final grade. The surface of all slopes should be protected from erosion by seeding, sodding, or other acceptable means. Adjacent on-site and off-site structures should be located at least 5 feet from the top of slopes.

5.5.2 Placement of Fill on Slopes

New fill should be placed and compacted against horizontal surfaces. Where fill is placed on existing slopes which exceed 5H:1V (horizontal to vertical), the existing slopes should be keyed and benched prior to structural fill placement in general accordance with the attached Fill Slope Detail, Figure 13. If subdrains are needed on benches, subject to the review of the CGT geotechnical representative, they should be placed as shown on the attached Fill Slope Detail, Figure 13. In order to achieve well-compacted slope faces, slopes should be overbuilt by a few feet and then trimmed back to proposed final grades. A representative from CGT should observe the benches, keyways, and associated subdrains, if needed, prior to placement of structural fill.

## 5.6 Shallow Spread Foundations

5.6.1 Subgrade Preparation

Satisfactory subgrade support for shallow foundations associated with the planned building addition can be obtained from the native medium dense to better, silty sand (SM), the native, medium stiff to better, sandy silt (ML), and native, medium stiff to better, lean clay (CL), or on structural fill that is properly placed and

compacted on this material during construction. These materials were encountered at depths of about 0 to 4½ feet bgs in the explorations.

Boulders encountered during foundation excavation should be removed and replaced with granular structural fill. The geotechnical engineer or his representative should be contacted to observe subgrade conditions prior to placement of forms, reinforcement steel, or granular backfill (if required). If soft, loose, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the geotechnical representative at the time of construction. The resulting over-excavation should be brought back to grade with imported granular structural fill in conformance with Section 5.4.2 of this report. The maximum particle size of over-excavation backfill should be limited to 1½ inches and ¾ inch within 12 inches of the bottom of new structural elements, (footings, concrete slabs, pavements, etc.). All granular pads for footings should be constructed a minimum of 6 inches wider on each side of the footing for every vertical foot of over-excavation.

### 5.6.2 Minimum Footing Width & Embedment

Minimum footing widths should be in conformance with the most recent, Oregon Structural Specialty Code (OSSC). As a guideline, CGT recommends individual spread footings should have a minimum width of 24 inches. Similarly, for one-story, light-framed structures, we recommend continuous wall footings have a minimum width of 12 inches. For two-, three-, and four-story, light-framed structures, we recommend continuous wall footings have a minimum width of 15, 18, and 24 inches, respectively. All footings should be founded at least 18 inches below the lowest, permanent adjacent grade.

### 5.6.3 Bearing Pressure & Settlement

The minimum footing dimensions described above will likely govern footing sizes. Nonetheless, footings founded as recommended above, should be proportioned for a maximum allowable soil bearing pressure of 1,500 pounds per square foot (psf). This bearing pressure is a net bearing pressure, applies to the total of dead and long-term live loads, and may be increased by one-third when considering seismic or wind loads. For the recommended design bearing pressure, total settlement of footings is anticipated to be less than 1 inch. Differential settlements between adjacent columns and/or bearing walls should not exceed ½-inch. Based on the soils encountered in the explorations and soils encountered during excavation, limited (less than 1-foot) over-excavation/backfill should be anticipated in some areas in order to achieve the indicated allowable soil bearing pressure.

### 5.6.4 Lateral Capacity

A maximum passive (equivalent-fluid) earth pressure of 150 pounds per cubic foot (pcf) is recommended for design for footings confined by the native soils described earlier or imported granular structural fill that is properly placed and compacted during construction. The recommended earth pressure was developed using a factor of safety of 1½, which is appropriate due to the amount of movement required to develop full passive resistance. In order to develop the above capacity, the following should be understood:

1. Concrete must be poured neat in the excavation or the perimeter of the foundation must be backfilled with imported granular structural fill,
2. The adjacent grade must be level or rising away from the footing,
3. The static ground water level must remain below the base of the foundation throughout the year, and
4. Adjacent development (e.g. slabs, pavements, etc.) and/or the upper 12 inches of adjacent unpaved, structural fill areas should not be considered when calculating passive resistance.

An ultimate coefficient of friction equal to 0.45 may be used when calculating resistance to sliding for footings founded on a minimum of 6 inches of imported granular structural fill (crushed rock) that is properly placed and compacted during construction.

#### 5.6.5 Subsurface Drainage

Recognizing the fine-grained soils encountered at this site, placement of foundation drains is recommended at the outside base elevations of perimeter continuous wall footings. Foundation drains should consist of a minimum 4-inch diameter, perforated, PVC drainpipe wrapped with a non-woven geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet of open graded drain rock per lineal foot of pipe. The drain rock should also be encased in a geotextile fabric in order to provide separation from the surrounding clayey soils. Foundation drains should be positively sloped and should outlet to a suitable discharge point. The geotechnical engineer or his representative should observe the drains prior to backfilling. Roof drains should not be tied into foundation drains.

### 5.7 Floor Slabs

#### 5.7.1 Subgrade Preparation

Satisfactory subgrade support for floor slabs constructed on grade, supporting up to 150 psf area loading, can be obtained from native medium dense to better, silty sand (SM), the native, medium stiff to better, sandy silt (ML), and native, medium stiff to better, lean clay (CL), or on structural fill that is properly placed and compacted on this material during construction. Boulders encountered during floor slab excavation should be removed and replaced with granular structural fill. The geotechnical engineer or his representative should observe floor slab subgrade soils to evaluate surface consistencies. If soft, loose, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the CGT geotechnical representative at the time of construction. The resulting over-excavation should be brought back to grade with imported granular structural fill as described in Section 5.4.2 of this report.

#### 5.7.2 Crushed Rock Base

Concrete floor slabs should be supported on a minimum 6-inch thick layer of crushed rock base in conformance with Section 5.4.3 of this report. We recommend “choking” the surface of the base rock with sand just prior to concrete placement. Choking means the voids between the largest aggregate particles are filled with sand, but does not provide a layer of sand above the base rock. Choking the base rock surface reduces the lateral restraint on the bottom of the concrete during curing. Choking the base rock also reduces punctures in overlying vapor retarding membranes due to foot traffic where such membranes are used.

#### 5.7.3 Design Considerations

For floor slabs constructed as recommended, an equivalent modulus of subgrade reaction of 75 pounds per cubic inch (pci) is recommended for the design of the floor slab. If a higher equivalent modulus of subgrade reaction value is required, this can be achieved with a thicker base rock section below the slab. For example, on this project, the use of a 12-inch thick base rock section below the slab would allow the use of an equivalent modulus of subgrade reaction value of 100 pci. Please consult the geotechnical engineer if alternative values are needed. Floor slabs constructed as recommended will likely settle less than ½-inch. For general floor slab construction, slabs should be jointed around columns and walls to permit slabs and foundations to settle differentially.

5.7.4 Subgrade Moisture Considerations

Liquid moisture and moisture vapor should be expected at the subgrade surface. The crushed rock base recommended above typically serves as a capillary break and provides protection against liquid moisture. Where moisture vapor emission through the slab must be minimized, e.g. impervious floor coverings, storage of moisture sensitive materials directly on the slab surface, etc., a vapor retarding membrane or vapor barrier below the slab should be considered. Factors such as cost, special considerations for construction, floor coverings, and end use suggest that the decision regarding a vapor retarding membrane or vapor barrier be made by the architect and owner.

If a vapor retarder or vapor barrier is placed below the slab, its location should be based on current American Concrete Institute (ACI) guidelines, ACI 302 Guide for Concrete Floor and Slab Construction. In some cases, this indicates placement of concrete directly on the vapor retarder or barrier. Please note that the placement of concrete directly on impervious membranes increases the risk of plastic shrinkage cracking and slab curling in the concrete. Construction practices to reduce or eliminate such risk, as described in ACI 302, should be employed during concrete placement.

## 5.8 Pavements

5.8.1 Subgrade Preparation

In general, the subgrade soils encountered should be suitable for pavement support. However, depending on final subgrade elevations, weather conditions and soils encountered at the time of construction, a contingency for limited over-excavation and replaced with imported granular structural fill in conformance with Section 5.4.2 of this report, and the use of geotextile fabric should be planned. When evaluating its suitability as a pavement subgrade, the presence of stress concentrators (large cobbles and boulders) within 12 inches of the design pavement section should also be precluded whenever possible.
Additional subgrade improvement may be required based on the subgrade conditions encountered during construction. Where silt or clay soils are exposed at the subgrade surface, geotextile fabric should be placed at the subgrade surface prior to placing the base rock section.

*5.8.1.1 Dry Weather Construction*
After site preparation as recommended above, but prior to placement of fill and/or base rock, the geotechnical engineer or his representative should observe a proof roll test of the exposed subgrade soils in order to identify areas of excessive yielding. Proof rolling of subgrade soils is typically conducted during dry weather conditions using a fully-loaded, 10- to 12-cubic-yard, tire-mounted, tandem-axle dump truck or equivalent weighted water truck. Areas that appear too soft and wet to support proof rolling equipment should be prepared in general accordance with the recommendations for wet weather construction presented in Section 5.3 of this report. If areas of soft soil or excessive yielding are identified, the affected material should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill in conformance with Section 5.4.2 of this report.

*5.8.1.2 Wet Weather Construction*
Preparation of pavement subgrade soils during wet weather should be in conformance with Section 5.3 of this report. As indicated therein, increased base rock sections and a geotextile separation fabric may be required in wet conditions.

### 5.8.2 Input Parameters

Design of the flexible pavement sections presented below was based on the parameters presented in the following table, procedures in the American Association of State Highway and Transportation Officials (AASHTO) 1993 "Design of Pavement Structures" manual, ODOT Pavement Design Guide 2011, and the Asphalt Pavement Association of Oregon Asphalt Pavement Design Guide. If any of the items listed need revised, please contact us and we will reassess the provided design sections.

**Table 3 Input Parameters Assigned for Pavement Design**

| Input Parameter | Design Value[1] | | Input Parameter | | Design Value[1] |
|---|---|---|---|---|---|
| Pavement Design Life | 20 years | | Resilient Modulus[4] | Suitable Silt, Silty Sand, Lean Clay Subgrade | 5,000 psi |
| Annual Percent Growth | 0 percent | | | Crushed Aggregate Base | 22,500 psi |
| Serviceability | 4.2 initial, 2.5 terminal | | Structural Coefficient[2] | Crushed Aggregate Base | 0.08 |
| Reliability[2] | 75 percent | | | Asphalt | 0.42 |
| Standard Deviation[2] | 0.49 | | Vehicle Traffic[5] | APAO Level I "Residential Driveways" | Less than 10,000 ESAL |
| Drainage Factor[3] | 1.0 | | | APAO Level II "Residential Streets" | Less than 50,000 ESAL |

[1] If any of the above parameters are incorrect, please contact us so that we may revise our recommendations, if warranted.
[2] Value based on guidelines presented in Section 5.3 of the 2011 ODOT Pavement Design Manual for flexible pavements, local streets.
[3] Assumes good drainage away from pavement, base, and subgrade is achieved by proper crowning of subgrades.
[4] Values based on experience with similar soils prepared as recommended in this report.
[5] ESAL = Total 18-Kip equivalent single axle load. Traffic levels taken from Table 3.1 of APAO manual. If an increased traffic load is estimated, please contact us so that we may refine the traffic loading and revise our recommendations, if warranted.
[6] Suitability of subgrade at the time of construction and may require limited over-excavation as described in Section 5.8.1 of this report. A contingency for such over-excavation is recommended. Evaluation of actual requirements should be made at the time of construction based on actual subgrade soils encountered.

### 5.8.3 Recommended Minimum Sections

The following table presents the minimum recommended flexible pavement sections for the traffic levels indicated in the preceding table, based on the referenced AASHTO procedures.

**Table 4 Recommended Minimum Pavement Sections**

| Material | Minimum Thickness (inches)[1] | |
|---|---|---|
| | APAO Level I (Residential Driveways) | APAO Level II (Residential Streets) |
| Asphalt Pavement (inches) | 3 | 4 |
| Crushed Aggregate Base (inches)[2] | 12 | 12 |
| Subgrade Soils | Prepared in accordance with Section 5.8.1 of this report. Silt or clay subgrade soils should be covered with geotextile fabric prior to placing base rock materials. | |

[1] Subject to review of Clackamas County standard structural sections and functional classification of subject roadway.
[2] Thickness shown assumes dry weather construction. Geotextile separation fabric required regardless of weather conditions. Additional granular over-excavation/backfill (sub-base) section may be required in wet weather or otherwise unsuitable subgrade conditions. Refer to Section 5.3 and for additional discussion.

### 5.8.4 Asphalt & Base Course Materials

Asphalt pavement and base course material should conform to the most recent State of Oregon Standard Specifications for Highway Construction. Place aggregate base in one lift, and compact to not less than 95 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). Asphalt pavement should be compacted to at least 91 percent of the material's theoretical maximum density, as determined in general accordance with ASTM D2041 (Rice Specific Gravity).

### 5.8.5 Rigid Retaining Walls

At this time, we are not aware of final grading plans and the presence or absence of retaining walls within the overall development except those that might be related to basement walls. The following preliminary recommendations are provided for preliminary design purposes and are based on the assumption that silt or clay soils will be the predominant soil retained by the basement walls.

#### *5.8.5.1 Footings*

Retaining wall footings should be designed and constructed in conformance with the recommendations presented in Section 8.5 of this report, as applicable.

#### *5.8.5.2 Wall Drains*

We recommend retaining wall drains consist of a minimum 4-inch diameter, perforated, HDPE (High Density Poly-Ethylene) drainpipe wrapped with a non-woven geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet of open graded drain rock per lineal foot of pipe. The drain rock should be encased in a geotextile fabric in order to provide separation from the surrounding soils. Retaining wall drains should be positively sloped and should outlet to a suitable discharge point. The geotechnical engineer or his representative should be contacted to observe the drains prior to backfilling.

#### *5.8.5.3 Backfill*

Retaining walls should be backfilled with imported granular structural fill in conformance with Section **Error! Reference source not found.** of this report and contain less than 5 percent passing the U.S. Standard No. 200 Sieve. The backfill should be compacted to a minimum of 90 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). When placing fill behind walls, care must be taken to minimize undue lateral loads on the walls. Heavy compaction equipment should be kept at least "H" feet from the back of the walls, where "H" is the height of the wall. Light mechanical or hand tamping equipment should be used for compaction of backfill materials within "H" feet of the back of the walls.

#### *5.8.5.4 Design Considerations*

For rigid retaining walls founded, backfilled, and drained as recommended above, the following table presents parameters recommended for design.

**Table 5 Design Parameters for Rigid Retaining Walls**

| Retaining Wall Condition | Modeled Backfill Condition | Static Equivalent Fluid Pressure ($S_A$) | Additional Seismic Equivalent Fluid Pressure ($S_{AE}$) | Surcharge from Uniform Load, q, Acting on Backfill Behind Retaining Wall |
|---|---|---|---|---|
| Not Restrained from Rotation | Level (i = 0) | 34 pcf | 12 pcf | 0.30*q |
| Restrained from Rotation | Level (i = 0) | 58 pcf | 6 pcf | 0.50*q |
| Note 1. Refer to the attached Figure 14 for a graphical representation of static and seismic loading conditions. Seismic component of active thrust acts at 0.6H above the base of the wall.<br>Note 2. Seismic (dynamic) lateral loads were computed using the Mononobe-Okabe Equation as presented in the 1997 Federal Highway Administration (FHWA) design manual. | | | | |

The above design recommendations are based on the assumptions that:

(1) the walls consist of concrete cantilevered retaining walls ($\beta$ = 0 and $\delta$ = 24 degrees, see Figure 14).
(2) the walls are 10 feet or less in height.
(3) the backfill is drained and consists of imported granular structural fill ($\phi$ = 38 degrees).
(4) no line load, point, or area load surcharges are imposed behind the walls.
(5) the grade behind the wall is level, or sloping down and away from the wall, for a distance of 10 feet or more from the wall.
(6) the grade in front of the walls is level or sloping up for a distance of at least 5 feet from the wall.

Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

### 5.9 Additional Considerations

#### 5.9.1 Drainage

Subsurface drains should be connected to the nearest storm drain, on-site infiltration system (if selected and designed by others), or other suitable discharge point. Paved surfaces and ground near or adjacent to the buildings should be sloped to drain away from the buildings. Surface water from paved surfaces and open spaces should be collected and routed to a suitable discharge point. Surface water should not be directed into foundation drains or onto site slopes.

#### 5.9.1 Expansive Potential

The near surface native soils consisted of silty sand (SM), sandy silt (ML), and lean clay (CL), with boulders noted in some areas. Based on experience with similar soils in the area of the site, these soils are considered to have a low susceptibility to volume change due to changes in moisture content.

## 6.0 RECOMMENDED ADDITIONAL SERVICES

Satisfactory earthwork, foundation, floor slab, and pavement performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during subsurface explorations, and recognition of changed conditions often requires experience. We recommend that qualified

personnel visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those observed to date and anticipated in this report.

The project geotechnical engineer or their representative should provide observations and/or testing of at least the following earthwork elements during construction:

- Site Stripping & Grubbing
- Subgrade Preparation for Structural Fills, Shallow Foundations, Floor Slabs, and Pavements
- Compaction of Structural Fill and Utility Trench Backfill
- Compaction of Base Rock for Floor Slabs and Pavements

It is imperative that the owner and/or contractor request earthwork observations and testing at a frequency sufficient to allow the geotechnical engineer to provide a final letter of compliance for the earthwork activities.

## 7.0 LIMITATIONS

We have prepared this report for use by the owner/developer and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed as a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between or away from our explorations. If subsurface conditions vary from those encountered in our site explorations, CGT should be alerted to the change in conditions so that we may provide additional geotechnical recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process.

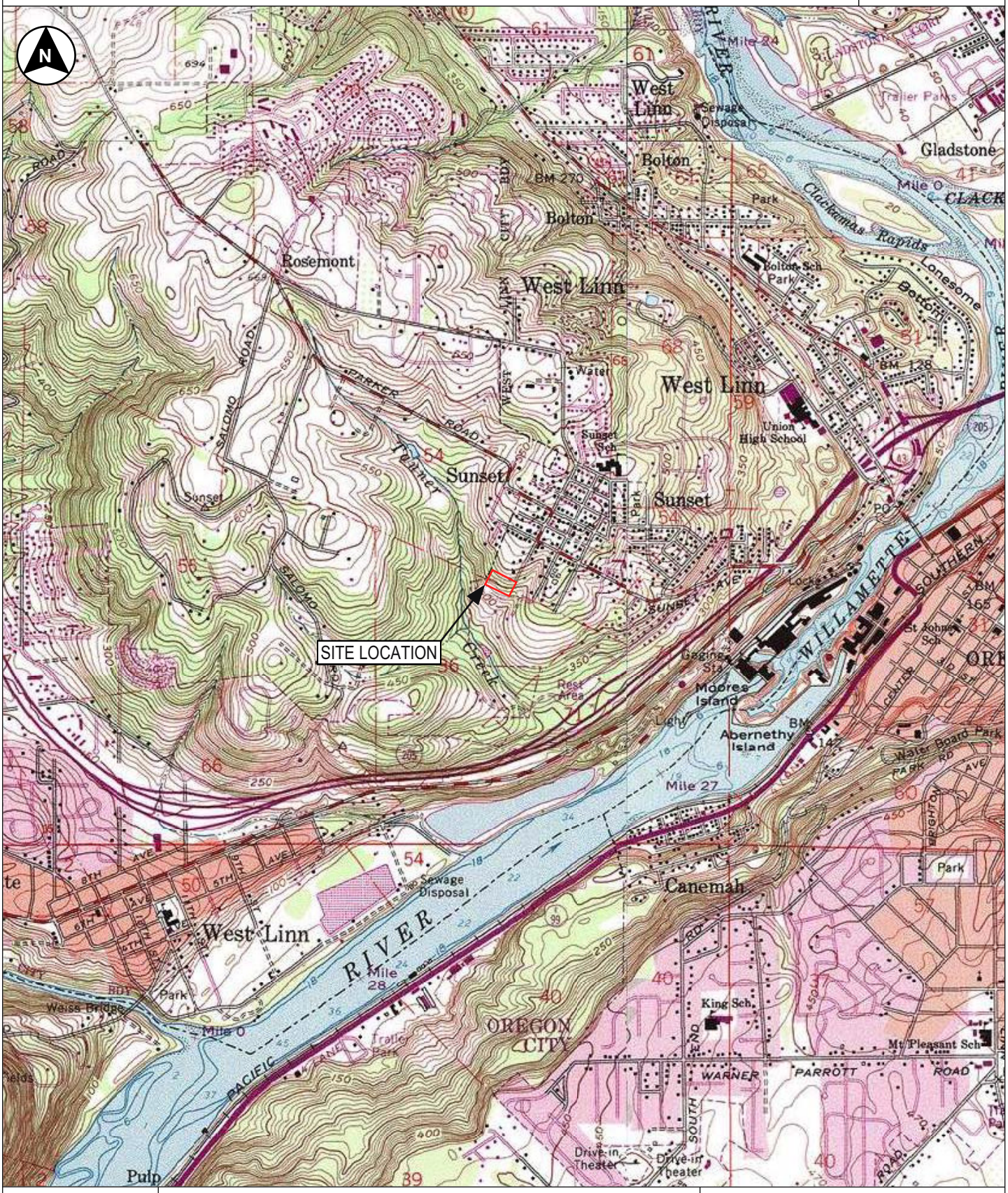
The owner/developer is responsible for ensuring that the project designers and contractors implement our recommendations. When the design has been finalized, prior to releasing bid packets to contractors, we recommend that the design drawings and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification. Design review and construction phase testing and observation services are beyond the scope of our current assignment, but will be provided for an additional fee.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Geotechnical engineering and the geologic sciences are characterized by a degree of uncertainty. Professional judgments presented in this report are based on our understanding of the proposed construction, familiarity with similar projects in the area, and on general experience. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared; no warranty, expressed or implied, is made. This report is subject to review and should not be relied upon after a period of three years.

***CORNWALL STREET SUBDIVISION - WEST LINN, OREGON***
***Project Number G1504283***

**FIGURE 1**
**Site Location**

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Map created with TOPO!™, © 2006 National Geographic Holdings
USGS 7.5 Minute Topographic Map Series, Canby, Oregon Quadrangle.

Township 2 South, Range 1 East, Section 36 Willamette Meridian

Latitude: 45.356965
Longitude: -122.633618

1 Inch = 2,000 feet

0 2000 4000

*CORNWALL STREET SUBDIVISION - WEST LINN, OREGON*
*Project Number G1504283*

**FIGURE 2**
**Site Plan**


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LEGEND

TP-1 Test pit

1 Orientation of site photographs shown on Figure 3

1 Inch = 100 Feet

0 100 200

NOTES: Drawing based on observations made while on site and site plans provided by client. All exploration locations should be considered approximate.

Photograph 1: Looking southwest towards the south margin of the site from just south of the existing residence.

Photograph 2: Looking south from the southeast towards the south-east corner of the site from just south of the existing residence.

Photograph 3: Looking northwest along the south margin of the site from within Lot 7.

Photograph 4: Looking north-northwest towards the northwest margin of the site from the proposed alignment of Landis Street.

# CORNWALL STREET SUBDIVISION - WEST LINN, OREGON
## Project Number G1504283

**FIGURE 4**
**USCS**

### Classification of Terms and Content

NAME: MINOR Constituents (12-50%); MAJOR Constituents (>50%); Slightly (5-12%)
Relative Density or Consistency
Color
Moisture Content
Plasticity
Trace Constituents (0-5%)
Other: Grain Shape, Approximate Gradation, Organics, Cement, Structure, Odor...
Geologic Name or Formation: Fill, Willamette Silt, Till, Alluvium, etc.

### USCS Grain Size

| | | |
|---|---|---|
| Fines | | <#200 (.075 mm) |
| Sand | Fine<br>Medium<br>Coarse | #200 - #40 (.425 mm)<br>#40 - #10 (2 mm)<br>#10 - #4 (4.75) |
| Gravel | Fine<br>Coarse | #4 - 0.75 inch<br>0.75 inch - 3 inches |
| Cobbles | | 3 to 12 inches;<br>scattered <15% est.<br>numerous >15% est. |
| Boulders | | > 12 inches |

### Relative Density or Consistency

| Granular Material | | Fine-Grained (cohesive) Materials | | | | |
|---|---|---|---|---|---|---|
| SPT N-Value | Density | SPT N-Value | Torvane tsf Shear Strength | Pocket Pen tsf Unconfined | Consistency | Manual Penetration Test |
| | | <2 | <0.13 | <0.25 | Very Soft | Thumb penetrates more than 1 inch |
| 0 - 4 | Very Loose | 2 - 4 | 0.13 - 0.25 | 0.25 - 0.50 | Soft | Thumb penetrates about 1 inch |
| 4 - 10 | Loose | 4 - 8 | 0.25 - 0.50 | 0.50 - 1.00 | Medium Stiff | Thumb penetrates about ¼ inch |
| 10 - 30 | Medium Dense | 8 - 15 | 0.50 - 1.00 | 1.00 - 2.00 | Stiff | Thumb penetrates less than ¼ inch |
| 30 - 50 | Dense | 15 - 30 | 1.00 - 2.00 | 2.00 - 4.00 | Very Stiff | Readily indented by thumbnail |
| >50 | Very Dense | >30 | >2.00 | >4.00 | Hard | Difficult to indent by thumbnail |

### Moisture Content

Dry: Absence of moisture, dusty, dry to the touch

Damp: Some moisture but leaves no moisture on hand

Moist: Leaves moisture on hand

Wet: Visible free water, likely from below water table

| | Plasticity | Dry Strength | Dilatancy | Toughness |
|---|---|---|---|---|
| **ML** | Non to Low | Non to Low | Slow to Rapid | Low, can't roll |
| **CL** | Low to Medium | Medium to High | None to Slow | Medium |
| **MH** | Medium to High | Low to Medium | None to Slow | Low to Medium |
| **CH** | Medium to High | High to Very High | None | High |

### Structure

Stratified: Alternating layers of material or color >6 mm thick

Laminated: Alternating layers < 6 mm thick

Fissured: Breaks along definite fracture planes

Slickensided: Striated, polished, or glossy fracture planes

Blocky: Cohesive soil that can be broken down into small angular lumps which resist further breakdown

Lenses: Has small pockets of different soils, note thickness

Homogeneous: Same color and appearance throughout

### Unified Soil Classification Chart (Visual-Manual Procedure) (Similar to ASTM Designation D-2487)

| Major Divisions | | | Group Symbols | Typical Names |
|---|---|---|---|---|
| Coarse Grained Soils: More than 50% retained on No. 200 sieve | Gravels: 50% or more *retained* on the No. 4 sieve | Clean Gravels | GW | Well-graded gravels and gravel/sand mixtures, little or no fines |
| | | | GP | Poorly-graded gravels and gravel/sand mixtures, little or no fines |
| | | Gravels with Fines | GM | Silty gravels, gravel/sand/silt mixtures |
| | | | GC | Clayey gravels, gravel/sand/clay mixtures |
| | Sands: More than 50% *passing* the No. 4 sieve | Clean Sands | SW | Well-graded sands and gravelly sands, little or no fines |
| | | | SP | Poorly-graded sands and gravelly sands, little or no fines |
| | | Sands with Fines | SM | Silty sands, sand/silt mixtures |
| | | | SC | Clayey sands, sand/clay mixtures |
| Fine-Grained Soils: 50% or more Passes No. 200 Sieve | Silt and Clays Low Plasticity Fines | | ML | Inorganic silts, rock flour, clayey silts |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays |
| | | | OL | Organic silt and organic silty clays of low plasticity |
| | Silt and Clays High Plasticity Fines | | MH | Inorganic silts, clayey silts |
| | | | CH | Inorganic clays of high plasticity, fat clays |
| | | | OH | Organic clays of medium to high plasticity |
| Highly Organic Soils | | | PT | Peat, muck, and other highly organic soils |

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*Additional References:*
*ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes and*
*ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*

**Table 22: Scale of Relative Rock Weathering**

| Designation | Field Identification |
|---|---|
| Fresh | Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric. |
| Slightly Weathered | Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric. Decomposition extends up to 1-inch into rock. |
| Moderately Weathered | Rock mass is decomposed 50% or less. Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits. |
| Predominantly Weathered | Rock mass is more than 50% decomposed. Rock can be excavated with geologist's pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water. |
| Decomposed | Rock mass is completely decomposed. Original rock fabric may be evident. May be reduced to soil with hand pressure. |

**Table 23: Scale of Relative Rock Hardness**

| Term | Hardness Designation | Field Identification | Approximate Unconfined Compressive Strength |
|---|---|---|---|
| Extremely Soft | R0 | Can be indented with difficulty by thumbnail. May be moldable or friable with finger pressure. | <100 psi |
| Very Soft | R1 | Crumbles under firm blows with point of geology pick. Can be peeled by pocket knife. Scratched with finger nail. | 100-1000 psi |
| Soft | R2 | Can be peeled by pocket knife with difficulty. Cannot be scratched with finger nail. Shallow indention made by firm blow of geology pick. | 1000-4000 psi |
| Medium Hard | R3 | Can be scratched by knife or pick. specimen can be fractured with a single firm blow of hammer/geology pick. | 4000-8000 psi |
| Hard | R4 | Can be scratched with knife or pick only with difficulty. Several hard blows required to fracture specimen. | 8000-16000 psi |
| Very Hard | R5 | Cannot be scratched by knife or sharp pick. Specimen requires many blows of hammer to fracture or chip. Hammer rebounds after impact. | >16000 psi |

**Table 24: Stratification Terms**

| Term | Characteristics |
|---|---|
| Laminations | Thin beds (<1cm). |
| Fissle | Tendency to break along laminations. |
| Parting | Tendency to break parallel to bedding, any scale. |
| Foliation | Non-depositional, e.g., segregation and layering of minerals in metamorphic rock. |



*Tables adapted from the 1987 Soil and Rock Classification Manual, Oregon Department of Transportation.*

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# FIGURE 6

## Test Pit TP-1



**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 486 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 | | | | | | 0 20 40 60 80 100 |
| | | SM FILL | **SILTY SAND FILL with gravel:** Brown, moist, with roots (less than ¼-inch diameter), and with fine to coarse angular gravel (up to 1-inch diameter). | | | | | | 0.5 | | |
| | | | | | | GRAB TP1-1 | | | 1 | | |
| 484 | | | | | | | | | 0.5 | | |
| | | ML FILL | **SANDY SILT FILL:** Gray, moist, exhibited low plasticity, and with fine to coarse angular gravel, brick and asphalt debris (up to 2-inch diameter), and roots (up to 1-inch diameter). | | 2 | | | | 1 | | |
| | | | | | | | | | 1.5 | | |
| | | | | | | GRAB TP1-2 | | | 2 | | |
| | | | | | | | | | 2.5 | | |
| 482 | | | | | 4 | | | | 2.5 | | |
| | | SM | **SILTY SAND:** Medium dense, red-brown, damp to moist, fine- to medium-grained, with roots, and with gravel and boulders (up to 20 inch-diameter). | | | | | | | | |
| 480 | | | | | 6 | | | | | | |
| | | | | | | GRAB TP1-3 | | | | | 20 |
| 478 | | | | | 8 | | | | | | |
| | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), red and black, moist. | | | GRAB TP1-4 | | | | | 36 |
| 476 | | | | | 10 | | | | | | |
| | | | • Test pit terminated at about 10 feet bgs.<br>• No groundwater or caving observed within the depth explored.<br>• Test pit loosely backfilled by Icon Construction with cuttings upon completion. | | | | | | | | |

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# FIGURE 7

## Test Pit TP-2



**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 486 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 484 | | SM FILL | **SILTY SAND FILL with gravel:** Brown, moist, with roots (less than 3-inch diameter), and with fine to coarse angular gravel (up to 4-inch diameter). | | 0 | | | | 0.5<br>0.5<br>1 | | |
| | | | | | 2 | | | | 1.5 | | |
| 482 | | CL | **LEAN CLAY with gravel:** Medium stiff to very stiff, gray-brown, exhibited medium plasticity, with roots (less than ¼-inch diameter), and with fine to coarse gravel (up to 2-inch diameter). | | 4 | GRAB TP2-1 | | | 1.5<br>2.5<br>3<br>4 | | 35 |
| 480 | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), red, black, gray and tan, and moist. | | 6 | GRAB TP2-2 | | | | | 43 |
| 478 | | | • Test pit terminated at about 7½ feet bgs due to practical refusal on a boulder.<br>• No groundwater or caving observed within the depth explored.<br>• Test pit loosely backfilled by Icon Construction with cuttings upon completion. | | | | | | | | |
| 476 | | | | | | | | | | | |

Carlson Geotechnical
7185 SW Sandburg Street
Tigard, OT 97281
Telephone: 503-601-8250
Fax: 503-601-8254

# FIGURE 8

## Test Pit TP-3



**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 486 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 | | | | 1 | | |
| | | | | | | | | | 1.5 | | |
| | | SM | **SILTY SAND:** Medium dense, gray-brown, damp to moist, fine- to medium-grained, with roots (less than, and with cobbles (up to 8-inch diameter). | | | | | | 2.5 | | |
| 484 | | | | | 2 | | | | 2 | | |
| | | | | | | | | | 2.5 | | |
| | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), moist, gray, red, brown, and tan | | | | | | 3.5 | | |
| | | | | | | | | | 4 | | |
| 482 | | | | | 4 | | | | 4 | | |
| 480 | | | | | 6 | | | | | | |
| 478 | | | | | 8 | | | | | | |
| | | | • Test pit terminated at about 8 feet bgs due to practical refusal on basalt.<br>• No groundwater or caving observed within the depth explored.<br>• Test pit loosely backfilled with cuttings upon completion. | | | | | | | | |
| 476 | | | | | | | | | | | |

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# FIGURE 9

## Test Pit TP-4



**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 468 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **SILTY SAND:** Medium dense, gray-brown, damp to moist, fine- to medium-grained, with roots (less than, and with gravel and boulders (up to 20-inch diameter). | | 0 | | | | 0.5 | | |
| | | SM | | | | | | | 1 | | |
| | | | | | | | | | 1 | | |
| 466 | | | | | 2 | | | | 1.5 | | |
| | | | **LEAN CLAY with gravel:** Medium stiff to very stiff, gray-brown, exhibited medium plasticity, and with cobbles (up to 9-inch diameter). | | | | | | 1.5 | | |
| | | CL | Light to moderate groundwater seepage observed at about 3 feet bgs. | | | GRAB TP4-1 | | | 2.5 | | 22 45 31 |
| | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), moist, gray, red, brown, and tan | | | | | | 3.5 | | |
| 464 | | | | | 4 | | | | 4 | | |
| 462 | | | | | 6 | | | | | | |
| | | | • Test pit terminated at about 7 feet bgs due to practical refusal on a boulder.<br>• No caving observed within the depth explored.<br>• Test pit loosely backfilled with cuttings upon completion. | | | | | | | | |
| 460 | | | | | | | | | | | |
| 458 | | | | | | | | | | | |

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Fax: 503-601-8254

# FIGURE 10

## Test Pit TP-5



**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 446 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 | | | | 0.5 | | |
| | | ML | **SANDY SILT:** Medium stiff to stiff, gray to brown, moist, exhibited low plasticity, with fine to coarse gravel and cobbles (up to 10-inch diameter), and with roots (up to 3-inch diameter). | | | | | | 0.5 | | |
| | | | | | | | | | 1 | | |
| 444 | | | | | 2 | | | | 2 | | |
| | | CL | **LEAN CLAY with gravel:** Medium stiff to very stiff, gray-brown, exhibited medium plasticity, and with cobbles (up to 9-inch diameter). | | | | | | 2.5 | | |
| | | | | | | | | | 3.5 | | |
| | | | | | | | | | 4 | | |
| 442 | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), moist, gray, red, brown, and tan | | 4 | | | | 4 | | |
| | | | Moderate groundwater seepage observed at about 4 feet bgs. | | | | | | | | |
| 440 | | | | | 6 | | | | | | |
| 438 | | | | | 8 | | | | | | |
| | | | • Test pit terminated at about 8 feet bgs.<br>• No caving observed within the depth explored.<br>• Test pit loosely backfilled with cuttings upon completion. | | | | | | | | |
| 436 | | | | | | | | | | | |

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# FIGURE 11

## Test Pit TP-6



**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 450 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ML | **SANDY SILT:** Medium stiff to stiff, gray to brown, moist, exhibited low plasticity, with fine to coarse gravel, and with roots (up to 2-inch diameter). | | 0 | | | | 0.5<br>0.5<br>0.5 | | |
| 448 | | CL | **LEAN CLAY with gravel:** Medium stiff to very stiff, gray-brown, exhibited medium plasticity, and with cobbles (up to 9-inch diameter). | | 2 | GRAB TP6-1 | | | 1.5<br>1.5<br>2.5 | | 33 |
| 446 | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), moist, gray, red, brown, and tan<br>Moderate groundwater seepage observed at about 4 feet bgs. | | 4 | | | | 3<br>4 | | |
| 444 | | | | | 6 | | | | | | 30 |
| 442 | | | • Test pit terminated at about 7 feet bgs.<br>• No groundwater or caving observed within the depth explored.<br>• Test pit loosely backfilled with cuttings upon completion. | | | | | | | | |
| 440 | | | | | | | | | | | |

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# FIGURE 12

## Test Pit TP-7

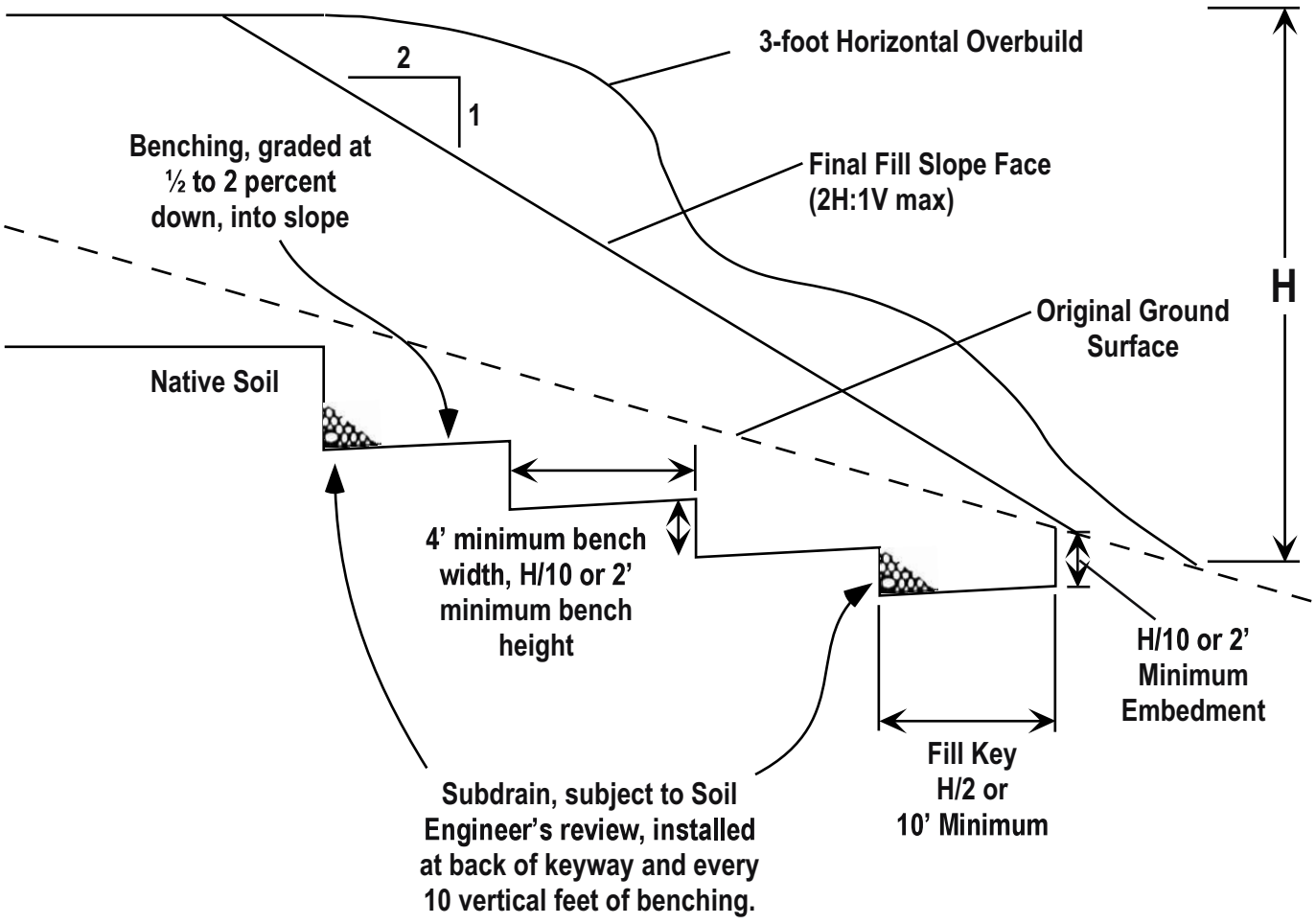


**CLIENT** Icon Construction - Darren Gusdorf
**PROJECT NAME** Cornwall Street Subdivision
**PROJECT NUMBER** G1504283
**PROJECT LOCATION** 4096 Cornwall Street, West Linn, Oregon
**DATE STARTED** 12/10/15 **GROUND ELEVATION** 460 ft
**ELEVATION DATUM** See Figure 2
**EXCAVATION CONTRACTOR** Icon Construction
**LOGGED BY** BLN **REVIEWED BY** KJS
**EQUIPMENT** John Deere 50G
**SEEPAGE** ---
**EXCAVATION METHOD** Excavator
**GROUNDWATER AT END** ---
**NOTES**
**GROUNDWATER AFTER EXCAVATION** ---

| ELEVATION (ft) | GRAPHIC LOG | U.S.C.S. | MATERIAL DESCRIPTION | GROUNDWATER | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | WDCP $N_{60}$ VALUE | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | ▲ WDCP $N_{60}$ VALUE ▲ / PL LL MC / ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ML | **SANDY SILT:** Medium stiff to stiff, gray to brown, moist, exhibited low plasticity, with fine to coarse gravel, and with roots (up to 2-inch diameter). | | 0 | | | | 0.5 | | |
| | | | | | | | | | 0.5 | | |
| | | | | | | | | | 0.5 | | |
| 458 | | CL | **LEAN CLAY with gravel:** Medium stiff to very stiff, gray-brown, exhibited medium plasticity, and with cobbles (up to 9-inch diameter). | | 2 | | | | 1 | | |
| | | | | | | | | | 1.5 | | |
| | | | | | | | | | 3.5 | | |
| 456 | | | **PREDOMINANTLY WEATHERED BASALT:** Very soft (R1), moist, gray, red, brown, and tan | | 4 | | | | 4 | | |
| | | | | | | | | | 4 | | |
| 454 | | | | | 6 | | | | | | |
| | | | • Test pit terminated at about 6 feet bgs.<br>• No groundwater or caving observed within the depth explored.<br>• Test pit loosely backfilled with cuttings upon completion. | | | | | | | | |
| 452 | | | | | | | | | | | |
| 450 | | | | | | | | | | | |

*CORNWALL STREET SUBDIVISION - WEST LINN, OREGON*
*Project Number G1504283*

**FIGURE 13**
**FILL SLOPE DETAIL**




CARLSON CGT GEOTECHNICAL 503-601-8250

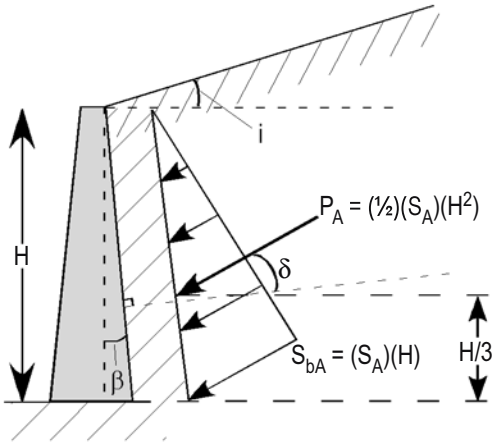
NOTE: Surfaces to receive fill with slopes steeper than 5H:1V (horizontal:vertical) should be benched and keyed as shown.

**CORNWALL STREET SUBDIVISION - WEST LINN, OREGON**
**CGT Project No. G1504283**

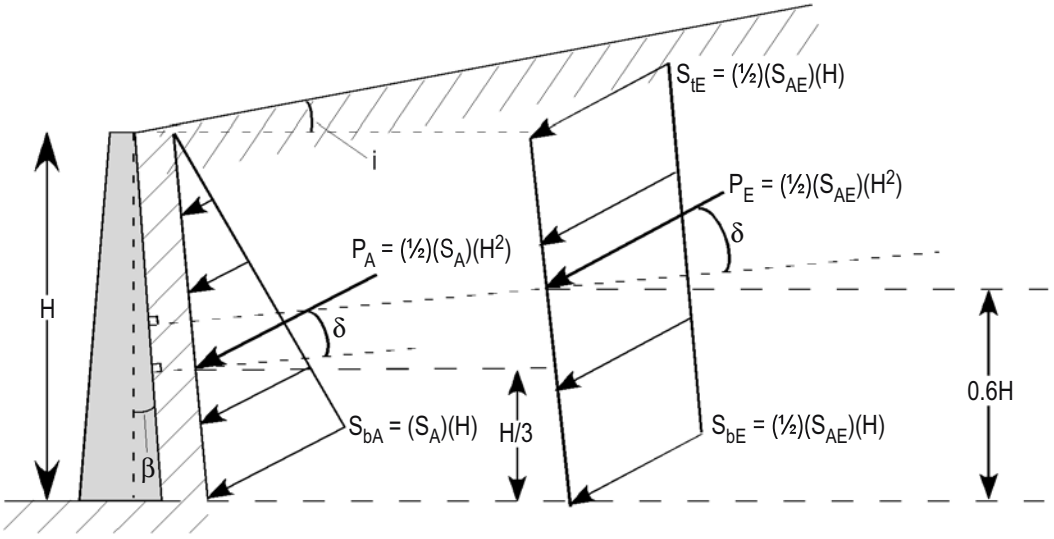
**FIGURE 14**
**RETAINING WALLS**

## ACTIVE LATERAL PRESSURE DISTRIBUTION

### STATIC LOADING CONDITIONS




### SEISMIC LOADING CONDITIONS




LEGEND

$P_A$ = Static active thrust force acting at a triangular distribution on wall (lb/ft$^3$)

$P_E$ = Dynamic component of active thrust force acting at a uniform distribution on wall (lb/ft)

i = Slope of backfill (degrees)**

$S_A$ = Active (static) component of equivalent fluid pressure (lb/ft$^3$)*

$S_{tE}$ = Active earth pressure (dynamic) at the top of the wall (lb/ft$^3$)

$S_{bA}$ = Active earth pressure (static) at the bottom of the wall (lb/ft$^3$)

ϕ = Internal angle of friction for backfill (degrees)**

δ = Angle from normal of back of wall (degrees). Based on friction developing between wall and backfill**

β = Slope of back of wall (degrees)**

$S_{AE}$ = Dynamic component of equivalent fluid pressure (lb/ft$^3$)*

$S_{bE}$ = Active earth pressure (dynamic) at bottom of the wall (lb/ft$^3$)*

*Refer to report text for calculated values **Refer to report text for modeled/assumed values

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Notes

1. Uniform pressure distribution of seismic loading is based on empirical evaluations [Sherif et al, 1982 and Whitman, 1990].
2. Placement of seismic resultant force at 0.6H is based on wall behavior and model test results [Whitman, 1990].

SIGNED ON: 20FEB17

REGISTERED PROFESSIONAL LAND SURVEYOR

OREGON
JULY 13, 2004
TOBY G. BOLDEN
60377LS

RENEWS: DECEMBER 31, 2017

Design by: Richard E. Givens, Planning Consultant
Survey Work by: Centerline Concepts, Inc.

Applicant/Owner:
Icon Construction & Development, LLC
1980 Willamette Falls Drive, Suite 200
West Linn, OR 97068
PH: (503) 657-0406

Legal: 2-1E-36BA TL 6300

Water: City of West Linn

Sewer: City of West Linn

Contours: Centerline Concepts, Inc.

Site Area: 2.176 Acres

Engineer:
Theta Engineering, Inc.
PO Box 1345
Lake Oswego, OR 97035
PH: (503) 481-8822

Surveyor:
Centerline Concepts, Inc.
700 Molalla Ave.
Oregon City, OR 97045
PH: (503) 650-0188

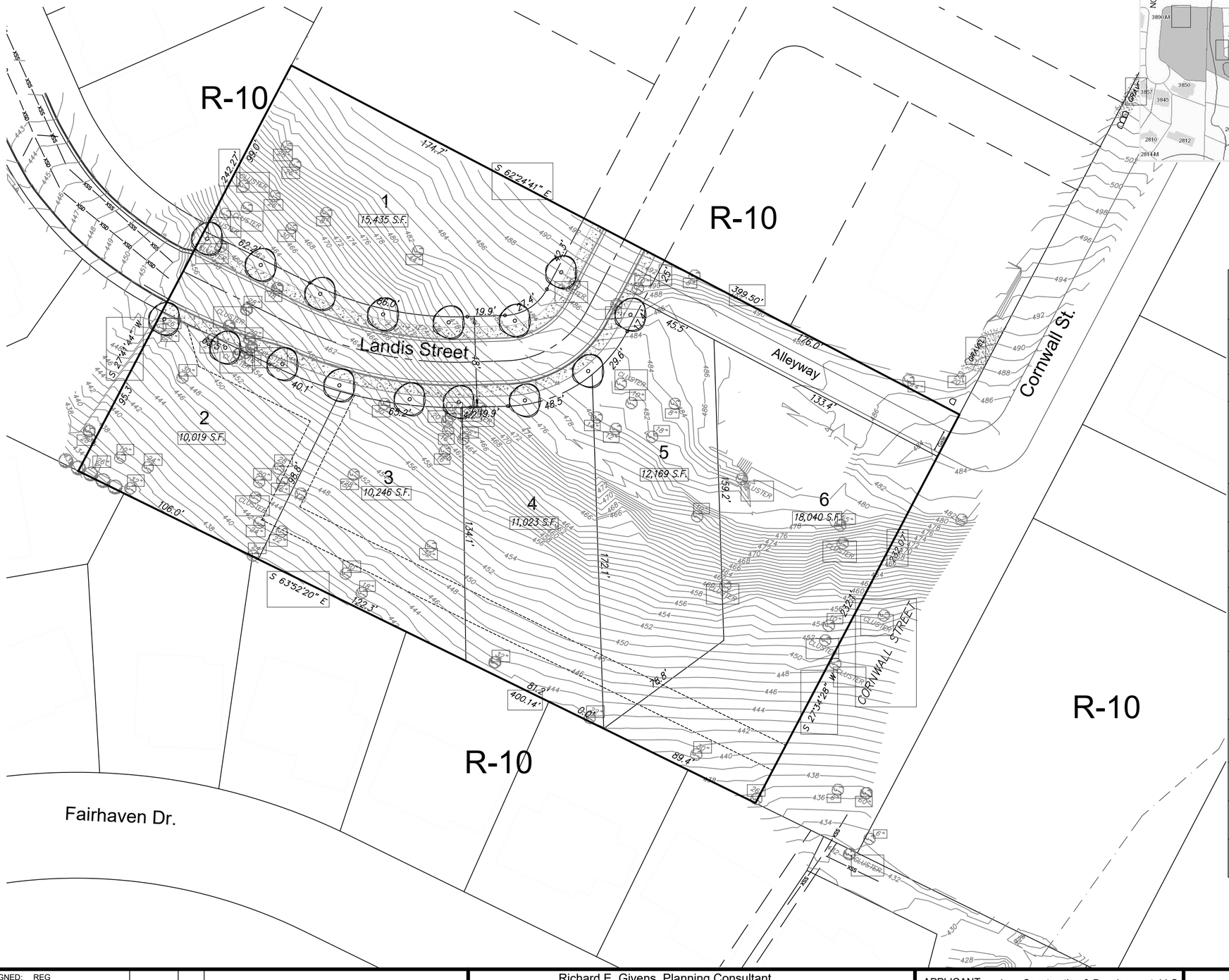
Zoning: R-10

NORTH

0 10' 20' 30' 40' 50' 100

Scale: 1" = 40'

Street Tree - 35' On Center





Vicinity Map

## Density Calculations

| | Area (sq. ft.) | Allowable Density | Units @1 per 10,000 sq.ft. |
|---|---|---|---|
| Gross Site Area | 94,808 | | |
| Land in a boundary street right-of-way, water course, or planned open space where density transfer is not requested: | 0 | | |
| Area in street right-of-way: | 17,627 | | |
| Net Site Area: | 77,181 | | |
| Area within Type I or II slopes where Developed: | 20,587 | 50% | 1.03 |
| Area within Type I or II slopes where Density Will be Transferred: | 0 | 75% | 0 |
| Area within Water Resource Area-all development transferred. | 0 | 50% | 0 |
| Open Space (Type III and IV Lands) | 0 | 100% | 0.00 |
| z | 56,594 | 100% | 5.7 |
| e | | | 6 |
| TOTAL ALLOWED DENSITY: | | | 6 UNITS |

| | | | | |
|---|---|---|---|---|
| DESIGNED: | REG | | | |
| DRAWN: | REG | | | |
| SCALE: | 1" = 30' | | | |
| DATE: | Oct. 2017 | | | |
| FILE: | 15-ICN-112 | DATE | NO. | REVISION |

Richard E. Givens, Planning Consultant
18680 Sunblaze Dr.
Oregon City, OR 97045
PH: (503) 479-0097

APPLICANT: Icon Construction & Development, LLC
1980 Willamette Falls Drive, Suite 200
West Linn, OR 97068
PH: (503) 657-0406

# Willow Ridge
## Tentative Plan

SHEET:
1/2

NORTH

0 10' 20' 30' 40' 50' 100'

SCALE: 1" = 30'

Slopes 0-15% (Type IV Land)
13,978 sq. ft. (14.8% of site)
8,984 sq. ft. of this is within street.

Slopes 15-25% (Type III Land)
57,578 sq. ft. (61% of site)
7,291 sq. ft. of this is within street.

Slopes 25-35% (Type II Land)
11,108 sq. ft. (11.7% of site)
1,167 sq. ft. of this is within street.

Slopes 35% Plus (Type I Land
11,891 sq. ft. (12.6% of site)
1,245 sq. ft. of this is within street.

Grading limits for new street onstruction.

Significant Trees per City Arborist.
Drip Line
Drip Line Plus 10'

Significant Trees to be removed.

Landis Street

Alleyway

Cornwall St.

CORNWALL STREET

Bark Chip Pedestrian Pathway

Fairhaven Dr.

S 62°24'41" E 399.50'

S 27°34'28" W 242.27'

S 63°52'20" E 400.14'

N 27°34'28" E 232.07'

1 2 3 4 5 6

| | | | | |
|---|---|---|---|---|
| DESIGNED: | REG | | | |
| DRAWN: | REG | | | |
| SCALE: | 1" = 30' | | | |
| DATE: | November 2017 | | | |
| FILE: | 15-ICN-112 | DATE | NO. | REVISION |

Richard E. Givens, Planning Consultant
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APPLICANT: Icon Construction & Development, LLC
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West Linn, OR 97068
PH: (503) 657-0406

# Willow Ridge
## Trees & Slope Analysis Plan

SHEET: 2/2

TL 4442
TL 4432
TL 4431
TL 4430
TL 4429
TL 4428
TL 4427
TL 4441
TL 6100
TL 4100
TL 4000
TL 4200
TL 4300
TL 4400
TL 4500
TL 4600
TL 4700
TL 4800
TL 7100

LANDIS STREET

CORNWALL STREET

CORNWALL STREET

FAIRHAVEN

EXISTING SAN MH
RIM: 437.6
IE. (SE) 423.8, 8"

EXISTING STM CB
RIM: 443.6
IE. (W) 439.2, 12"

EXISTING DETENTION SYSTEM

EXISTING SAN MH
RIM: 445.2
IE. (SE) 435.9, 8"
IE. (NW) 435.1, 8"

EXISTING SAN MH
RIM: 452.2
IE. 442.7, 8"
IE. (NW) 442.5, 8"

EXISTING STM MH
RIM: 442.10
IE. (SE) 427.9, 60"
IE. (NW) 427.8, 60"

EXISTING STM MH
RIM: 433.50
IE. (E) 437.1, 12"
IE. (SW) 427.1, 12"
IE. (SE) 430.6, 12"
IE. (NW) 4427.9, 16"

EXISTING STM CI
TC: 444.0
GRATE: 443.5
IE. (NE) 438.9, 12"

EXISTING STM MH
RIM: 445.9
IE. (SE) 434.9, 12"
IE. (NW) 434.6, 12"

EXISTING STM MH
RIM: 452.4
IE. OUT (NW) 446.0, 12"

STA. 0+00.00, ℄ LANDIS ST

PC = 0+62.83

PT = 1+85.58

PC = 1+85.58

PT = 2+33.23

CENTERLINE OF PAVEMENT

STA. 0+00.00, ℄ DRIVEWAY
STA. 2+53.56, ℄

END PAVEMENT
STA. 2+71.00, ℄

12.0' 12.0'
18.5' 18.5'
24.0' 24.0'

1
2
3
4
5
6

328.59 LF 12"ø STM

2.0'
5.0'
5.0'
32.0'

EXISTING 12" STM INLET
TOP OF PIPE: 493.51

EXISTING 12" STM OUTFALL
TOP OF PIPE: 486.22

STA. 2+00.00, ℄ DRIVEWAY

NOTE:
CURRENTLY NO TOPOGRAPHIC DATA
PAST THE CENTERLINE OF CORNWALL
STREET IN THIS AREA

EXISTING 12" STM OUTFALL
EL. 428.4

EXISTING 12" STM OUTFALL
EL. 426.5

OUTFALL TO DRAINAGE WAY

EXISTING SAN MH
RIM: 432.9
IE. (NE) 421.3, 8"
IE. (SE) 421.2, 8"
IE. (SW) 421.0, 8"

EXISTING 3" STM OUTFALL
EL. 419.8

EXISTING STM CI
RIM/TC 416.4
GRATE: 416.9
IE. (SW) 412.1, 12"

EXISTING SAN MH
RIM: 415.4
IE. (NE) 409.0, 8"
IE. (NW) 408.6, 8"

EXISTING 24" STM OUTFALL
EL. 413.1

EXISTING STM MH
RIM: 416.3
IE. (NE) 411.5, 12"
IE. (SE) 411.5, 12"
IE. (NW) 411.4, 12"

EXISTING STM CI
RIM/TC 416.5
GRATE: 416.0
IE. (NW) 412.0, 12"

EXISTING 24" STM OUTFALL
EL. 408.8

0 30 60
SCALE: 1" = 30'

2010-129L

# PRELIMINARY STREET AND UTILITY PLAN

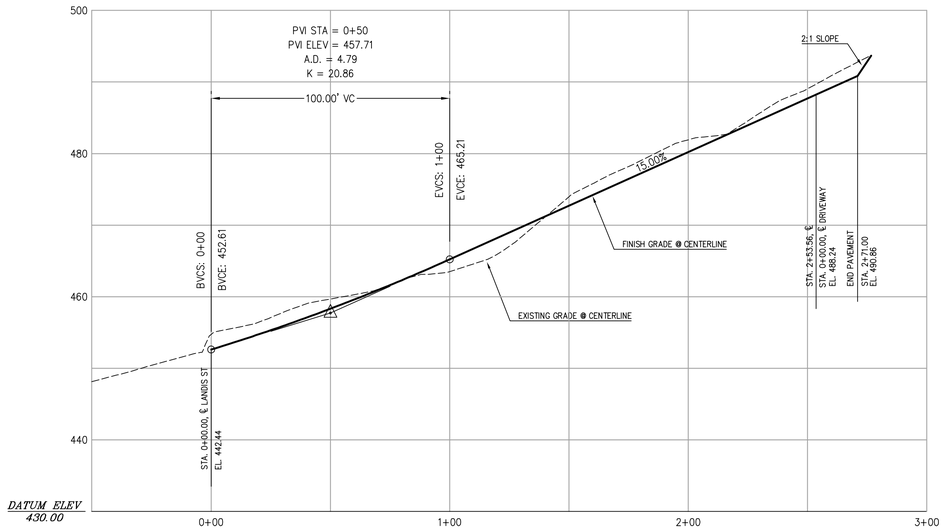
| | | | | |
|---|---|---|---|---|
| DESIGNED: | BDG | | | |
| DRAWN: | BJS | | | |
| SCALE: | 1" = 30' | | | |
| DATE: | July, 2017 | 11/02/2017 | 1 | APPLICATION |
| FILE: | Corwall Street Prelim6 | DATE | NO. | REVISION |


Theta,llc
ENGINEERING - SURVEYING - PLANNING
PO Box 1345
Lake Oswego, Oregon 97035
503/481-8822
email: thetaeng@comcast.net


Icon Construction & Development, LLC
1980 Willamette Falls Drive, Suite 200
West Linn, Oregon 97068
Phone: (503) 657-0406

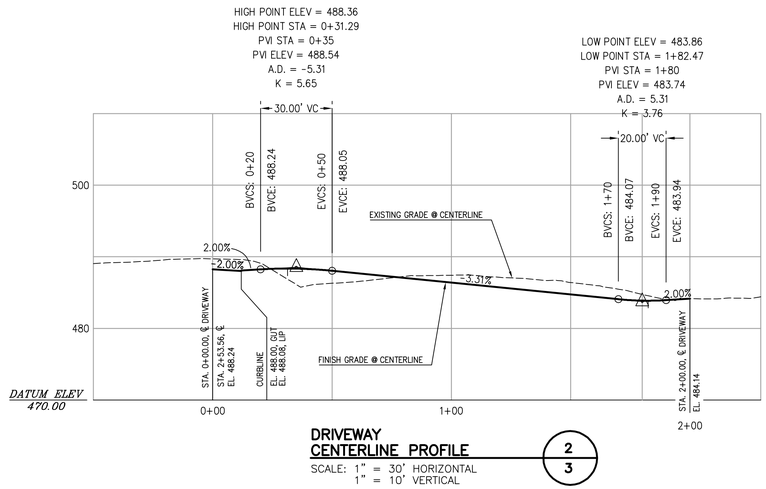
Willow Ridge
West Linn, Oregon

SHEET: 1/3




**LANDIS STREET**
**CENTERLINE PROFILE** 1/3

SCALE: 1" = 30' HORIZONTAL
1" = 10' VERTICAL




**DRIVEWAY**
**CENTERLINE PROFILE** 2/3

SCALE: 1" = 30' HORIZONTAL
1" = 10' VERTICAL

**PRELIMINARY STREET PROFILE**

2010-129L

| | | | | |
|---|---|---|---|---|
| DESIGNED: | BDG | | | |
| DRAWN: | BJS | | | |
| SCALE: | 1" = 30' | | | |
| DATE: | July, 2017 | | | |
| FILE: | Corwall Street Prelim6 | DATE | NO. | REVISION |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Phone: (503) 657-0406


Willow Ridge
West Linn, Oregon

SHEET: 2/3

TL 4442
TL 4432
TL 4431
TL 4430
TL 4429
TL 6100
TL 4427
TL 4428
TL 4441
TL 4000
TL 4100
TL 4200
TL 4300
TL 4400
TL 4500
TL 4600
TL 4700
TL 4800
TL 7100

LANDIS STREET

CORNWALL STREET

CORNWALL STREET

FAIRHAVEN

1
2
3
4
5
6

CLUSTER
ARBORVITAE ROW

0 30 60
SCALE: 1" = 30'

2010-129L

# PRELIMINARY GRADING PLAN

| | | | | |
|---|---|---|---|---|
| DESIGNED: | BDG | | | |
| DRAWN: | BJS | | | |
| SCALE: | 1" = 30' | | | |
| DATE: | July, 2017 | 11/02/2017 | 1 | APPLICATION |
| FILE: | Corwall Street Prelim6 | DATE | NO. | REVISION |


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Willow Ridge
West Linn, Oregon

SHEET: 3/3


2010-129L

**EXISTING CONDITIONS**

| | | | | |
|---|---|---|---|---|
| DESIGNED: | BDG | | | |
| DRAWN: | BJS | | | |
| SCALE: | 1" = 30' | | | |
| DATE: | April, 2016 | | | |
| FILE: | Cornwall Street Prelim3 | DATE | NO. | REVISION |


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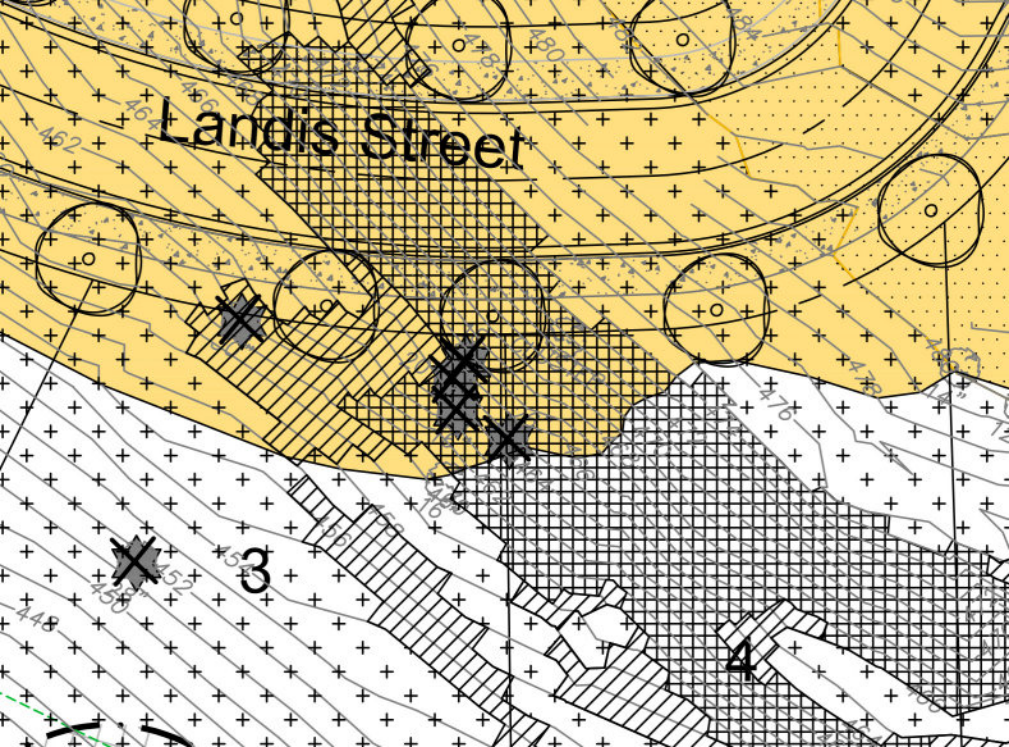
# Willow Ridge
West Linn, Oregon

SHEET: 1/4


Landis Street
3
4

3687

3699

R-10

4110

R-10

1
15,435 S.F.

2
10,019 S.F.

3
10,246 S.F.

4
11,023 S.F.

5
12,169 S.F.

6
18,040 S.F.

4096

Landis Street

Alleyway

Cornwall St.

CORNWALL STREET

174.7'

S 62°24'41" E

242.27'

99.0'

62.2'

86.0'

19.9'

27.4'

42.3'

25'

399.50'

176.0'

17.4'

45.5'

29.6'

48'

63.5'

40.1'

65.2'

4.2'

19.9'

48.5'

S 27°41'44" W

95.3'

106.0'

98.8'

134.1'

172.1'

159.2'

133.4'

232.07'

232.1'

S 27°34'28" W

78.8'

78.8'

S 63°52'20" E

122.3'

81.2'

400.14'

0.0'

89.4'

3745

3755

3765

R-10

3775

3785

Fairhaven Dr.

4003

R-10

GRAVEL