City of Sherwood
Oregon
Home of the Tualatin River National Wildlife Refuge

RECEIVED
JAN 18 2019
City of Sherwood
Planning Dept.

Case No. _____
Fee _____
Receipt # _____
Date _____
TYPE _____

City of Sherwood
Application for Land Use Action

Type of Land Use Action Requested: (check all that apply)

- ☐ Annexation
- ☐ Plan Amendment (Proposed Zone _____)
- ☒ Planned Unit Development
- ☐ Site Plan (square footage of building and parking area)
- ☐ Variance (list standards to be varied in description)
- ☐ Conditional Use
- ☐ Partition (# of lots _____)
- ☐ Subdivision (# of lots _____)
- ☐ Other: _____

By submitting this form the Owner, or Owner's authorized agent/ representative, acknowledges and agrees that City of Sherwood employees, and appointed or elected City Officials, have authority to enter the project site at all reasonable times for the purpose of inspecting project site conditions and gathering information related specifically to the project site.

Note: See City of Sherwood current Fee Schedule, which includes the "Publication/Distribution of Notice" fee, at **www.sherwoodoregon.gov.** Click on Government/Finance/Fee Schedule.

Owner/Applicant Information:

Applicant: Emerio Design, LLC / Steve Miller
Phone: (541) 318-7487 Cell
Applicant Address: 6445 SW Fallbrook Pl., Suite 100 Beaverton, OR 97008
Email: stevem@emeriodesign.com
Owner: JT Roth Construction, Inc. / Tim Roth
Phone: (503) 639-2639
Owner Address: 12600 SW 72nd #200
Email: timr@jtrothinc.com
Contact for Additional Information: _____

Property Information:

Street Location: 23000 SW Murdock Road
Tax Lot and Map No: 2S1W33CB; Tax Lot 300
Existing Structures/Use: Single-Family Dwelling and Accessory Structure
Existing Plan/Zone Designation: VLDR
Size of Property(ies) 4.88

Proposed Action:

Purpose and Description of Proposed Action:

The applicant is request land-use approval for an 12-Lot Planned Unit Development (PUD) in the VLDR zone.

Proposed Use: 12-Lot PUD

Proposed No. of Phases (one year each): One

Continued on Reverse

LAND USE APPLICATION FORM

Authorizing Signatures:

I am the owner/authorized agent of the owner empowered to submit this application and affirm that the information submitted with this application is correct to the best of my knowledge.

I further acknowledge that I have read the applicable standards for review of the land use action I am requesting and understand that I must demonstrate to the City review authorities compliance with these standards prior to approval of my request.

Applicant's Signature — Date: 1/18/2019

Owner's Signature — Date: 1-17-19

The following materials must be submitted with your application or it will not be accepted at the counter. Once taken at the counter, the City has up to 30 days to review the materials submitted to determine if we have everything we need to complete the review. Applicant can verify submittal includes specific materials necessary for the application per checklist.

■ **3 Copies of Application Form*** completely filled out and signed by the property owner (or person with authority to make decisions on the property.

■ **Copy of Deed** to verify ownership, easements, etc.

■ **At least 3 folded** sets of plans*

■ **At least 3 copies** of narrative addressing application criteria*

■ **Fee** (along with calculations utilized to determine fee if applicable)

■ **Neighborhood Meeting Verification** including affidavit, sign-in sheet and meeting summary (required for Type III, IV and V projects)

* **Note** that the required numbers of copies identified on the checklist are required for completeness; however, upon initial submittal applicants are encouraged to submit only 3 copies for completeness review. Prior to completeness, the required number of copies identified on the checklist and one full electronic copy will be required to be submitted.

EMERIO Design

CIVIL ENGINEERS & PLANNERS

DATE: 12-18-2019

PROPERTY OWNER/ DEVLOPER:
J.T. Roth Construction, Inc.
Attn: Tim Roth
12600 SW 72nd, Suite 200
Portland, OR 97223

CIVIL ENGINEER, PLANNING & SURVEYOR:
Emerio Design, LLC
Attn: Steve Miller
6445 SW Fallbrook Pl., Suite 100
Beaverton, OR 97008
Cell: (541) 318-7487
E-mail: stevem@emeriodesign.com

REQUEST: 13-Lot residential subdivision in the VLDR Planned Unit Development (PUD) Zone. The proposed **"Murdock Rd. PUD"** will be developed pursuant to the City of Sherwood Land Use and Development Code requirements.

SITE LOCATION: 23000 SW Murdock Road

ZONING: VLDR, Very Low Density Residential, City of Sherwood, Oregon

SIZE: 5.27 Acres

LEGAL DESCRIPTION: Tax Map 2S133CB, Tax Lot 300 and a portion of Tax Lot 100 (6,384 sq. ft.)

LIST OF EXHIBITS:

1 - Vicinity Map and Washington Co Assessor Map

2 – Detailed Development Plan and Landscape Plans

3 – Remedial Action Work Plan

4 – Drainage Report

EMERIO Design

5 – Pre-Application Notes

6 – Sight Distance Evaluation

7 – Murdock Road PUD Architectural Pattern Book

8 – Clean Water Services Service Provider Letter

9 – Neighborhood Meeting Notice and Notes

10 – Title Report

11 – Geotechnical Report

12 – Approved Design Modification Request

I. INTRODUCTION

Background Information: The subject site is approximately 5.27 acres in size and is generally rectangular in shape. The site is currently developed with a single-family dwelling and an accessory structure. The property is vegetated with a mix of trees, shrubs, and grass fields, and has an undulating topography with a large rock outcropping at the southwest corner of the property.

With this proposal, the applicant is proposing to develop the site into a 13-lot residential subdivision/planned development for single-family detached residential dwellings. The subject property is part of the SE Sherwood Master Plan, which was approved in concept by the Planning Commission via resolution in 2006. Although not formally adopted and incorporated into the Comprehensive Plan nor adopted by the City Council, it does provide guidance for development and the intention of the community and surrounding property owners for the area. The subject site has an underlying zoning district of Very Low Density Residential (VLDR) and will be developed utilizing the requirements of the VLDR zoning district in conjunction with the recommendations and guidelines of the SE Sherwood Master Plan, including the allowed density of four dwelling units per net buildable acre, which will be discussed later in this narrative. As part of the planned unit development (PUD), the applicant is requesting a modification to the front yard setback, rear yard setback for Lots 1 and 4, and the street side yard setback for Lots 4 – 5, and 9. The front yard setback will be reduced from 20 feet to15 feet for the house and 20 feet for the garage, the rear yard setback will be reduced to 15 feet for Lots 1 and 4, and the street side yard setback will be reduced from 20 to 15 feet for lots 4 – 5, and 9.

The site was part of the "Ken Foster Farm" site, originally about 40 acres and was used for farming. It was subdivided approximately twenty years ago, a portion of which is this

5.27-acre site. It is known that portions of the larger Ken Foster Farm site had been used for discarding animal hides and carcasses that were remnants from the local tanner operation in the city. As part of the Department of Environmental Quality (DEQ) investigation of the Tannery site on SW Oregon Street, it was discovered that the soil on the Ken Foster Farm site was contaminated. The property to the northeast, Ironwood Subdivision, was in development when the issue became known which required significant soil removal and oversight from the Department of Environmental Quality (DEQ).

An excerpt from the Department of Environmental Quality Technical memorandum dated July 13, 2005 describes that from 1962 to 1971, tannery wastes from the Frontier Leather Company were applied by Mr. Foster to several areas of pasture land. Liquid sludge from the tannery's primary wastewater settling tanks was also distributed on the site.

DEQ entered the Ken Foster Farm site into the Environmental Cleanup Site Information Database in 2000 and completed a Preliminary Assessment (PA) in 2004, funded by cooperative grant funds from the Environmental Protection Agency (EPA) Region 10.

The applicant is responsible for completing clean-up of all known contamination on the site. The applicant/owner is actively working with DEQ at the time of this application submittal to finalize the clean-up of the contamination. All approvals from DEQ shall be received prior to the applicant proceeding with any development of the subject property. A Remedial Action Work Plan has been included with this application submittal.

II. CONFORMANCE WITH CITY OF SHERWOOD CODE APPROVAL CRITERIA

SHERWOOD MUNICIPAL CODE (Code)
TITLE 16 – ZONING AND COMMUNITY DEVELOPMENT CODE

Division I ***GENERAL PROVISIONS***

Chapter 16.04 ***ESTABLISHMENT OF ZONING DISTRICTS***

Response: The subject property is identified on the City of Sherwood's (City) Official Zoning Map as being in the Very Low Density Residential (VLDR) zoning district within the SE Sherwood Plan, noting that the SE Sherwood Plan has never been officially adopted by the City.

Division II LAND USE AND DEVELOPMENT

Chapter 16.12 RESIDENTIAL LAND USE DISTRICTS

16.12.010 – Purpose and Density Requirements

A. Very Low Density Residential (VLDR)

1. Standard Density

The VLDR zoning district provides for low density, larger lot single-family housing and other related uses in natural resource and environmentally sensitive areas that warrant preservation but are otherwise deemed suitable for limited development. Standard density in the VLDR zone is 0.7 to 1 dwelling unit per acre.

Response: The subject site is going to be developed as a Planned Unit Development; therefore, the standard density is not applicable to this project.

2. VLDR Planned Unit Development Density Standards

Property in the VLDR zone that is developed through the Planned Unit Development (PUD) process under Chapter 16.40, if all floodplain, wetlands, and other natural resource areas are dedicated or remain in common open space, may develop to a density of 1.4 to 2.0 dwelling units per net buildable acre under the following conditions:

a. The minimum lot size is not less than 10,000 square feet;

b. The following areas are dedicated to the public or preserved as common open space: floodplains under Section 16.134.020 (Special Resource Zones); natural resources areas as shown on the Natural Resources and Recreation Plan Map, attached as Appendix C, or as specified in Chapter 5 of the Community Development Plan; and wetlands defined and regulated under current Federal regulation and Division VIII of this Code; and

c. The higher density development will better preserve natural resources as compared to one (1) unit per acre.

Response: The subject site is going to be developed as a Planned Unit Development; however, the subject parcel is part of the Southeast Sherwood Master Plan and will be developed as a Southeast Sherwood Master Planned Unit Development which has different standards and are discussed below.

3. Southeast Sherwood Master Planned Unit Development

a. Property in the VLDR zone that is developed through the Planned Unit Development process under Chapter 16.40 and is based on, and generally conforms to the concepts, goals and objectives of the SE Sherwood Master Plan may develop to a maximum density of four (4.0) dwelling units per net buildable acre.

Response: The proposed project will be a planned unit development in the Southeast Sherwood Master Planned Unit Development area and generally conforms to the concepts, goals and objectives of the SE Sherwood Master Plan. Accordingly, the maximum density allowed is four dwelling units per net buildable acre. Density calculations will be given in detail later in this narrative. A complete discussion of Chapter 16.40 will also take place later in this narrative.

b. Development under Section 16.12.010.A.3 must generally follow the development pattern shown as Alternative B/C in the SE Sherwood Master Plan (2006) and address the following factors:

(1) Varied lot sizes are allowed with a minimum lot area of 10,000 square feet if it can be shown that adequate buffering exists adjacent to developed properties with screening, landscaping, roadways or open space.

Response: Proposed lots are sized as follows: Lot 1 – 11,355 square feet; Lot 2 – 10,572 square feet; Lot 3 – 12,177 square feet; Lot 4 – 10,117 square feet; Lot 5 – 11,116 square feet; Lot 6 – Lot 10,032 square feet; Lot 7 – 10,031 square feet; Lot 8 – 10,725 square feet; Lot 9 – 10,455; Lot 10 – 11,233; Lot 11 – 13,630; Lot 12 – 12,777; Lot 13 – 10,260 square feet. All lots either meet or exceed the 10,000-square foot minimum. Buffering, therefore, is not necessary as all lots meet or exceed the minimum 10,000-square footage requirement. It is also noted that a water quality tract (i.e. Tract D) located at the northwest corner and landscaped usable open space along the west (i.e. Tract A) and east (i.e. Tract C) of the subject site all act as buffers to adjacent developed properties.

(2) The open space areas as required by Chapter 16.40 (Planned Unit Development), where feasible, should include parks and pathways that are located within the general vicinity of Alternative B/C in the SE Sherwood Master Plan.

Response: Open space requirements are addressed later in this narrative. Proposed Tracts A, C, and E will provide usable open space areas for the PUD and will be dedicated as Tracts A, C, and E usable open space. Tract A will also be utilized to preserve a grove of mature pine trees, which will help maintain the character of the area. Tract C has been located on the eastern boundary of the site and will help facilitate connectivity with future open space to the east as intended in the SE Sherwood Master Plan.

(3) There is a pedestrian-friendly transportation system that links the site with nearby residential developments, schools, parks, commercial areas and other destinations.

Response: The subject property is surrounded by different levels of residential development, with the developments to the south and west being more densely developed than lands to the north and east. There are no schools, parks or commercial areas nearby which need to be linked with the subject site. The proposed development will link with the surrounding residential sites via installation of a sidewalk along the east side of SW Murdock Rd., as well as along both sides of the proposed street running north/south through the site. With the construction of these features, pedestrian connectivity will be provided along SW Murdock Road, as well as within the interior of the project by the proposed road and will allow for future connectivity with the redevelopment of the surrounding parcels.

(4) The unique environmental opportunities and constraints identified in the SE Sherwood Master Plan.

Response: Pursuant to the SE Sherwood Master Plan, the subject site does not contain any unique environmental opportunities and/or constraints. With that being said, the applicant is proposing to preserve a large grove of mature pine trees within Tract A. The above criterion does not apply to the applicant's proposal because there are no unique environmental opportunities and constraints identified in the SE Sherwood Master Plan on the site.

(5) The view corridors identified in the SE Sherwood Master Plan.

Response: The subject property does not have any identified view corridors depicted on the SE Sherwood Master Plan, therefore, this criterion does not apply to the applicant's request.

(6) The housing design types that are compatible with both surrounding and existing development.

Response: The proposed housing design types as discussed in the submitted Murdock Rd. PUD Architectural Pattern Book are Prairie, Modern and Craftsman style, similar and compatible with, the existing houses in the adjacent subdivision and existing/surrounding developments.

c. A density transfer under Chapter 16.40.050.C.2. is not permitted for development under this Section 16.12.010.A.3.

Response: No density transfers are required or being requested for this project.

d. The Planning Commission will consider the specific housing design types identified and the preservation of the identified view corridors at the time of final

development review to ensure compatibility with the existing and surrounding development.

Response: The developer acknowledges that specific housing design types identified in this application will have to be identified again for final review as part of the final development review process. The subject site does not have any identified view corridors on the SE Sherwood Master Plan.

16.12.020 – Allowed Residential Land Uses

A. Residential Land Uses

Response: This project proposes single-family detached dwellings. Single-family detached dwellings are listed as a permitted use in the VLDR zone as per the table in 16.12.020.

16.12.030 – Residential Land Use Development Standards

A. Generally

No lot area, setback, yard, landscaped area, open space, off-street parking or loading area, or other site dimension or requirement, existing on, or after, the effective date of this Code shall be reduced below the minimum required by the Code. Nor shall the conveyance of any portion of a lot, for other than a public use or right-of-way, leave a lot or structure on the remainder of said lot with less than minimum Code dimensions, area, setbacks or other requirements, except as permitted by Chapter 16.84.

B. Development Standards

Except as modified under chapter 16.68 (Infill Development), Section 16.144.030 (Wetland, Habitat and Natural Areas) chapter 16.44 (Townhomes), or as otherwise provided, required minimum lot areas, dimensions and setbacks shall be provided in the following table.

C. Development Standards per Residential Zone

Response: The table lists the minimum lot area for single-family detached dwellings in the VLDR-PUD zone as 10,000 square feet. This project proposes thirteen (13) lots, all at 10,000 square feet or larger in area as illustrated on the submitted plan set. This standard has been met.

The table lists the minimum lot width at the front property line as 25 feet in the VLDR-PUD zone. Except for lots 2 and 3, which will be flag lots with 12.72 feet of frontage each on

the proposed public street, all other proposed lots exceed the minimum lot width requirement. Lots 2 and 3 will have a shared driveway over the "flag-pole" portion of the lots, and lot 3 will also have 89-feet of frontage on SW Ironwood Ln. once additional right-of-way is dedicated with the development of property to the east. Front lot line dimensions are noted on Sheet 3 of the submitted plan set.

There isn't a requirement for a minimum lot width at the building line in the VLDR-PUD zone. There isn't a requirement for a minimum lot depth in the VLDR-PUD zone.

Maximum height is 30 feet or 2 stories. This has been noted on Sheet 1 of the submitted plan set and will be reviewed for compliance during the building permit process.

Setbacks in the VLDR-PUD zone for a single-family detached dwelling are as follows as per the table in 16.12.030:

	Required	**Provided**
Front:	20 feet	15 feet for house, 20 feet for garage
Face of garage:	20 feet	20 feet
Interior side:	5 feet	5 feet
Corner lot street side:	20 feet	15 feet for Lots 4 – 5, and 9.
Rear:	20 feet	20 feet, except for Lots 1 and 4, which will be 15 ft.

The minimum setbacks have been noted on Sheet 1 of the submitted plan set. All setbacks will be reviewed for compliance during the building permit process.

As part of the planned unit development (PUD), the applicant is requesting a modification to the front yard setback, rear yard setback for Lots 1 and 4, and the street side yard setback for Lots 4 – 5, and 9. The front yard setback will be reduced from 20 feet to15 feet for the house and 20 feet for the garage, the rear yard setback will be reduced to 15 feet for Lots 1 and 4, and the street side yard setback will be reduced from 20 to 15 feet for lots 4 – 5, and 9. The adjusted setbacks have been noted on Sheet 3.

16.12.040 – Community Design

For standards relating to off-street parking and loading, energy conservation, historic resources, environmental resources, landscaping, access and egress, signs, parks and open space, on-site storage, and site design, see Divisions V, VIII, IX.

Response: The relevant sections of Divisions V, VIII and IX are addressed in this narrative and application package.

16.12.050 – Flood Plain

Except as otherwise provided, Section 16.134.020 shall apply.

Response: The subject site is not located within a flood plain; neither this section nor Section 16.134.020 apply to this development.

Chapter 16.40 PLANNED UNIT DEVELOPMENT (PUD)

16.40.020 Preliminary Development Plan

A. Generally

A PUD Preliminary Development Plan shall be submitted for review and approval in accordance with Chapter 16.72. PUDs shall be considered: a) on sites that are unusually constrained or limited in development potential, as compared to other land with the same underlying zoning designation, because of: natural features such as floodplains, wetlands, and extreme topography, or man-made features, such as parcel configuration and surrounding development; b) on parcels of land within the Urban Renewal District where flexibility and creativity in design may result in greater public benefit than strict adherence to the code; or c) in other areas deemed appropriated by Council during the adoption of a concept plan required by a Metro UGB expansion.

Response: In this case, the site is unusually limited in development potential because of the cost of cleanup of contaminated soils due to dumping of tannery waste on the site of the former Ken Foster Farms, in addition to the cost of undergrounding overhead power lines along the site's SW Murdock Rd. frontage. Development as proposed facilitates the complete remediation of contaminated soils on this portion of the former KFF site, which is of great public benefit as lead and other harmful toxins have been detected in soils within the boundaries of the former KFF property. There is further public benefit with the development is this site as it implements the street system envisioned in the Sherwood Transportation System Plan and the SE Sherwood Master Plan for this region of the city. The number of lots proposed makes it feasible to develop the property considering the cleanup and infrastructure costs, thereby ensuring that the potential public health hazard is eliminated, and that vehicular and pedestrian connectivity and circulation is provided.

The only variations being sought are setback adjustments of the front, rear and street setback. As part of the planned unit development (PUD), the applicant is requesting a modification to the front yard setback, rear yard setback for Lots 1 and 4, and the street side yard setback for Lots 4 – 5, and 9. The front yard setback will be reduced from 20

feet to15 feet for the house and 20 feet for the garage, the rear yard setback will be reduced to 15 feet for Lots 1 and 4, and the street side yard setback will be reduced from 20 to 15 feet for lots 4 – 5, and 9. The adjusted setbacks have been noted on Sheet 3.

B. Content

The Preliminary Development Plan application shall include the following documentation:

1. Existing conditions map(s) showing: All properties, existing uses, and zoning districts within three hundred (300) feet, topography at five (5) foot intervals, floodplain, significant natural vegetation and features, private and public facilities including but not limited to utilities, streets, parks, and buildings, historic and cultural resources, property boundaries, lot lines, and lot dimensions and area.

Response: An Existing Conditions Map, which is Sheet 2 of the plan set, has been included with this application submittal.

2. Listing of all property owners adjacent to the PUD as per Section 16.72.020, including names and addresses, and a listing of all persons, including names and addresses, with an interest in the property subject to the PUD application.

Response: The application package includes the names and addresses of nearby property owners, as well as the names and addresses of the owners of the subject site, applicants and consultants.

3. Proposal map(s) showing: Alterations to topography, floodplain, natural vegetation…

Response: The required items are shown on the submitted plans.

4. Narrative describing: the intent of the PUD and how general PUD standards as per this Chapter are met, details of the particular uses, densities, building types and architectural controls proposed, form of ownership, occupancy and responsibility for maintenance for all uses and facilities, trees and woodlands, public facilities to be provided, specific variations from the standards of any underlying zoning district or other provisions of this Code, and a schedule of development.

Response: This narrative includes the necessary information.

5. If the PUD involves the subdivision of land, the proposal must also include a preliminary subdivision plat and meet all requirements of Chapter 16.120. The preliminary subdivision will be processed concurrently with the PUD.

Response: Sheet 3 of the submitted plan set is the Preliminary Plat for the proposed subdivision of land.

6. ***Architectural Pattern Book: A compendium of architectural elevations, details and colors of each building type shall be submitted with any PUD application. The designs shall conform to the site plan urban design criteria in…***

Response: An Architectural Pattern Book is included with the application package and includes all the required information.

C. ***Commission Review***
The Commission shall review the application pursuant to Chapter 16.72 and may act to recommend to the Council approval, approval with conditions or denial. The Commission shall make their decision based on the following criteria:
1. ***The proposed development is in substantial conformance with the Comprehensive Plan and is eligible for PUD consideration per 16.40.020.A.***

Response: The proposed development complies with the standards of the Development Code, which implements the Comprehensive Plan. The proposal is eligible for PUD consideration per 16.40.20.A in that it is unusually limited in development potential by the financial burden of cleaning up contaminated soils in addition to infrastructure costs which further limits the amount of space available for development. There is great public benefit to facilitating the complete remediation of the contaminated soils on this part of the former Ken Foster Farms site, as well as the proposed improvements along the east side of SW Murdock Rd. and the proposed north/south street as designated in the Sherwood Transportation System Plan and the SE Sherwood Master Plan.

2. ***The preliminary development plans include dedication of at least 15 percent of the buildable portion of the site to the public in the form of usable open space, park or other public space, (subject to the review of the Parks & Recreation Board) or to a private entity managed by a homeowners association. Alternatively, if the project is located within close proximity…***

Response: The buildable area of the site is 144,481 square feet and 15% of the buildable area is 21,672 square feet. Tracts A, C and E have been designated as usable open space tracts comprising 36,574 square feet. Tract A will run along the sites SW Murdock Rd. frontage and then widen in the middle to provide for pedestrian connectivity between the proposed public street and SW Murdock Road. Tract A will also contain a preserved grove of pine trees, shrubs and ground cover.

Tract C contains 7,916 square feet of open-space and will provide connectivity with the property to the east to expand the open-space as contemplated in the SE Sherwood Master Plan when that property redevelops.

Tracts A, C and E will be conveyed by title to the homeowners' association for maintenance and management. Tracts A and C, as the designated usable open space, total 36,574 square feet which exceeds the minimum requirement of 21,672 square feet.

3. ***That exceptions from the standards of the underlying zoning district are warranted by the unique design and amenities incorporated in the development plan.***

Response: All standards of the underlying zoning district are being met as part of this application, except a modification to the front, rear, and street side yard setbacks.

Due to the topography, geography, and the fact that future right-of-way will be dedicated creating future corner lots, the applicant would like to have the flexibility to place the houses as close to the front and street as possible to avoid grading and site disturbance in those areas that have constraints. The setback modification request provides flexibility to place the houses and driveways on the lots in the flattest areas possible, some of which are right at the street.

Thus, as part of the planned unit development (PUD), the applicant is requesting a modification to the front yard setback, rear yard setback for Lots 1 and 4, and the street side yard setback for Lots 4 – 5, and 9. The front yard setback will be reduced from 20 feet to15 feet for the house and 20 feet for the garage, the rear yard setback will be reduced to 15 feet for Lots 1 and 4, and the street side yard setback will be reduced from 20 to 15 feet for lots 4 – 5, and 9. The adjusted setbacks have been noted on Sheet 3.

4. ***That the proposal is in harmony with the surrounding area or its potential future use, and incorporates unified or internally compatible architectural treatments, vernacural, and scale subject to review and approval in Subsection (B)(6).***

Response: The proposed project (residential detached dwellings) is in harmony with the surrounding area as the proposed lots are comparable in size and use to the existing development (also residential detached dwellings) to the west and to future development as outlined in the SE Sherwood Master Plan. Conceptual architectural treatments are included with this application as Exhibit B showing prairie, craftsman and modern styles similar with the surrounding area. Proposed houses will meet the minimum side and rear setback and maximum height requirements (and, therefore be of a similar scale) of the adjacent developments that have been constructed in the VLDR zone.

5. ***That the system of ownership and the means of developing, preserving and maintaining parks and open spaces are acceptable.***

Response: Tracts A, B, C, and E will be dedicated to the homeowners' association for maintenance, preservation and management. These tracts will be developed by the applicant as part of the subdivision site development.

6. That the PUD will have a beneficial effect on the area which could not be achieved using the underlying zoning district.

Response: Due to the costs of cleanup of contaminated soils, it is not financially feasible to develop the site at the density of the VLDR zoning district. Development through the planned unit development process in the SE Sherwood Master Plan allows a density of four dwelling units per net acre which will facilitate complete remediation of contaminated soils on this portion of the former Ken Foster Farms site. Without SE Sherwood Master Plan PUD approval, complete cleanup of the site may be left undone or as a burden for the taxpayers to fund. Additionally, the proposed development will extend a sidewalk along the sites SW Murdock Rd. frontage, underground overhead utility lines along SW Murdock Rd., and provide for future connectivity opportunities as shown in the SE Sherwood Master Plan and the Sherwood Transportation System Plan.

7. That the proposed development, or an independent phase of the development, can be substantially completed within one (1) year from date of approval.

Response: The proposed project will be completed in one phase. The developer intends to begin final engineering drawings upon receipt of preliminary approval so that site development will be substantially completed within one year from date of preliminary approval.

8. That adequate public facilities and services are available or are made available by the construction of the project.

Response: Water, sanitary sewer and storm sewer are available to serve the development and will be extended through the site with the development of the proposed north/south public street. The lots will access onto the proposed north/south public street, which will connect to SW Ironwood Ln., both of which will provide for public access.

9. That the general objectives of the PUD concept and the specific objectives of the various categories of the PUDs described in this Chapter have been met.

Response: This narrative describes how the objectives of this Chapter have been met in concert with the submitted plan set and attached exhibits.

10. The minimum area for a Residential PUD shall be five (5) acres, unless the Commission finds that a specific property of lesser area is suitable as a PUD because it is unusually constrained by topography, landscape features, location, or surrounding development, or qualifies as "infill" as defined in Section 16.40.050(C)(3).

Response: The subject site is approximately 5.27 gross acres which does not qualify it for a PUD outright. However, because the site is zoned VLDR zone, it is considered within "natural resource and environmentally sensitive areas warranting preservation, but otherwise deemed suitable for limited development," according to the purpose statement of the VLDR zone. The subject site has undulating topography, a large rock outcropping in the SW corner of the site and is limited in regard to gaining access to SW Murdock Rd., all of which make the property unusually constrained. Additional acreage is not able to be added to the proposal as the surrounding property is in private ownership and the owners were not willing to sell at this time. Also, as previously discussed, the site has contaminated soils which are highly expensive to remediate.

16.40.050 Residential PUD

A. Permitted Uses
The following uses are permitted outright in Residential PUD when approved as part of a Final Development Plan:

1. Varied housing types
2. Related NC uses which are designed and located so as to…
3. All other uses permitted within the underlying zoning district in which the PUD is located.

Response: The project proposes single-family detached dwellings which are a permitted use in the underlying zoning district VLDR. No other uses are proposed as part of this development.

B. Conditional Uses

Response: No conditional uses are proposed as part of this project.

C. Development Standards
1. Density
The number of dwelling units permitted in a Residential PUD is the same as that allowed in the underlying zoning district, except as provided in Sections 16.40.40.D and 16.40.050.C.2.

Response: Chapter 16.10 of the Code defines density as "the intensity of residential land uses per acre, stated as the number of dwelling units per net buildable acre. Net

buildable acre means an area measuring 43,560 square feet after excluding present and future rights-of-way and environmentally constrained areas." Net buildable acre is further defined separately as "an area measuring 43,560 square feet after excluding present and future rights-of-way, environmentally constrained areas, public parks and other public uses." The subject property has an underlying zoning district of VLDR which is unique in that there is a special density allowance permitting a greater density (two units) that what would be allowed in the underlying zoning designation (one unit) if the applicant requests development as a Planned Unit Development (PUD).

It is even further unique in that property in the VLDR zone that is developed through the Planned Unit Development process under Chapter 16.40 and is based on, and generally conforms to the concepts, goals and objectives of the SE Sherwood Master Plan may develop to a maximum density of four dwelling units per net buildable acre. The effect of the special density allowance, using the SE Sherwood Master Plan, grants four units per acre rather than the underlying zoning density of up to one unit per acre.

The gross and net square footages are shown below.

LOT 1	11,355 Sq. Ft.
LOT 2	10,572 Sq. Ft.
LOT 3	12,177 Sq. Ft.
LOT 4	10,117 Sq. Ft.
LOT 5	11,116 Sq. Ft.
LOT 6	10,032 Sq. Ft.
LOT 7	10,031 Sq. Ft.
LOT 8	10,725 Sq. Ft.
LOT 9	10,455 Sq. Ft.
LOT 10	11,233 Sq. Ft.
LOT 11	13,630 Sq. Ft.
LOT 12	12,777 Sq. Ft.
LOT 13	10,260 Sq. Ft.
SW Murdock Rd. right-of-way	8,236 Sq. Ft.
SW Ironwood Ln. right-of-way	656 Sq. Ft.
Public Street right-of-way	33,514 Sq. Ft.
Tract A usable open space	22,274 Sq. Ft.
Tract B private street	3,138 Sq. Ft.
Tract C usable open space	7,916 Sq. Ft.
Tract D water quality	2,828 Sq. Ft.
Tract E Usable Open Space	6,384 Sq. Ft.
Gross Square Footage =	229,432 Sq. Ft.

Deductions from Gross Square Footage:	
right-of-way (SW Murdock Rd., SW Ironwood Ln, and Public St.) =	42,406 Sq. Ft.
Private Street (Tract B) =	3,138 Sq. Ft.
Usable open space (Tracts A, C, and E) =	36,574 Sq. Ft.
Water quality tract (Tract D) =	2,828 Sq. Ft.
Total =	84,946 Sq. Ft in Deductions

Gross Square Footage	229,432 Sq. Ft.
-Deductions	84,946 Sq. Ft
Net Square Footage =	144,486 Sq. Ft. or 3.32 Net Acres

In this case, there are 3.32 net buildable acres because of right-of-way dedication, water quality tract, and the open space areas are all excluded in the overall calculation of net buildable acreage. Calculating net density under the special density allowance of four (4) units per acre provides for up to 13 units (3.32 net acres x 4 units = 13.28). Tracts A, B, C, D and E are not developable due to the irregular shape of the subject parcel, the requirement of open space and the requirement for a water quality treatment area.

2. Density Transfer

Response: No density transfers are proposed, nor are they allowed under Section 16.12.010.A.3.

3. Minimum Lot Size

Response: The minimum lot size of the underlying zoning district of VLDR is 10,000 square feet when in a PUD. All proposed lots are 10,000 square feet or greater in size.

Division III ADMINISTRATIVE PROCEDURES

Chapter 16.70 GENERAL PROVISIONS

16.70.010 – Pre-Application Conference

Response: A pre-application conference for this project was held on November 1, 2018. The planning staff contacts at the meeting were Erika Palmer and Joy Chang. A copy of the notes from the pre-application conference have been included in this submittal package.

16.70.020 – Neighborhood Meeting

Response: A Neighborhood Meeting for this project was held on November 29, 2018. The Neighborhood Meeting Sign-in Sheet, the Affidavits of Mailing and a summary of the meeting notes have been included with this application packet.

16.70.030 – Application Requirements

A. Form

Response: The required Application for Land Use Action has been obtained from the City and is herewith included in this submittal. The original signatures of the property owner/legal representative/applicant are contained on the submitted application.

B. Copies

Response: This application package includes one complete electronic copy of the full application packet via a CD, and three complete application packet sets. Additional required copies will be submitted when the application is deemed complete by City staff.

C. Content

Response: The appropriate fee check for the application has been submitted with this application package. The required Neighborhood Meeting materials are included as an attachment to this package. A Tax Map obtained from the Washington County Assessor's website is attached and also included with the submittal are the following items: three sets of mailing labels for property owners of record within 1,000 of the subject site; a Vicinity Map which is depicted on the Existing Conditions Map; the narrative; three copies of a current preliminary title report; the Existing Conditions Map identified as Sheet 2 of the plan drawing set; and the Preliminary Plat identified as Sheet 3, CWS Service Provider Letter, as well as a geotechnical report for the site. Lastly, the applicant has also included a copy of the Remedial Action Work Plan addressing the environmental clean-up of the site. Although this Work Plan has not yet been 100% signed off on by DEQ, the applicant is working very closely with DEQ and it is believed that DEQ sign off is eminent.

DIVISION IV PLANNING PROCEDURES

Chapter 16.80 PLAN AMENDMENTS
Chapter 16.82 CONDITIONAL USES
Chapter 16.84 VARIANCES
Chapter 16.86 TEMPORARY USES

Response: This application is not requesting any plan amendments, conditional uses, temporary uses or variances. A modification from the required 20-foot front and street setback to 15 feet and 10 feet, respectively, is being requested through the planned unit development process.

DIVISION V COMMUNITY DESIGN

Chapter 16.90 SITE PLANNING

16.90.020 – Site Plan Review

A. Site Plan Review Required

Site Plan review is required prior to any substantial change to a site or use that does not meet the criteria of a minor or major modification, issuance of buildings permits for a new building or structure…

Response: This application is for approval of a new Subdivision/Planned Unit Development which will divide the existing site into eleven lots, thus representing a substantial change to the subject property and therefore requiring Site Plan Review.

D. Required Findings

No site plan approval will be granted unless each of the following is found:

1. The proposed development meets applicable zoning district standards and design standards in Division II, and all provisions of Divisions V, VI, VIII and IX.

Response: Divisions I through IX of the Code, as applicable, have been addressed throughout this narrative under the appropriate division, chapter and section headings.

2. The proposed development can be adequately served by services conforming to the Community Development Plan, including but not limited to water, sanitary facilities, storm water, solid waste, parks and open space, public safety, electric power, and communications.

Response: Water, sewer and storm lines will be extended through the site via the proposed public street, and/or increased in size as necessary, to accommodate the thirteen (13) new residential building lots. Power and communications lines will also be extended from what is existing to the residential building lots. Sheet 7 identifies proposed utility lines for the project. The site is currently served by the City's public safety agencies, which will continue to serve the eleven new detached dwellings. The development is proposing landscaped open space for use by the future residents. The Preliminary Plat (Sheet 3) illustrates these areas and Sheets 9 and 10 provide the

landscaping plan and details for the open space areas. Solid waste and recyclable items will be disposed of in individual residential bins that will be rolled to the curbside of the proposed public street for weekly removal by the local waste and recycling service.

3. ***Covenants, agreements, and other specific documents are adequate, in the City's determination, to assure an acceptable method of ownership, management, and maintenance of structures, landscaping, and other on-site features.***

Response: The new residential building lots will be owned and maintained by individual homeowners. The extension of the new public street to and through the site will be dedicated as right-of-way to be maintained by the City. Tracts A, B and C within the development will be dedicated to the homeowners' association for maintenance, preservation and management. The water quality tract (i.e. Tract D) and will be dedicated to the City for ownership and maintenance. Detailed CC&R's will be provided with the Final Development Plan review.

4. ***The proposed development preserves significant natural features to the maximum extent feasible, including but not limited to natural drainage ways, wetlands, trees, vegetation (including but not limited to environmentally sensitive lands), scenic views, and topographical features, and conforms to the applicable provisions of Division VIII of this Code and Chapter 5 of the Community Development Code.***

Response: The subject property does not contain any significant natural features, such as natural drainage ways, wetland, or environmentally sensitive land, requiring preservation. With that being said, the applicating will be preserving a grove of existing pine trees within Tract A and vegetation within Tract C will remain undisturbed and preserved. Existing vegetation and trees elsewhere on the subject site, outside of Tract C, will be removed as necessary to accommodate infrastructure development and construction of the new houses and driveways.

5. ***For developments that are likely to generate more than 400 average daily trips (ADTs), or at the discretion of the City Engineer, the applicant must provide adequate information, such as a traffic impact analysis (TIA) or traffic counts, to demonstrate the level of impact to the surrounding transportation system. The developer is required to mitigate for impacts attributable to the project, pursuant to TIA requirements in Section 16.106.080 and rough proportionality requirements in Section 16.106.090. The determination of impact or effect and the scope of the impact study must be coordinated with the provider of the affected transportation facility.***

Response: The proposed development of thirteen (13) single-family residential building lots will not generate more than 400 average daily trips, thus a traffic impact analysis is not required and one has not been provided.

6. ***The proposed commercial, multi-family, institutional or mixed-use development is oriented to the pedestrian and bicycle, and to existing and planned transit facilities. Urban design standards include the following:***

Response: These standards are not applicable as the project is not commercial, multi-family, institutional or mixed used. Rather, the proposed project is for single-family residential detached dwellings.

Chapter 16.92 LANDSCAPING

16.92.010 – Landscaping Plan Required

Response: This development requires a site plan, and thus a landscaping plan is also required pursuant to Section 16.92.010. A preliminary landscaping plan has been included as Sheet 11 of the submitted plan set.

16.92.20 – Landscaping Materials

A. Type of Landscaping
Required landscaped areas shall include an appropriate combination of native evergreen or deciduous trees and shrubs, evergreen ground cover, and perennial plantings. Trees to be planted in or adjacent to public rights-of-way shall meet the requirements of this Chapter. Plants may be selected from the City's "Suggested Plant Lists for Required Landscaping Manual" or suitable for the Pacific Northwest climate and verified by a landscape architect or certified landscape professional.

1. ***Ground Cover Plants***
   a. ***All of the landscape that is not planted with trees and shrubs must be planted in ground cover plants, which may include grasses. Mulch is not a substitute for ground cover, but is allowed in addition to the ground cover plants.***
   b. ***Ground cover plants other than grasses must be at least four-inch pot size and spaced at distances appropriate for the plant species. Ground cover plants must be planted at a density that will cover the entire area within three (3) years from the time of planting.***

2. ***Shrubs***
   a. ***All shrubs must be of sufficient size and number to be at full growth within three (3) years of planting.***
   b. ***Shrubs must be at least the one-gallon container size at the time of planting.***

3. ***Trees***
   a. ***Trees at the time of planting must be fully branched and must be a minimum of two (2) caliper inches and at least six (6) feet in height.***

b. Existing trees may be used to meet the standards of this chapter, as described in Section 16.92.020.C.2.

B. Plant Material Selection and Preparation

1. Required landscaping materials shall be established and maintained in a healthy condition and of a size sufficient to meet the intent of the approved landscaping plan. Specifications shall be submitted showing that adequate preparation of the topsoil and subsoil will be undertaken.

2. Landscape materials should be selected and sited to produce a hardy and drought-resistant landscape area. Selection of the plants should include consideration of soil type, and depth, the amount of maintenance required, spacing, exposure to sun and wind, the slope and contours of the site, and compatibility with existing native vegetation preserved on the site.

Response: Sheet 11 of the submitted plan set shows the location for all proposed landscaped areas within the proposed PUD (i.e. Tracts A, C, and E). The proposed landscaped areas will be covered with a combination of trees, shrubs, grasses, groundcovers and lawn. Mulch is not being used as a substitute for ground cover.

Additionally, ground cover plants will be either 4" pots at 12" on center or one-gallon pots at two feet on center. The selected ground cover will be planted at a density to cover the entire intended area within three years of planting.

Plants will be selected appropriate to the site based upon hardiness, exposure to the elements and slope and contours of the site. All planting areas will have a minimum of 6" workable topsoil and to till as necessary; to amend all topsoil with 2" of compost; and to spread at a minimum two-inch depth aged compost mulch in all planted areas.

A variety of shrubs and trees will also be planted on the site in the proposed landscaped areas. Shrubs at time of planting will range in size from two-gallon to five-gallon pots, all of which exceed the minimum planting requirement stated in the Code.

The proposed trees will range in height at the time of planting from between six feet to 12 feet with calipers ranging between two inches to three inches. All trees will be fully branched at the time of planting.

Lastly, The applicant has worked closely with City Staff and has agreed to provide, as a condition of approval, a detailed landscape plan stamped by a professional landscape architect as part of the required Final Development Plan review.

C. Existing Vegetation

1. ***All developments subject to site plan review per Section 16.90.020 and required to submit landscaping plans per this section shall preserve existing trees, woodlands and vegetation on the site to the maximum extent possible, as determined by the Review Authority, in addition to complying with the provisions of Section 16.142 (Parks, Trees and Open Space) and Chapter 16.144 (Wetland, Habitat, and Natural Resources).***
2. ***Existing vegetation, except those plants on the Nuisance Plants list as identified in the "Suggested Plant Lists for Required Landscaping Manual" may be used to meet the landscape standards, if protected and maintained during the construction phase of the development.***
    a. ***If existing trees are used, each tree six (6) inches or less in diameter counts as one (1) medium tree.***
    b. ***Each tree that is more than six (6) inches and up to nine (9) inches in diameter counts as two (2) medium trees.***
    c. ***Each additional three (3) inch diameter increment above nine (9) inches counts as an additional medium tree.***

Response: Existing trees and vegetation are shown on Sheet 2 of the submitted plan set. None of the existing trees and vegetation are being used to meet the landscape standards. Nevertheless, Tract A will preserve a grove a mature pine trees and all existing trees and vegetation within Tract C will remain undisturbed and preserved.

D. Non-Vegetative Features

1. ***Landscaped areas as required by this Chapter may include architectural features interspersed with planted areas, such as sculptures, benches, masonry or stone walls, fences, rock groupings, bark dust, semi-pervious decorative paving, and graveled areas.***
2. ***Impervious paving shall not be counted toward the minimum landscaping requirements unless adjacent to at least one (1) landscape strip and serves as a pedestrian pathway.***
3. ***Artificial plants are prohibited in any required landscaped area.***

Response: Artificial plants are not proposed. The only impervious paving in the landscaping area will be the proposed pedestrian pathways which have been counted toward the minimum landscaping requirement since they are adjacent to landscaping strips and serve as pedestrian pathways within Tract A.

16.92.30 – Site Area Landscaping and Perimeter Screening Standards

Response: This project does not have any perimeter screening and buffering requirements as it is a residential zone surrounded by other residential zones. No parking lots are being provided as part of this single-family residential subdivision so parking area landscaping requirements are not applicable. There will be no centralized waste

and recycling bin storage areas so enclosures, screening or landscaping for such areas is not applicable.

16.92.040 – Installation and Maintenance Standards

A. Installation
All required landscaping must be in-ground, except when in raised planters that are used to meet minimum Clean Water Services storm water management requirements. Plant materials must be installed to current nursery industry standards. Plant materials must be property supported to ensure survival. Support devices such as guy wires or stakes must not interfere with vehicular or pedestrian movement.

B. Maintenance and Mitigation of Landscaped Areas
1. Maintenance of existing non-invasive native vegetation is encouraged within a development and required for portion of the property not being developed.
2. All landscaping shall be maintained in a manner consistent with the intent of the approved landscaping plan.
3. Any required landscaping trees removed must be replanted consistent with the approved landscaping plan and comply with…

Response: The homeowners' association will be responsible for maintenance and preservation of the landscaped areas contained within Tracts A and C. Landscaping on individual lots will be the responsibility of the individual lot owner.

C. Irrigation
The intent of this standard is to ensure that plants will survive the critical establishment period when they are most vulnerable due to lack of watering. All landscaped areas must provide an irrigation system, as stated in Option 1, 2, or 3.
1. Option 1: A permanent built-in irrigation system with an automatic controller installed.
2. Option 2: An irrigation system designed and certified by a licensed landscape architect or other qualified professional as part of the landscape plan, which provides sufficient water to ensure that the plants become established. The system does not have to be permanent if the plants chosen can survive independently once established.
3. Option 3: Irrigation by hand.

Response: Landscaped areas within the tracts shall be equipped with an irrigation system.

D. Deferral of Improvements
Landscaping shall be installed prior to issuance of occupancy permits, unless security equal to one hundred twenty-five (125) percent of the cost of the landscaping is filed with the City…

Response: The applicant intends to install all landscaping prior to issuance of occupancy permits. Should this become impossible due to plant availability and/or weather, the required security will be filed with the City in accordance with the Code.

Chapter 16.94 OFF-STREET PARKING AND LOADING

Response: The proposed development is for thirteen (13) single-family residential detached dwellings. No multifamily or attached housing is proposed. No commercial, institutional or industrial uses are proposed. No surface parking lots are proposed. All off-street parking requirements for individual dwellings will be met through the individual driveway on each lot. Each lot's driveway will provide the one required off-street parking space as noted in Table 1 of Chapter 16.94. Driveways will be completed as part of the building permit process for each house. Bicycle parking is not required for single-family detached dwellings.

Chapter 16.96 ON-SITE CIRCULATION

Response: The Cover Sheet, which is Sheet 1 of the submitted plan set, shows a complete on-site circulation system. Public sidewalks for pedestrian circulation are being installed on both sides of the proposed public street and along the east side of SW Murdock Road. As walkway within Tract A will provide connectivity with the surrounding pedestrian walkways.

The proposed public street will be extended through the subject property as part of this development and stubbed at the northern boundary of the site in order to provide for a future connection to the future right-of-way along the northern boundary when adjacent parcels redevelop. In this way, vehicular connectivity and circulation will be provided for the area and will meet the requirements of the SE Sherwood Master Plan.

Chapter 16.98 ON-SITE STORAGE

Response: There will be no material storage or hazardous materials stored as part of the proposed development. No outdoor storage areas for either equipment or recreational vehicles are proposed as part of the overall development either. Should individual property owners wish to store recreational vehicles on their individual lots, applicable and appropriate permits would be obtained by individual lot owners as necessary. Common trash enclosures are not proposed as each house will utilize residential trash and recycling bins and will roll them to the curb each week for weekly disposal. No outdoor sales, food vendors, etc. will be allowed to set up displays or merchandise in the development.

Chapter 16.100 PERMANENT SIGNS

Response: No permanent signage is proposed as part of this application.

DIVISION VI PUBLIC INFRASTRUCTURE

Chapter 16.106 TRANSPORTATION FACILITIES

Response: The site currently has frontage along SW Murdock Rd. and will be taking access from SW Ironwood Lane, which will connect with the proposed the internal public street. Required improvements will be made to SW Murdock Rd. along the site's frontage, which will improve pedestrian access and provide better visibility along the corridor. The proposed development will connect with SW Ironwood Ln. to the south, as well as a future public street to the north when parcels to the east redevelop. With the develop of the parcels east of the site, the full transportation system envisioned with the SE Sherwood Master Plan will be realized. Street lighting will be installed as necessary to meet current city standards. Sheets 5 – 7 of the submitted plan set show the proposed improvements to SW Murdock Rd., SW Ironwood Ln., and the design of the new north/south public street.

Chapter 16.110 SANITARY SEWERS

Response: Sheet 8 shows a proposed sanitary sewer main to be constructed within the extension of the proposed temporary drive. It will connect to an existing sewer manhole in SW Murdock Road. Each of the lots will have an individual sewer lateral connecting from the proposed sewer main in the new public street.

Chapter 16.112 WATER SUPPLY

Response: Currently an eight-inch diameter public water main exists within SW Murdock Road adjacent to the west edge of the subject property. Interconnection of the existing water main line and those extended into the development will take place as part of this development. The proposed interconnection is shown on Sheet 8 of the submitted plan set along with individual water meters to each of the new lots.

Chapter 16.114 STORM WATER

Response: Sheet 8 of the submitted plan set shows a proposed water quality facility along the northwestern edge of the development. The proposed water quality facility will be built to Clean Water Services standards. Two (2) water quality manholes, also to Clean Water Services standards, are proposed in Tract A, and a third stormwater manhole is proposed within SW Murdock Road. A new storm drain line will be installed in SW Murdock Road as part of its extension and will connect with the existing storm

manhole located at the intersection of SW Upper Roy Street. All storm laterals for the individual lots will connect to the new storm lines, which will in turn connect with the proposed water quality tract.

Chapter 16.116 FIRE PROTECTION

Response: Sheet 8 of the submitted plan set shows the installation of a new fire hydrant along the proposed public street where it intersects with the proposed temporary drive to provide a water supply for fire protection within 500 feet of all proposed residential structures within the development.

Chapter 16.118 PUBLIC AND PRIVATE UTILITIES

Response: All applicable utility lines will be extended from their existing locations on the subject property, adjacent to the subject property or in existing or proposed right-of-way to each of the new residential lots. An eight-foot wide public utilities easement is provided along the front line of each proposed lot and is depicted on Sheet 3. No private utilities easements are proposed.

Division VII LAND DIVISIONS, SUBDIVISION, PARTITIONS, LOT LINE…

Chapter 16.120 SUBDIVISIONS

16.120.020 – General Subdivision Provisions

- ***A. Approval of a subdivision occurs through a two-step process: the preliminary plat and the final plat.***
  - ***1. The preliminary plat shall be approved by the Approval Authority before the final plat can be submitted for approval consideration; and***
  - ***2. The final plat shall reflect all conditions of approval of the preliminary plat.***
- ***B. All subdivision proposals shall conform to all state regulations set forth in ORS Chapter 92, Subdivisions and Partitions.***
- ***C. Future re-division***
  When subdividing tracts into large lots, the Approval Authority shall require that the lots be of such size and shape as to facilitate future re-division in accordance with the requirements of the zoning district and this Division.
- ***D. Future Partitioning***
  When subdividing tracts into large lots which may be resubdivided, the City shall require that the lots be of a size and shape, and apply additional building site restrictions, to allow for the subsequent division of any parcel into lots of smaller size and the creation and extension of future streets.
- ***E. Lot averaging***

Lot size may be averaged to allow lots less than the minimum lot size allowed in the underlying zoning district subject to the following regulations:

1. ***The average lot area for all lots is not less than allowed by the underlying zoning district.***
2. ***No lot created under this provision shall be less than 90% of the minimum lot size allowed in the underlying zoning district.***
3. ***The maximum lot size cannot be greater than 10% of the minimum lot size.***

F. Required Setbacks

All required building setback lines as established by this Code, shall be shown in the preliminary subdivision plat.

G. Property Sales

No property shall be disposed of, transferred, or sold until required subdivision approvals are obtained, pursuant to this Code.

Response: This application represents the applicant's request for preliminary plat approval. The applicant acknowledges that the final plat will reflect all conditions of approval of this preliminary plat. The licensed land surveyor who will prepare the final plat will ensure that it conforms to all state regulations set forth in ORS Chapter 92, Subdivisions and Partitions. None of the lots are large enough to be re-divided or partitioned since the minimum lot size is 40,000 square feet without a planned unit development. Lot averaging is not applicable as all lots meet the minimum lot size of 10,000 square feet in a planned unit development. Yard setbacks are stated on Sheet 1 of the submitted plan set and are also illustrated on each of the lots on all applicable plan sheets. None of the proposed lots will be disposed of, transferred or sold until required subdivision approvals have been obtained.

16.120.030 – Approval Procedure-Preliminary Plat

A. Approval Authority

1. ***The approving authority for preliminary and final plats of subdivisions shall be in accordance with Section 16.72.010 of this Code.***
   a. ***A subdivision application for 4-10 lots will follow a Type II review process.***
   b. ***A subdivision application for 11-50 lots will follow a Type III review process.***
   c. ***A subdivision application for over 50 lots will follow a Type IV review process.***

Response: The proposal is for twelve lots; therefore, the subdivision application is being processed as a Type III review.

2. ***Approval of subdivisions is required in accordance with this Code before a plat for any such subdivision may be filed or recorded with County. Appeals to a decision may be filed pursuant to Chapter 16.76***

Response: Preliminary plat approval shall be received prior to proceeding to the filing or recording of the final plat.

B. Phased Development

1. The Approval Authority may approve a time schedule for developing a subdivision in phases, but in no case shall the actual construction time period for any phase be greater than two years without reapplying for a preliminary plat.

2. The criteria for approving a phased subdivision review proposal are

3. The application for phased development approval shall be reviewed concurrently with the preliminary plat application and the decision may be appealed in the same manner as the preliminary plat.

Response: No phasing is proposed for this thirteen-lot development. The subdivision is proposed to be developed in one phase.

16.120.40 – Approval Criteria: Preliminary Plat

A. Streets and roads conform to plats approved for adjoining properties as to widths, alignments, grades, and other standards, unless the City determines that the public interest is served by modifying streets or road patterns.

Response: Sheets 5 and 6 of the submitted plan set show the street plan, profile and section for SW Murdock Rd. and the proposed new public street, respectively. The plan, profile and section for each of these, as illustrated, conforms to the required City widths, alignments, grades and other standards.

B. Streets and roads held for private use are clearly indicated on the plat and all reservations or restrictions relating to such private roads and streets are set forth thereon.

Response: One private street is proposed as part of this application in Tract B. Additionally, Lots 2 and 3 will share a joint driveway access providing access to both lots. This has been noted on the submitted plan set.

C. The plat complies with applicable zoning district standards and design standards in Division II, and all provisions of Divisions IV, VI, VIII and IX. The subdivision complies with Chapter 16.128 (Land Division Design Standards).

Response: As previously stated in this narrative, the subject property is in the VLDR zoning district. The zoning district standards were addressed at the beginning of this narrative. The remainder of this narrative addresses the applicable provisions of Divisions IV, VI, VIII and IX as well as showing compliance with Chapter 16.128.

D. Adequate water, sanitary sewer, and other public facilities exist to support the use of land proposed in the plat.

Response: Water and sewer will be provided to each lot via water and sewer mains in the proposed private street. Sheet 7 of the submitted plan set shows sewer, water and storm for each lot as well as identifying proposed locations for water meters. Other public utility lines will be run through the identified public utility easements as necessary.

E. Development of additional, contiguous property under the same ownership can be accomplished in accordance with this Code.

Response: The property owner of the subject parcel does not own any additional, contiguous property.

F. Adjoining land can either be developed independently or is provided access that will allow development in accordance with this Code.

Response: The proposed north/south public street will provide for the future development of adjoining lands to the east consistent with the SE Sherwood Master Plan. Sheet 9 of the submitted plan set shows an aerial photo with a redevelopment plan for the parcel located immediately east of the subject site.

G. Tree and woodland inventories have been submitted and approved as per Section 16.142.060.

Response: Sheet 2 shows existing trees and vegetation. A mature grove of pine trees and vegetation located within Tract A will remain undisturbed and preserved as part of the PUD.

H. The plat clearly shows the proposed lot numbers, setbacks, dedications and easements.

Response: Sheet 3 of the submitted plan set is the Preliminary Plat. Each lot is clearly numbered, and the setbacks are shown on each lot. The proposed right-of-way dedication along SW Murdock Road is shown as well as the right-of-way dedication for the new public street. An eight-foot wide public utility easement is shown along the frontage of each lot.

I. A minimum of five percent (5%) open space has been provided per Section 16.44.010.B.8 (Townhome-Standards) or Section 16.142.030 (Parks, Open Spaces and Trees-Single-Family Residential Subdivisions), if applicable.

Response: This application is for a PUD which requires a minimum of 15% open space. For this project that equates to 20,176 square feet of open space which has been exceeded as has been previously discussed in this narrative.

Chapter 16.128 LAND DIVISION DESIGN STANDARDS

16.128.010 – Blocks

- ***A. Connectivity***
  - ***1. Block Size***
    The length, width, and shape of blocks shall be designed to provide adequate building sites for the uses proposed, and for convenient access, circulation, traffic control and safety.
  - ***2. Block Length***
    Block length standards shall be in accordance with Section 16.108.040. Generally, blocks shall not exceed five-hundred thirty (530) feet in length, except blocks adjacent to principal arterial, which shall not exceed…
  - ***3. Pedestrian and Bicycle Connectivity. Paved bike and pedestrian accessways shall be provided on public easements or right-of-way consistent with Figure 7.401.***

Response: The proposed development consists of a single block, that being the proposed north/south public street. The extension of the proposed public street from the north to the south will allow for it to connect with SW Ironwood Ln. to the south and a future public street to the north when properties to the east redevelop. Additionally, Tracts A and C will be able to connect with future open space when the parcel immediately east of the site redevelops and it will provide a mid-block pedestrian connection to SW Murdock Road. With a pedestrian connection in the open space and the future streets with the development of the surrounding parcels to the east of the site, the length of each block is approximately 345 feet long which is less than the maximum allowed by Code. Sidewalks are being provided on both sides of the proposed public street, as well as along the east side of SW Murdock Road.

- ***B. Utilities Easements for sewers, drainage, water mains, electric lines, or other utilities shall be dedicated or provided for by deed. Easements shall be a minimum of ten (10) feet in width and centered on rear or side lot lines; except for tie-back easements, which shall be six (6) feet wide by twenty (20) feet long on side lot lines at the change of direction.***

Response: An eight-foot wide public utility easement is being provided along the front of each of the lots.

- ***C. Drainages***

  Where a subdivision is traversed by a watercourse…

Response: The subject property does not contain any watercourses.

16.128.020 – Pedestrian and Bicycle Ways

Pedestrian or bicycle ways may be required to connect to cul-de-sacs, divide through an unusually long or oddly shaped block, or to otherwise provide adequate circulation.

Response: The proposed development does not contain any cul-de-sacs or any unusually long or oddly shaped blocks. Additionally, sidewalks and asphalt-paved pathways are being provided throughout the development as explained previously in this narrative to provide pedestrian and bicycle connectivity.

16.128.030 – Lots

- ***A. Size and Shape***
  Lot size, width, shape, and orientation shall be appropriate for the location and topography of the subdivision or partition, and shall comply with applicable zoning district requirements, with the following exception…
- ***B. Access***
  All lots in a subdivision shall abut a public street, except as allowed for infill development under Chapter 16.68.
- ***C. Double Frontage***
  Double frontage and reversed frontage lots are prohibited except where essential to provide separation of residential development from railroads…
- **D.** ***Side Lot Lines. Side lot lines shall, as far as practicable, run at right angles to the street upon which the lots face, except that on curved streets side lot lines shall be radial to the curve of the street.***
- **E.** ***Grading***
  Grading of building sites shall conform to the following standards, except when topography of physical conditions warrants special exceptions:
  1. ***Cut slopes shall not exceed one (1) and one-half (1 ½) feet horizontally to one (1) foot vertically.***
  2. ***Fill slopes shall not exceed two (2) feet horizontally to one (1) foot vertically.***

Response: The lots have been designed to comply with the lot size requirements of the underlying zoning district. Except for lots 10 and 11, which will have frontage on the private street located in Tract B, all lots front the proposed public street. The development does not contain any double frontage or reversed frontage lots. To the extent practicable, the side lots lines run at right angles to proposed public street in all instances. Cut and fill slopes do not exceed the Code standards for the building sites as shown on Sheet 4 and Sheet 11.

Division VIII ENVIRONMENTAL RESOURCES

Chapter 16.134 FLOODPLAIN (FP) OVERLAY

Response: The subject property is not in a floodplain overlay.

Chapter 16.138 MINERAL RESOURCES

Response: This application does not propose any mineral resource activities, just single-family residential dwellings.

Chapter 16.140 SOLID WASTE FACILITIES

This application is not for any type of solid waste facility.

Chapter 16.142 PARKS, TREES AND OPEN SPACES

16.142.30 – Single-Family or Duplex Residential Subdivisions

A. A minimum of five percent (5%) of the net buildable site (after exclusion of public right-of-way and environmentally constrained areas) shall be maintained as "open space". Open space must include usable areas such as public parks, swimming and wading pools, grass areas for picnics and recreational play, walking paths, and other like space. The following may not be used to calculate open space:

1. ***Required yards or setbacks.***
2. ***Required visual corridors.***
3. ***Required sensitive areas and buffers.***
4. ***Any area required to meet a standard found elsewhere in this code.***

Response: Tracts A and C provided the required usable open space, neither of which are required sensitive areas or buffers. The site does not contain any required visual corridors. Neither of the open space tracts include any required yards or setbacks. A meandering six-foot wide asphalt-paved pedestrian pathway will be provided the entire length of Tract A along SW Murdock Road to provide pedestrian connectivity between SW Murdock Road, SW Ironwood Lane and SW Upper Roy Street. Landscaping is shown on either side of the path to provide an attractive and comfortable walking experience for residents of the area. Tract C will provide a quiet and meditative resting area for residents of the area.

B. Enhanced streetscapes such as "boulevard treatments" in excess of the minimum public street requirements may count toward a maximum of 10,000 square feet of the open space requirement.

Response: The project is not proposing any enhanced streetscapes.

C. The open space shall be conveyed in accordance with one of the following methods:

1. By dedication to the City as public open space (if acceptable to the City). Open space proposed for dedication to the City must be acceptable to the City Manager or the Manager's designee with regard to…

2. By leasing or conveying title (including beneficial ownership) to a corporation, homeowners' association or other legal entity, with the City retaining the development rights to the open space. The terms of such lease or other instrument of conveyance must include provisions (e.g., maintenance, property tax payment, etc.) suitable to the City.

Response: The open space Tracts A and C will be conveyed by conveying title to a homeowners' association that will be established as part of this project, with the City retaining the development rights to the open space. The terms of the title conveyance will include provisions for maintenance and property tax payment suitable to the City. Tract D will be conveyed to the City.

D. The density of a single-family residential subdivision shall be calculated based on the net buildable site prior to exclusion of open space per this Section.

1. Example: a 40,000 square foot net buildable site would be required to maintain 2,000 square feet (5%) of open space but would calculate density based on 40,000 square feet.

Response: Chapter 16.10 of the Code defines density as "the intensity of residential land uses per acre, stated as the number of dwelling units per net buildable acre. Net buildable acre means an area measuring 43,560 square feet after excluding present and future rights-of-way and environmentally constrained areas." Net buildable acre is further defined separately as "an area measuring 43,560 square feet after excluding present and future rights-of-way, environmentally constrained areas, public parks and other public uses." The subject property has an underlying zoning district of VLDR which is unique in that there is a special density allowance permitting a greater density (two units) that what would be allowed in the underlying zoning designation (one unit) if the applicant requests development as a planned unit development.

It is even further unique in that property in the VLDR zone that is developed through the Planned Unit Development process under Chapter 16.40 and is based on, and generally conforms to the concepts, goals and objectives of the SE Sherwood Master Plan may develop to a maximum density of four dwelling units per net buildable acre. The effect of the special density allowance, using the SE Sherwood Master Plan, grants four units per acre rather than the underlying zoning density of up to one unit per acre.

The gross and net square footages are shown below.

LOT 1	11,355 Sq. Ft.
LOT 2	10,572 Sq. Ft.
LOT 3	12,177 Sq. Ft.
LOT 4	10,117 Sq. Ft.
LOT 5	11,116 Sq. Ft.
LOT 6	10,032 Sq. Ft.
LOT 7	10,031 Sq. Ft.
LOT 8	10,725 Sq. Ft.
LOT 9	10,455 Sq. Ft.
LOT 10	11,233 Sq. Ft.
LOT 11	13,630 Sq. Ft.
LOT 12	12,777 Sq. Ft.
LOT 13	10,260 Sq. Ft.
SW Murdock Rd. right-of-way	8,222 Sq. Ft.
SW Ironwood Ln. right-of-way	656 Sq. Ft.
Public Street right-of-way	33,514 Sq. Ft.
Tract A usable open space	22,274 Sq. Ft.
Tract B private street	3,138 Sq. Ft.
Tract C usable open space	7,916 Sq. Ft.
Tract D water quality	2,828 Sq. Ft.
Tract E Usable Open Space	6,384 Sq. Ft.
Gross Square Footage =	229,432 Sq. Ft.

Deductions from Gross Square Footage:	
right-of-way (SW Murdock Rd., SW Ironwood Ln, and Public St.) =	42,406 Sq. Ft.
Private Street (Tract B) =	3,138 Sq. Ft.
Usable open space (Tracts A, C, and E) =	36,574 Sq. Ft.
Water quality tract (Tract D) =	2,828 Sq. Ft.
Total =	84,946 Sq. Ft in Deductions

Gross Square Footage	229,432 Sq. Ft.
-Deductions	84,946 Sq. Ft
Net Square Footage =	144,486 Sq. Ft. or 3.32 Net Acres

In this case, there are approximately 3.32 net buildable acres because of right-of-way dedications, water quality tract and open space areas are all excluded in the overall calculation of net buildable acreage.

E. If a proposed residential subdivision contains or is adjacent to a site identified as "parks" on the Acquisition Map of the Parks Master Plan (2006) or has been identified for

acquisition by the Sherwood Parks and Recreation Board, establishment of open space *shall occur in the designated areas if the subdivision contains the park site, or immediately adjacent to the parks site if the subdivision is adjacent to it.*

Response: The subject site does not contain, nor is it adjacent to, any areas identified as "parks" on the Acquisition Map or the Sherwood Parks and Recreation Board. This standard, therefore, does not apply to this development.

F. If the proposed residential subdivision does not contain or is not adjacent to a site identified on the Parks Master Plan map or otherwise identified for acquisition by the Parks and Recreation Board, the applicant may elect to convey off-site park/open space.

Response: The applicant does not elect to convey off-site park/open space as part of this project.

G. This standard does not apply to a residential partition provided that a development may not use phasing or series partitions to avoid the minimum open space requirement. A partition of land that was part of an approved partition within the previous five (5) years shall be required to provide the minimum five percent (5%) open space in accordance with subsection (A) above.

Response: The proposed project is for a one-phase subdivision consisting of eleven lots.

H. The value of the open space conveyed under Subsection (A) above may be eligible for Parks System Development Charges (SDCs) credits based on the methodology identified in the most current Parks and Recreations System Development Methodology Report.

Response: The applicant will apply any eligible or available SDCs credits resulting from this development at the time of building permit applications.

16.142.040 – Visual Corridors

Response: The subject site, while located outside of the Old Town Overlay, does have frontage on an arterial street designated on Figure 8-1 of the Transportation System Plan (i.e. SW Murdock Road). All requirements for an arterial street will be observed as part of the development of the PUD, and a 15-foot landscaped visual corridor will be provided as required by the City's development code.

16.142.050 – Park Reservation

Response: The subject property is not part of any area designated on the Natural Resources and Recreation Plan Map; therefore, this subsection is not applicable to this application.

16.142.060 – Street Trees

A. Installation of Street Trees on New or Redeveloped Property
Trees are required to be planted to the following specifications along public streets abutting or within any new development or re-development. Planting of such trees shall be a condition of approval. The City shall be subject to the same…

1. Location: Trees shall be planted within the planter strip along a newly created or improved streets. In the event that a planter strip is not required or available, the trees shall be planted on private property within the front yard setback area or within public street right-of-way between front property lines and street curb lines or as required by the City.

Response: Required street trees will be planted within the newly-installed planter strips for both SW Murdock Road and the proposed new public street within the development. Sheet 1 also shows the required street trees.

2. Size: Trees shall have a minimum trunk diameter of two (2) caliper inches, which is measured six inches above the soil line, and a minimum height of six (6) feet when planted.

Response: As noted on Sheet 11, the street trees will have a minimum trunk diameter of two caliper inches, measured six inches above the soil line, and a minimum height of six feet when planted.

3. Types: Developments shall include a variety of street trees. The trees planted shall be chosen from those listed in 16.142.080 of this Code.

Response: Two different street trees from those listed in 16.142.080 of the Code will be planted alternately in the planter strips along both the east side of SW Murdock Rd. and along both sides of the proposed north/south public street.

4. Required Street Trees and Spacing:

a. The minimum spacing is based on the maximum canopy spread identified in the recommended street tree list in section 16.142.080 with the intent of providing a continuous canopy without openings between the trees. For example, if a tree has a canopy of forty (40) feet, the spacing between trees is forty (40) feet. If the tree is not on the list, the mature canopy width must be provided to the planning department by a certified arborist.

b. All new developments shall provide adequate tree planting along all public streets. The number and spacing of trees shall be determined based on the type of tree and the spacing standards described in a. above and considering driveways, street light locations and utility connections. Unless exempt per c. below, trees shall not be spaced more than forty (40) feet apart in any development.

c. A new development may exceed the forty-foot spacing requirement under section b. above, under the following circumstances:

(1) Installing the tree would interfere with existing utility lines and no substitute tree is appropriate for the site; or

(2) There is not adequate space in which to plant a street tree due to driveway or street light locations, vision clearance or utility connections, provided the driveways, street light or utilities could not be reasonably located elsewhere so as to accommodate adequate room for street trees; and

(3) The street trees are spaced as close as possible given the site limitations in (1) and (2) above.

(4) The location of street trees in an ODOT or Washington County right-of-way may require approval, respectively, by ODOT or Washington County and are subject to the relevant state or county standards.

(5) For arterial and collector streets, the City may require planted medians in lieu of paved twelve-foot wide center turning lanes, planted with trees to the specifications of this subsection.

Response: Sheet 12 of the submitted plan set shows the proposed planting of one street tree, spaced every 40 feet, in the planter strips along the east side of SW Murdock Road, the north side of SW Ironwood Ln., and along both sides of the proposed north/south public street.

B. Removal and Replacement of Street Trees

Response: There will be no removal of any existing Street Trees as part of this project.

16.142.070 – Trees on Property Subject to Certain Land Use Applications

A. Generally

The purpose of this Section is to establish…

B. Applicability

All applications including a Type II – IV land use review, shall be required to preserve trees or woodlands, as defined by this Section to the maximum extent feasible within the context of the proposed land use plan and relative to other codes, policies, and standards of the City Comprehensive Plan.

Response: This application includes a Type II subdivision land use review. All existing trees and vegetation will remain to the extent possible, noting that areas disturbed for infrastructure development and construction of houses and driveways will need to be cleared of existing vegetation and trees.

Section 16.142.070.D.2 requires that 40% of the property be covered in tree canopy. The gross acreage is 5.27 acres which yields 2.1 acres (91,824 sq. ft.) of tree canopy. The project is planting 38 street trees, preserving a large grove of mature pine trees, and providing landscaping along SW Murdock Road consistent with the requirements for an arterial street. As a condition of approval, the applicant will be submitting a detailed landscape plan as part of the required Final Development Plan demonstrating compliance with this criterion.

Total Mature Canopy: 103,699 square feet

Chapter 16.144 WETLAND, HABITAT AND NATURAL AREAS

Response: The subject property does not contain any wetlands, habitat and/or natural areas required for preservation as part of this development request; therefore, this section of the code does not apply to the applicant's proposal.

Chapter 16.148 VIBRATIONS

Chapter 16.150 AIR QUALITY

Chapter 16.152 ODORS

Response: The proposal is for eleven single-family residential building lots for future detached dwellings. No commercial, industrial or manufacturing uses are being proposed that would generate any vibrations, issues with air quality or odors. These portion of the Code, therefore, are not applicable to this application.

Chapter 16.154 HEAT AND GLARE

16.154.010 – Generally

Except for exterior lighting, all otherwise permitted commercial, industrial, and institutional uses shall conduct any operations producing excessive heat or glare entirely within enclosed buildings. Exterior lighting shall be directed away from adjoining properties, and the use shall not cause glare or lights to shine off site in excess of one-half (0.5) foot candle when adjoining properties are zoned for residential uses.

Response: This proposal is not for any commercial, industrial or institutional use. Rather, it's a residential development, and as such, all new lighting will be conducive to residential living, therefore not causing any glare or excessive shining to either the site itself or adjoining properties. No exterior lighting is proposed except street lights along the proposed public street and SW Murdock Rd., as required by City and which will meet City standards for lighting. Any other exterior lighting will be standard residential exterior light fixtures that will be placed on the exterior of the houses during the construction process and will be reviewed for compliance during the building permit process.

DIVISION IX HISTORIC RESOURCES

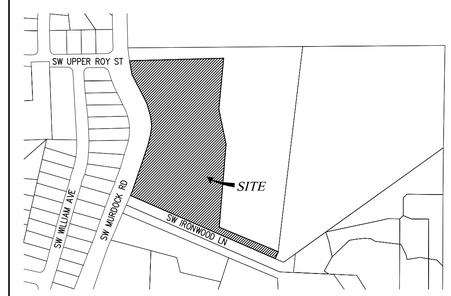
Response: The subject property is not within a special resource zone. The subject property is not within the Old Town Overlay District. The subject property does not contain any historic or cultural landmarks or landmark designations. Therefore, the provisions of Division IX are not applicable to this application.

MURDOCK ROAD

SUBDIVISION / PLANNED UNIT DEVELOPMENT
TAX LOT 300
TAX MAP 2S133CB
SHERWOOD, OREGON

LEGEND

	BOUNDARY LINE	SD	EXISTING STORM DRAIN LINE
	EASEMENT	SS	EXISTING SANITARY SEWER LINE
104	EXISTING 1' CONTOUR LINE	COM	EXISTING COMMUNICATION LINE
105	EXISTING 5' CONTOUR LINE	W	EXISTING WATER LINE
	EXISTING CROWN (CENTER LINE OF ROAD)	OH	EXISTING OVERHEAD POWER LINE
	EXISTING TREE	E	EXISTING UNDERGROUND POWER LINE
D	EXISTING STORM DRAIN MANHOLE	G	EXISTING GAS LINE
S	EXISTING SANITARY SEWER MANHOLE		EXISTING FENCE LINE
	EXISTING CATCH BASIN		PROPOSED STORM LINE
W	EXISTING WATER METER		PROPOSED SANITARY LINE
CV	EXISTING CONTROL VALVE		PROPOSED WATERLINE
W	EXISTING WATER VALVE		PROPOSED STORM LATERAL
	EXISTING FIRE HYDRANT		PROPOSED SANITARY LATERAL
T	EXISTING TRANSFORMER		PROPOSED SINGLE WATER METER
C	EXISTING COMMUNICATION PEDESTAL		PROPOSED DOUBLE WATER METER
E	EXISTING ELECTRICAL PEDESTAL		PROPOSED STORM MANHOLE
E	EXISTING ELECTRICAL VAULT		PROPOSED CATCH BASIN
	EXISTING LIGHT		PROPOSED SANITARY MANHOLE
	EXISTING UTILITY POLE		PROPOSED BLOWOFF
	EXISTING GUY WIRE		PROPOSED WATER VALVE
	EXISTING MAIL BOX	104	PROPOSED 1' CONTOUR LINE
	EXISTING SIGN	105	PROPOSED 5' CONTOUR LINE
	EXISTING HEDGE LINE	X X	PROPOSED SEDIMENT FENCE



VICINITY MAP
NTS

N

OWNER:

JT ROTH CONSTRUCTION INC
12600 SW 72ND #200
PORTLAND, OR 97223
CONTACT: TIM ROTH
503-639-2639 | TEL

APPLICANT:

EMERIO DESIGN, LLC
6445 SW FALLBROOK PL, SUITE 100
BEAVERTON, OR 97008
CONTACT: STEVE MILLER
541-318-7487 | CELL

LAND USE AND CIVIL ENGINEER:

EMERIO DESIGN, LLC
6445 SW FALLBROOK PL, SUITE 100
BEAVERTON, OR 97008
LAND USE CONTACT: STEVE MILLER
ENGINEER CONTACT: ERIC EVANS
503-746-8812 | TEL

SURVEYOR:

EMERIO DESIGN, LLC
6445 SW FALLBROOK PL, SUITE 100
BEAVERTON, OR 97008
CONTACT: KING PHELPS
503-746-8812 | TEL

BENCH MARK INFORMATION

THE DATUM FOR THIS SURVEY IS BASED UPON WASHINGTON COUNTY BENCHMARK NO 111. ELEVATION=213.55 NGVD29 DATUM.

SITE INFORMATION:

SITE ADDRESS:	23000 SW MURDOCK ROAD
TAX MAPS:	2S 1W 33CB
TAX LOTS:	300
GROSS AREA:	5.27 AC (BEFORE DEDICATION)
ZONING:	VERY LOW DENSITY RESIDENTIAL

DRAWING INDEX:

SETBACKS

FRONT:	15' (REQUESTED ADJUSTMENT FROM 20')
GARAGE:	20'
SIDE:	5'
STREET SIDE:	15' (REQUESTED ADJUSTMENT FROM 20')
REAR:	20'

LOTS

MINIMUM LOT AREA:	10,000 SF
MINIMUM LOT WIDTH:	25'
MINIMUM LOT DEPTH:	NONE
MINIMUM LOT WITH AT BUILDING LINE:	NONE
MAXIMUM BUILDING HEIGHT:	30' (OR TWO STORIES)

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

COVER SHEET

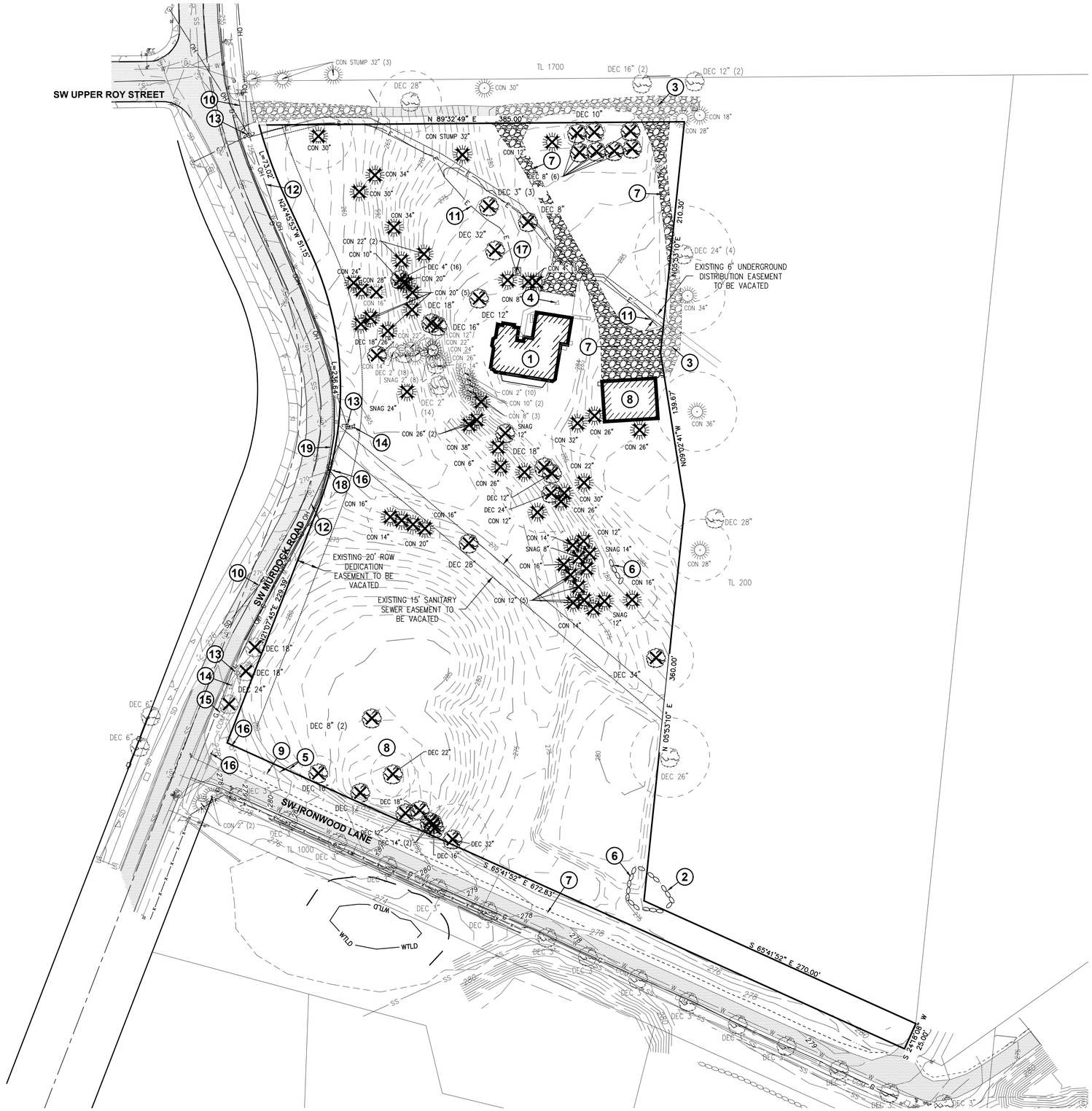
REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 01 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_01pcov, Layout: 01 COVER SHEET, Plot Date: 8/6/2019 11:56 AM, by: Kyung Han



LEGEND

- BOUNDARY LINE
- EASEMENT
- EXISTING 1' CONTOUR LINE
- EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE TO REMAIN
- EXISTING TREE TO BE REMOVED
- EXISTING STORM DRAIN MANHOLE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATER METER
- EXISTING CONTROL VALVE
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING TRANSFORMER
- EXISTING COMMUNICATION PEDESTAL
- EXISTING ELECTRICAL PEDESTAL
- EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- EXISTING STORM DRAIN LINE
- EXISTING SANITARY SEWER LINE
- EXISTING COMMUNICATION LINE
- EXISTING WATER LINE
- EXISTING OVERHEAD POWER LINE
- EXISTING UNDERGROUND POWER LINE
- EXISTING GAS LINE
- EXISTING FENCE LINE

DEMOLITION NOTES:

1. EXISTING BUILDING TO REMAIN
2. EXISTING HEDGE TO REMAIN
3. EXISTING GRAVEL TO REMAIN
4. EXISTING CONCRETE DRIVEWAY TO REMAIN
5. EXISTING COMMUNICATION LINE TO REMAIN
6. EXISTING HEDGE TO BE REMOVED
7. EXISTING GRAVEL TO BE REMOVED
8. EXISTING BUILDING TO BE REMOVED
9. EXISTING FENCE TO BE REMOVED
10. EXISTING CULVERT TO BE ABANDONED/REMOVED
11. EXISTING UNDERGROUND POWER LINE TO BE REMOVED AND REROUTED TO EXISTING DWELLINGS
12. EXISTING OVERHEAD UTILITY LINE TO BE REMOVED AND REROUTED
13. EXISTING UTILITY POLE TO BE RELOCATED (NEW LOCATION TO BE DETERMINED BY OTHERS)
14. EXISTING GUY ANCHOR TO BE RELOCATED (NEW LOCATION TO BE DETERMINED BY OTHERS)
15. EXISTING MAIN BOXES TO BE RELOCATED
16. EXISTING SIGN TO BE RELOCATED
17. EXISTING TRANSFORMER TO BE RELOCATED (NEW LOCATION TO BE DETERMINED BY OTHERS)
18. EXISTING AC PAVEMENT TO BE REMOVED
19. SAWCUT LINE

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

EXISTING CONDITIONS AND DEMOLITION PLAN

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 02 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_02pcm, Layout: 02 EXISTING CONDITIONS AND DEMOLITION PLAN, Plot Date: 8/6/2019 11:56 AM, by: Kyung Ham

LEGEND

BOUNDARY LINE

EASEMENT

PROPOSED MURDOCK PUD SETBACKS

FRONT: 15 FT.
GARAGE: 20 FT.
REAR: 20 FT. (EXCEPT LOTS 1 & 4 15 FT.)
SIDE: 5 FT.
STREET SIDE: 15 FT. (LOTS 4, 5 & 9)

GROSS AND NET SQUARE FOOTAGES

LOT 1	11,355 SQUARE FEET	
LOT 2	10,572 SQUARE FEET	
LOT 3	12,177 SQUARE FEET	
LOT 4	10,117 SQUARE FEET	
LOT 5	11,116 SQUARE FEET	
LOT 6	10,032 SQUARE FEET	
LOT 7	10,031 SQUARE FEET	
LOT 8	10,725 SQUARE FEET	
LOT 9	10,455 SQUARE FEET	
LOT 10	11,233 SQUARE FEET	
LOT 11	13,630 SQUARE FEET	
LOT 12	12,777 SQUARE FEET	
LOT 13	10,260 SQUARE FEET	
SW MURDOCK ROAD RIGHT-OF-WAY	8,236 SQUARE FEET	
SW IRONWOOD LANE RIGHT-OF-WAY	656 SQUARE FEET	
PUBLIC STREET RIGHT-OF-WAY	33,514 SQUARE FEET	
TRACT A USABLE OPEN SPACE	22,274 SQUARE FEET	
TRACT B PRIVATE STREET	3,138 SQUARE FEET	
TRACT C USABLE OPEN SPACE	7,916 SQUARE FEET	
TRACT D WATER QUALITY	2,828 SQUARE FEET	
TRACT E USABLE OPEN SPACE	6,384 SQUARE FEET	
GROSS SQUARE FOOTAGE =	229,432 SQUARE FEET	
DEDUCTIONS FROM GROSS SQUARE FOOTAGE:		
RIGHT-OF-WAY (SW MURDOCK RD, SW IRONWOOD LN & PUBLIC ST) =	42,406 SQUARE FEET	
PRIVATE STREET (TRACT B) =	3,138 SQUARE FEET	
USABLE OPEN SPACE (TRACT A, C, AND E)	36,574 SQUARE FEET	
WATER QUALITY TRACT (TRACT D) =	2,828 SQUARE FEET	
TOTAL =	84,946 SQUARE FEET IN DEDUCTIONS	
GROSS SQUARE FOOTAGE	229,432 SQUARE FEET	
-DEDUCTIONS	84,946 SQUARE FEET	
NET SQUARE FOOTAGE =	144,486 SQUARE FEET	OR 3.32 NET ACRES

N

50' 0 25' 50' 100'

SCALE: 1" = 50'

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

PRELIMINARY PLAT

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 03 OF 12

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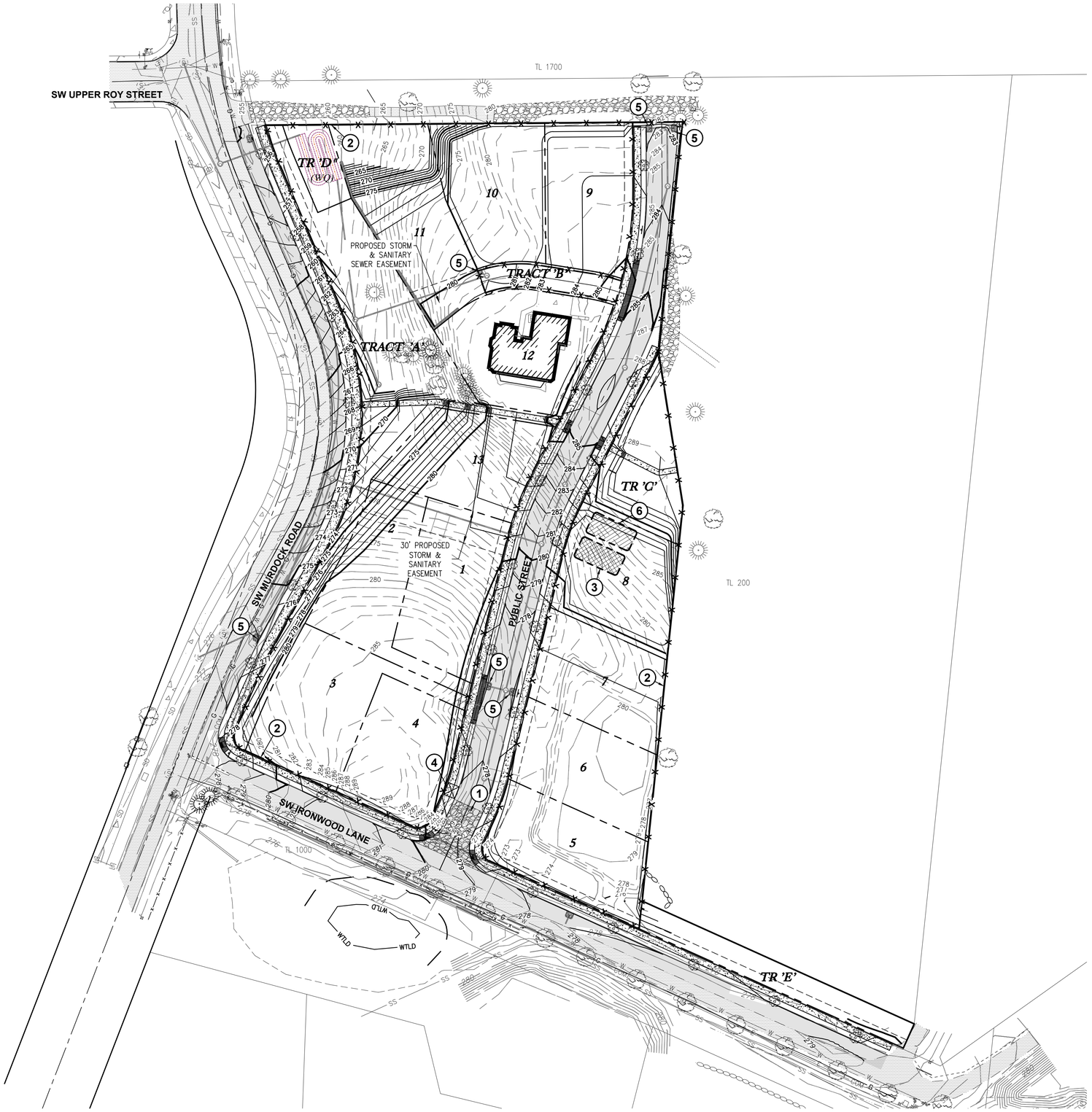


LEGEND

- BOUNDARY LINE
- EASEMENT
- 104 EXISTING 1' CONTOUR LINE
- 105 EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE
- D EXISTING STORM DRAIN MANHOLE
- S EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- W EXISTING WATER METER
- CV EXISTING CONTROL VALVE
- W EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- T EXISTING TRANSFORMER
- C EXISTING COMMUNICATION PEDESTAL
- EXISTING ELECTRICAL PEDESTAL
- EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- SD EXISTING STORM DRAIN LINE
- SS EXISTING SANITARY SEWER LINE
- COM EXISTING COMMUNICATION LINE
- W EXISTING WATER LINE
- OH EXISTING OVERHEAD POWER LINE
- E EXISTING UNDERGROUND POWER LINE
- G EXISTING GAS LINE
- EXISTING FENCE LINE

EROSION CONTROL NOTES:

1. CONSTRUCTION ENTRANCE
2. SEDIMENT FENCE
3. STOCK PILE AREA
4. CONCRETE WHEEL WASH
5. BIO-BAG AT CATCH BASIN/AREA DRAIN
6. CONSTRUCTION STAGING AREA

N

50' 0 25' 50' 100'

SCALE: 1" = 50'

SW MURDOCK ROAD SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

PRELIMINARY GRADING AND EROSION CONTROL PLAN

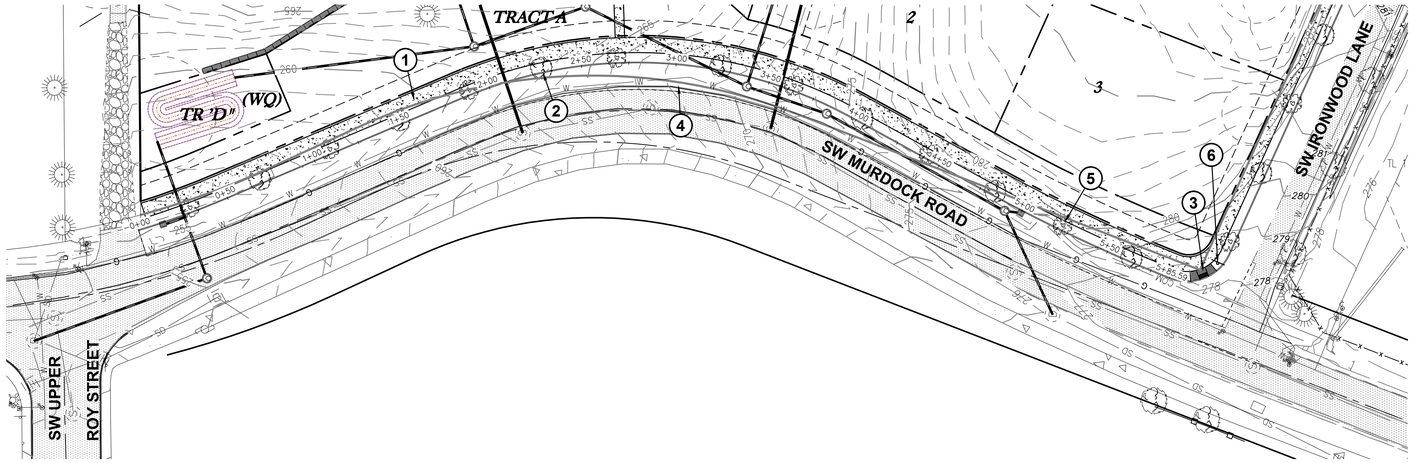
REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 04 OF 12

FILE P: \2200-008 Murdock Subdivision \dwg \plan \2200-008_04pgrd, Layout: 04 PRELIMINARY GRADING AND EROSION CONTROL PLAN, Plot Date: 8/6/2019 11:57 AM, by: Kyung Han



SW MURDOCK ROAD - PLAN

SCALE: 1" = 40'

40' 0 20' 40' 80'

SCALE: 1" = 40'

SW MURDOCK ROAD CURB - PROFILE

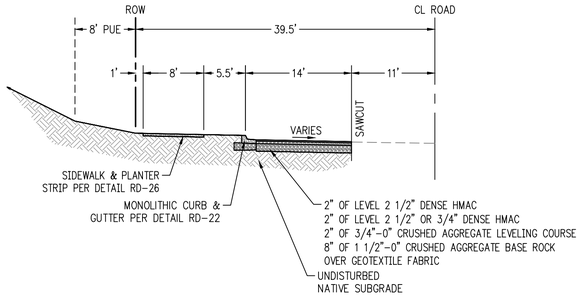
SCALE: 1" = 40' H, 1" = 5' V

LEGEND

- BOUNDARY LINE
- EASEMENT
- 104 EXISTING 1' CONTOUR LINE
- 105 EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE
- D EXISTING STORM DRAIN MANHOLE
- S EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- W EXISTING WATER METER
- CV EXISTING CONTROL VALVE
- W EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- T EXISTING TRANSFORMER
- C EXISTING COMMUNICATION PEDESTAL
- EP EXISTING ELECTRICAL PEDESTAL
- EV EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- SD EXISTING STORM DRAIN LINE
- SS EXISTING SANITARY SEWER LINE
- COM EXISTING COMMUNICATION LINE
- W EXISTING WATER LINE
- OH EXISTING OVERHEAD POWER LINE
- E EXISTING UNDERGROUND POWER LINE
- G EXISTING GAS LINE
- EXISTING FENCE LINE

NOTES:

1. PROPOSED SIDEWALK
2. PROPOSED MONOLITHIC CURB & GUTTER
3. PROPOSED CURB RETURN
4. PROPOSED AC PAVEMENT
5. PROPOSED STREET TREE (TYP)
6. NEW STREET & STOP SIGN LOCATION



SW MURDOCK ROAD - SECTION

NTS

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

SW MURDOCK ROAD
IMPROVMENT PLAN &
PROFILE

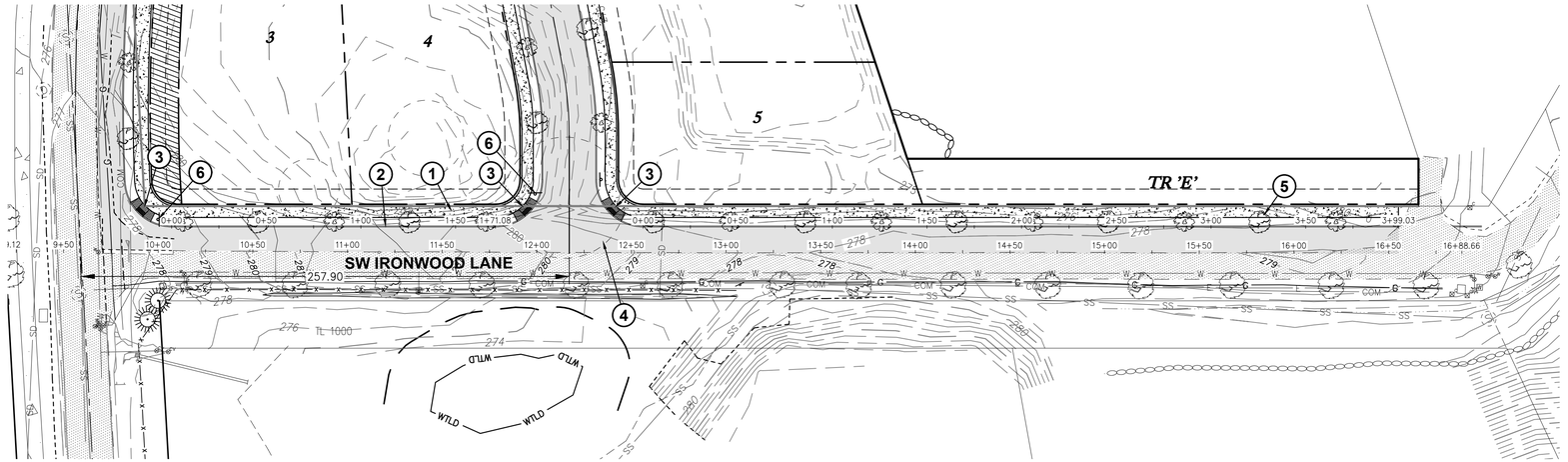
REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 05 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_05pst1, Layout: 05 SW MURDOCK ROAD IMPROVMENT PLAN & PROFILE, Plot Date: 8/6/2019 11:59 AM, by: Kyung Han



SW IRONWOOD LANE - PLAN

SCALE: 1" = 40'

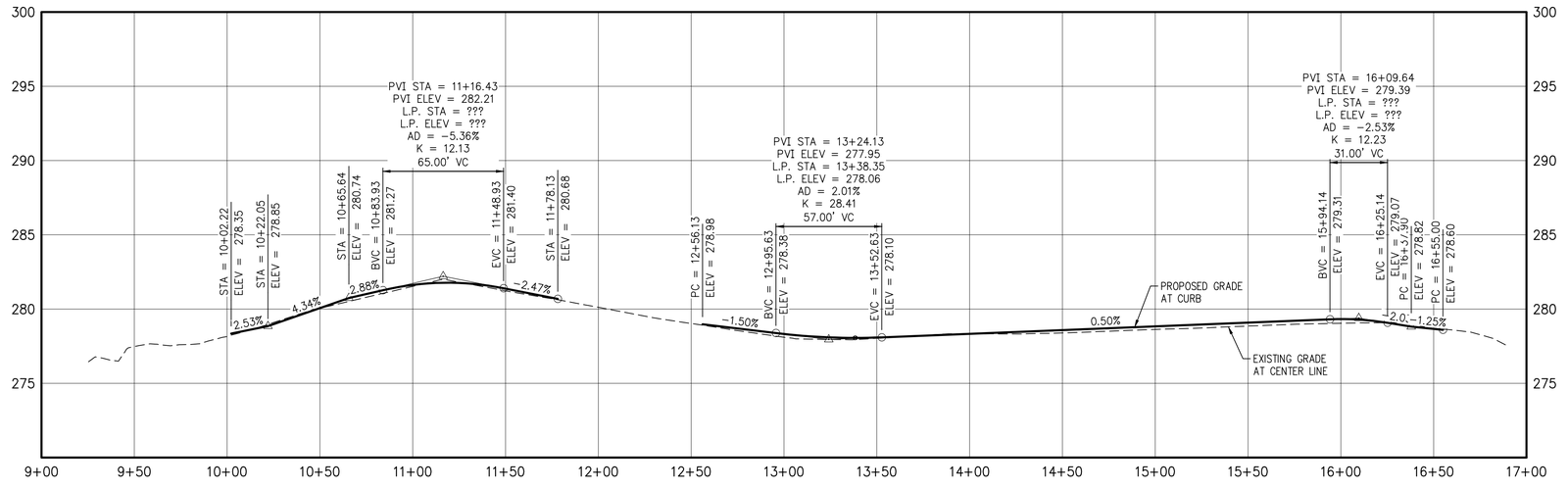
SCALE: 1" = 40'

LEGEND

- BOUNDARY LINE
- EASEMENT
- EXISTING 1' CONTOUR LINE
- EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE
- EXISTING STORM DRAIN MANHOLE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATER METER
- EXISTING CONTROL VALVE
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING TRANSFORMER
- EXISTING COMMUNICATION PEDESTAL
- EXISTING ELECTRICAL PEDESTAL
- EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- SD — EXISTING STORM DRAIN LINE
- SS — EXISTING SANITARY SEWER LINE
- COM — EXISTING COMMUNICATION LINE
- W — EXISTING WATER LINE
- OH — EXISTING OVERHEAD POWER LINE
- E — EXISTING UNDERGROUND POWER LINE
- G — EXISTING GAS LINE
- EXISTING FENCE LINE

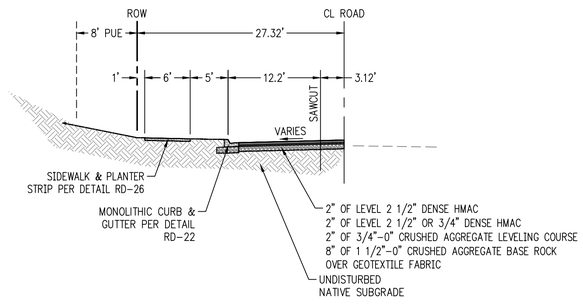
NOTES:

1. PROPOSED SIDEWALK
2. PROPOSED MONOLITHIC CURB & GUTTER
3. PROPOSED ADA RAMP
4. PROPOSED AC PAVEMENT
5. PROPOSED STREET TREE (TYP)
6. STREET & STOP SIGN



SW IRONWOOD LANE CURB - PROFILE

SCALE: 1" = 40' H, 1" = 5' V



SW IRONWOOD LANE - SECTION

NTS

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

SW IRONWOOD LANE IMPROVMENT PLAN & PROFILE

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
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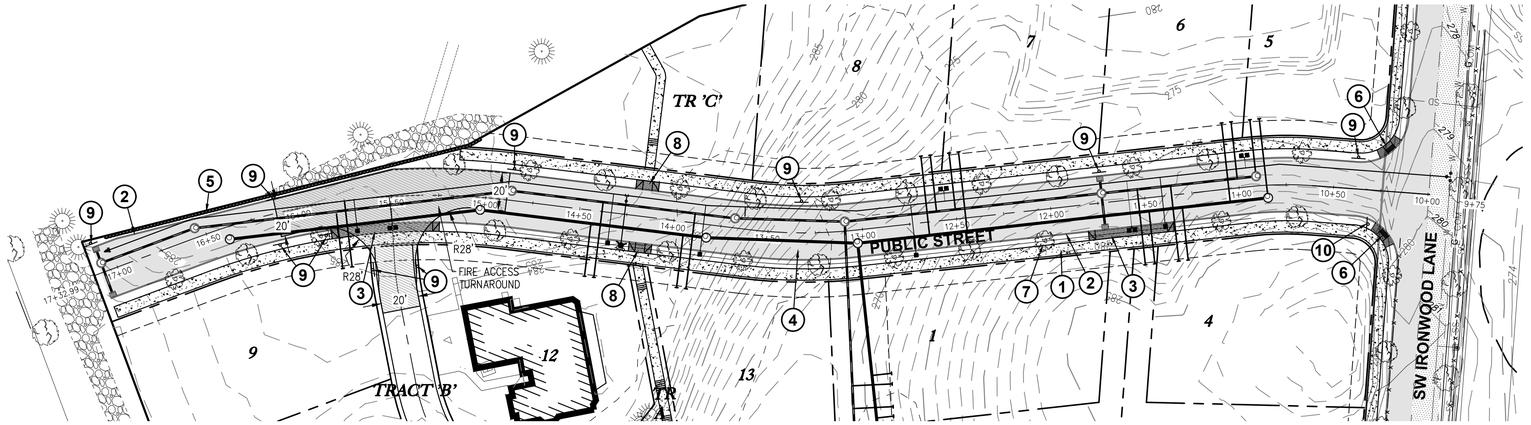
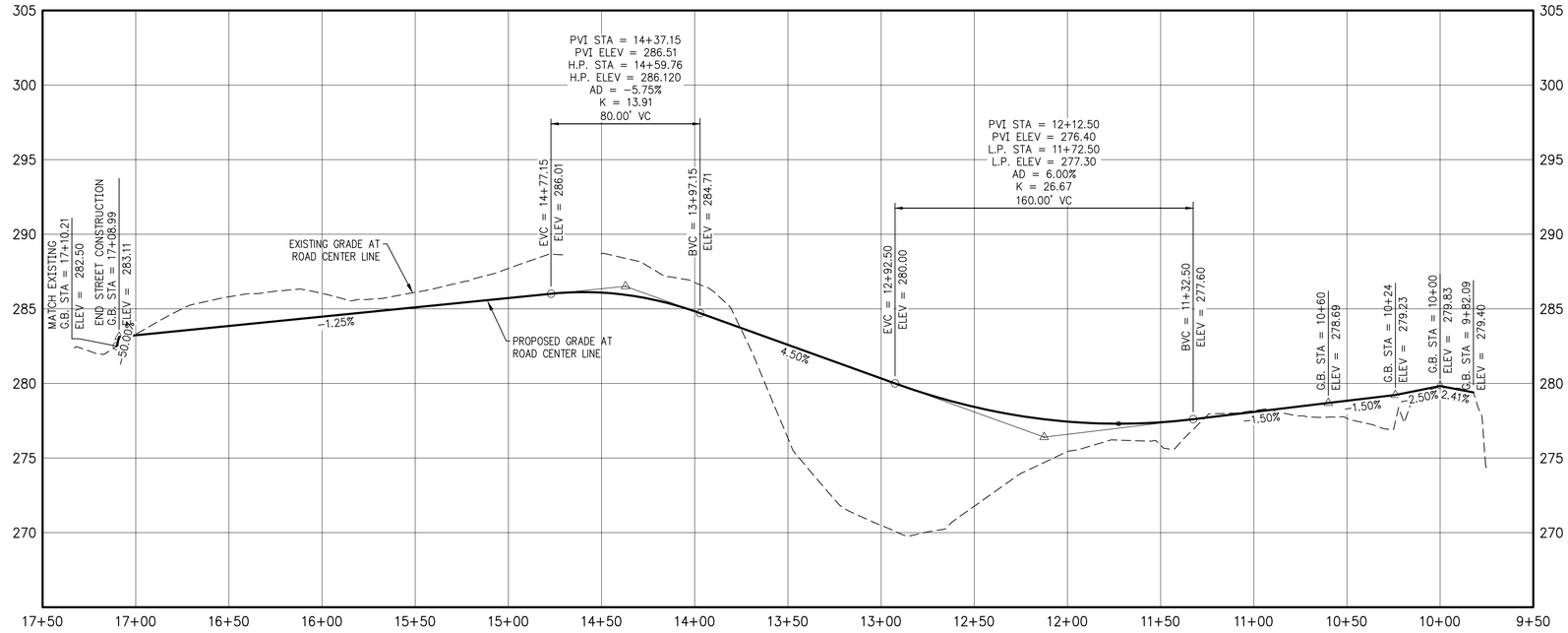
SHEET 06 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_06pst2, Layout: 06 SW IRONWOOD LANE IMPROVMENT PLAN & PROFILE, Plot Date: 8/6/2019 12:00 PM, by: Kyung Han



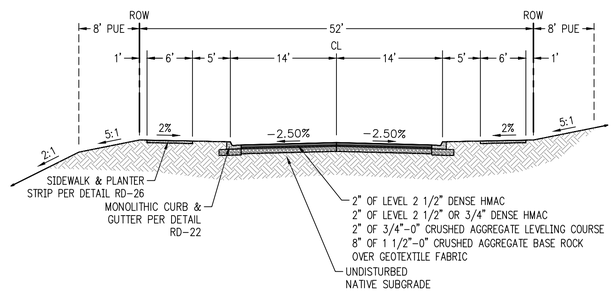
PUBLIC STREET - PLAN

SCALE: 1" = 40'



PUBLIC STREET - PROFILE

SCALE: 1" = 40' H, 1" = 5' V



PUBLIC STREET - SECTION

NTS

LEGEND

- BOUNDARY LINE
- EASEMENT
- EXISTING 1' CONTOUR LINE
- EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE
- EXISTING STORM DRAIN MANHOLE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATER METER
- EXISTING CONTROL VALVE
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING TRANSFORMER
- EXISTING COMMUNICATION PEDESTAL
- EXISTING ELECTRICAL PEDESTAL
- EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- EXISTING STORM DRAIN LINE
- EXISTING SANITARY SEWER LINE
- EXISTING COMMUNICATION LINE
- EXISTING WATER LINE
- EXISTING OVERHEAD POWER LINE
- EXISTING UNDERGROUND POWER LINE
- EXISTING GAS LINE
- EXISTING FENCE LINE

NOTES:

1. PROPOSED SIDEWALK
2. PROPOSED MONOLITHIC CURB & GUTTER
3. PROPOSED DRIVEWAY APPROACH
4. PROPOSED AC PAVEMENT
5. PROPOSED WALL
6. PROPOSED CURB RETURN
7. PROPOSED STREET TREE (TYP)
8. PROPOSED ADA RAMP
9. PROPOSED 'NO PARKING' SIGN
10. PROPOSED STREET & STOP SIGN

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

PUBLIC STREET PLAN AND PROFILE

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
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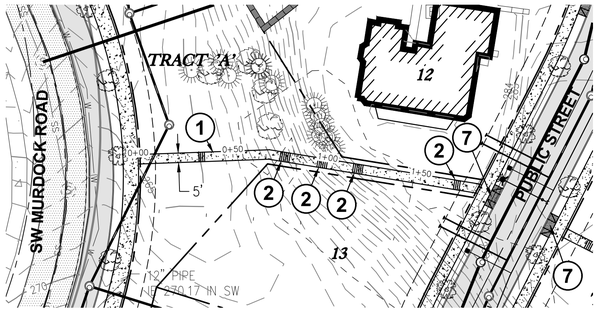
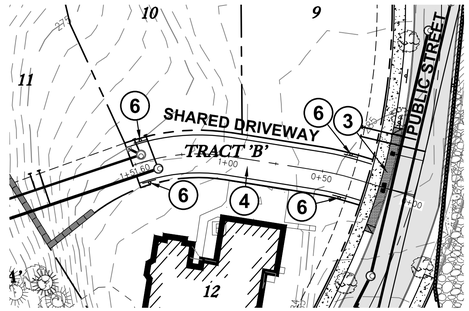
SHEET 07 OF 12

FILE:P:\0200-008 Murdock Subdivision\Dwg\plan\0200-008_07pst3, Layout: 07 PUBLIC STREET PLAN AND PROFILE, Plot Date: 8/6/2019 12:00 PM, by: Kyung Han



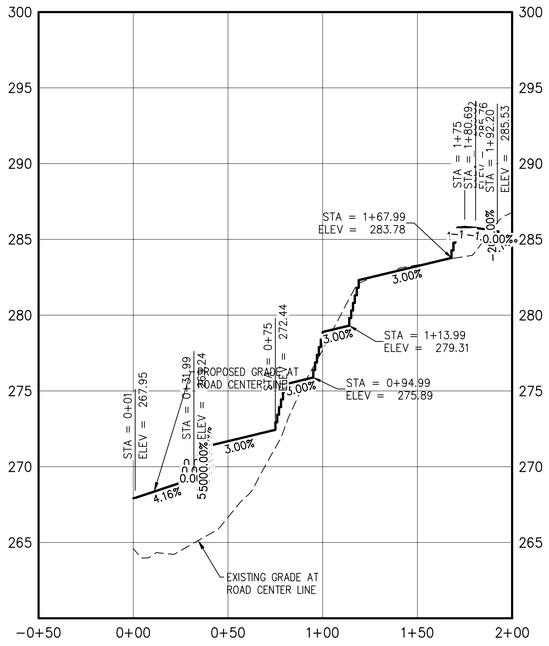
TRACT A PATH - PLAN

SCALE: 1" = 40'



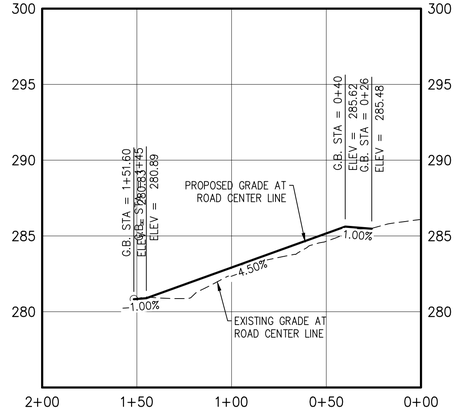
TRACT B DRIVEWAY - PLAN

SCALE: 1" = 40'



TRACT A PATH - PROFILE

SCALE: 1" = 40' H, 1" = 5' V



TRACT B DRIVEWAY - PROFILE

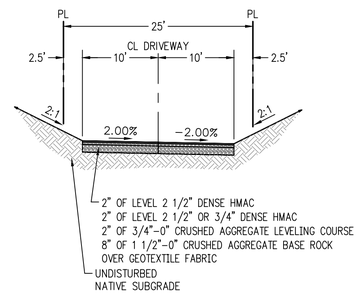
SCALE: 1" = 40' H, 1" = 5' V

LEGEND

- BOUNDARY LINE
- EASEMENT
- EXISTING 1' CONTOUR LINE
- EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE
- EXISTING STORM DRAIN MANHOLE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATER METER
- EXISTING CONTROL VALVE
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING TRANSFORMER
- EXISTING COMMUNICATION PEDESTAL
- EXISTING ELECTRICAL PEDESTAL
- EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- EXISTING STORM DRAIN LINE
- EXISTING SANITARY SEWER LINE
- EXISTING COMMUNICATION LINE
- EXISTING WATER LINE
- EXISTING OVERHEAD POWER LINE
- EXISTING UNDERGROUND POWER LINE
- EXISTING GAS LINE
- EXISTING FENCE LINE

NOTES:

1. PROPOSED 5' WIDE CONCRETE PATH
2. PROPOSED STEPS
3. PROPOSED DRIVEWAY APPROACH
4. PROPOSED AC PAVEMENT
5. PROPOSED STREET LIGHT
6. PROPOSED 'NO PARKING' SIGN
7. PROPOSED ADA RAMP



TRACT B DRIVEWAY - SECTION

NTS

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

TRACT A PATH & B DRIVEWAY PLANS & PROFILES

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL SUITE 100
BEAVERTON, OREGON 97008
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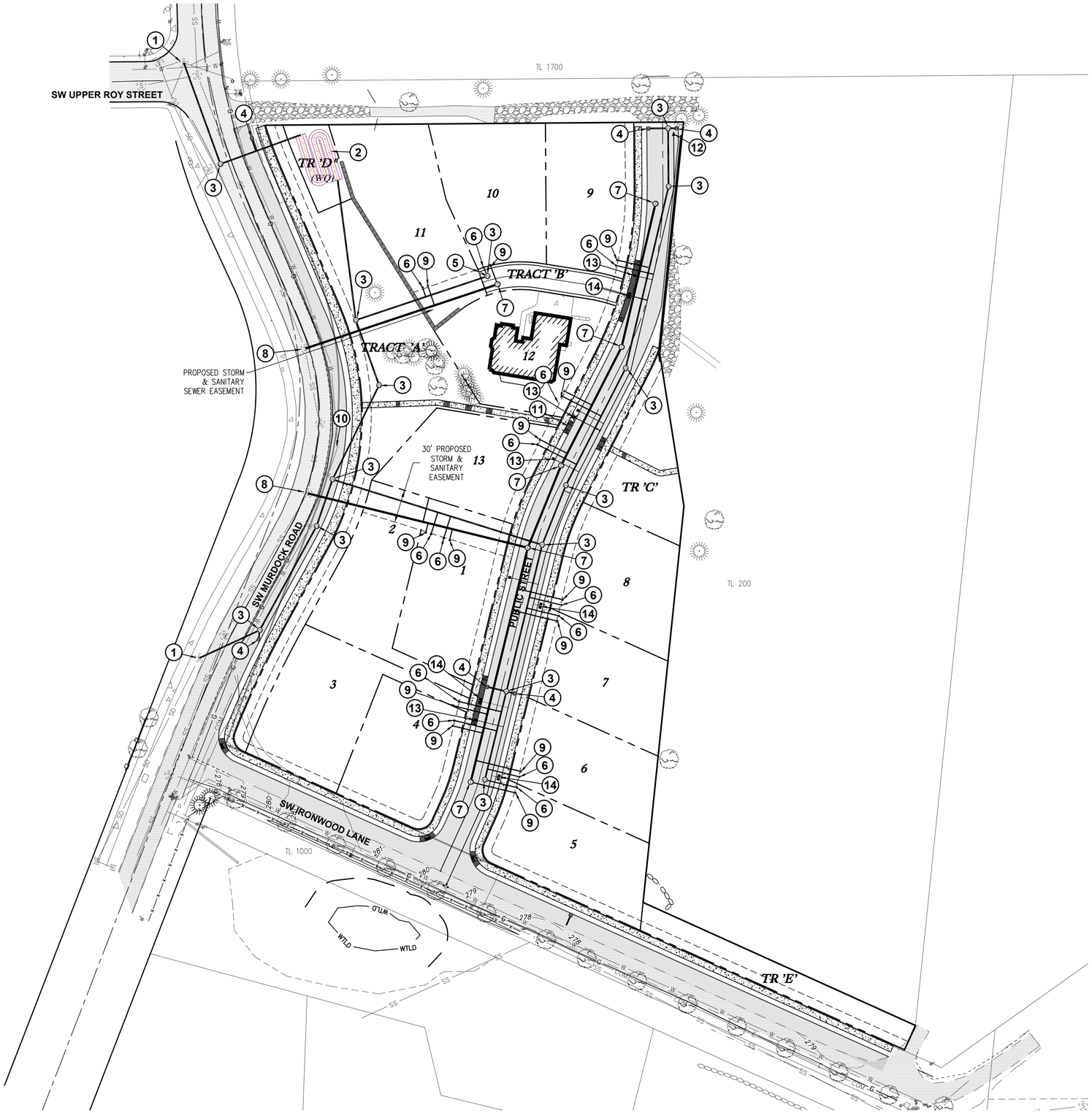
SHEET 08 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_08p.dwg, Layout: 08 TRACT A PATH & B DRIVEWAY PLANS & PROFILES, Plot Date: 8/6/2019 12:01 PM, by: Kyung Han



LEGEND

- BOUNDARY LINE
- EASEMENT
- EXISTING 1' CONTOUR LINE
- EXISTING 5' CONTOUR LINE
- EXISTING CROWN (CENTER LINE OF ROAD)
- EXISTING TREE
- EXISTING STORM DRAIN MANHOLE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATER METER
- EXISTING CONTROL VALVE
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING TRANSFORMER
- EXISTING COMMUNICATION PEDESTAL
- EXISTING ELECTRICAL PEDESTAL
- EXISTING ELECTRICAL VAULT
- EXISTING LIGHT
- EXISTING UTILITY POLE
- EXISTING GUY WIRE
- EXISTING MAIL BOX
- EXISTING SIGN
- EXISTING HEDGE LINE
- EXISTING STORM DRAIN LINE
- EXISTING SANITARY SEWER LINE
- EXISTING COMMUNICATION LINE
- EXISTING WATER LINE
- EXISTING OVERHEAD POWER LINE
- EXISTING UNDERGROUND POWER LINE
- EXISTING GAS LINE
- EXISTING FENCE LINE
- PROPOSED STORM LINE
- PROPOSED SANITARY LINE
- PROPOSED WATERLINE
- PROPOSED STORM LATERAL
- PROPOSED SANITARY LATERAL
- PROPOSED SINGLE WATER METER
- PROPOSED DOUBLE WATER METER
- PROPOSED STORM MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED SANITARY MANHOLE
- PROPOSED BLOWOFF
- PROPOSED WATER VALVE

UTILITY NOTES:

1. PROPOSED CONNECTION TO EXISTING STORM MANHOLE
2. PROPOSED WATER QUALITY SWALE
3. PROPOSED STORM MANHOLE
4. PROPOSED CG-2 CATCH BASIN
5. PROPOSED LYNCH TYPE CATCH BASIN
6. PROPOSED STORM LATERAL
7. PROPOSED SANITARY MANHOLE
8. PROPOSED CONNECTION TO EXISTING SANITARY MANHOLE
9. PROPOSED SANITARY LATERAL
10. PROPOSED CONNECTION TO EXISTING WATERLINE
11. PROPOSED FIRE HYDRANT
12. PROPOSED BLOWOFF
13. PROPOSED SINGLE WATER METER
14. PROPOSED DOUBLE WATER METER

N

50' 0 25' 50' 100'

SCALE: 1" = 50'

SW MURDOCK ROAD SUBDIVISION/PUD TAX MAP T2S R1W 33CB TAX LOT 00300 WASHINGTON COUNTY, OREGON

PRELIMINARY UTILITY PLAN

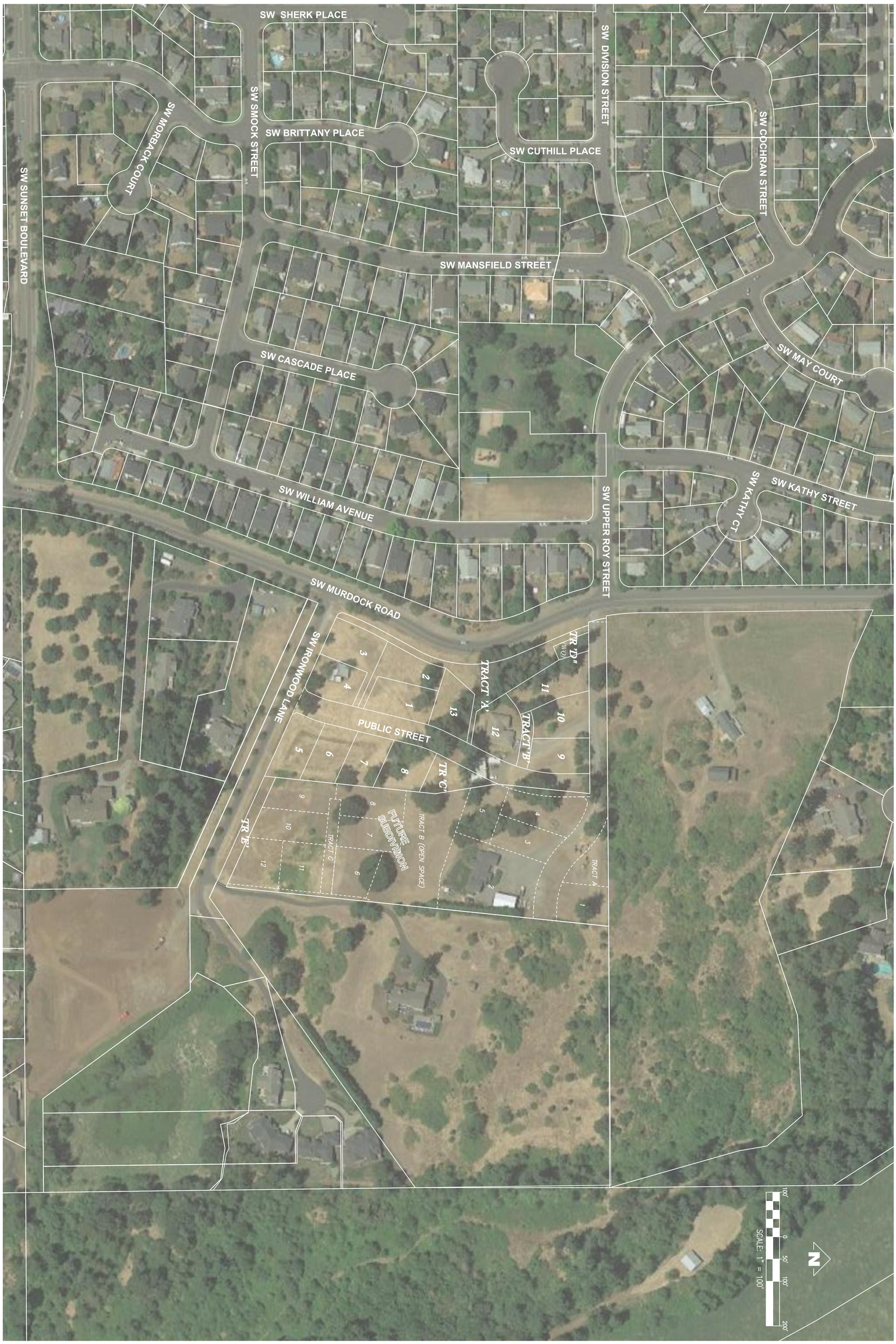
REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 09 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_08plot_Layout: 09 PRELIMINARY UTILITY PLAN, Plot Date: 8/6/2019 12:02 PM, by: Kyung Han



SHEET 10 OF 12

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

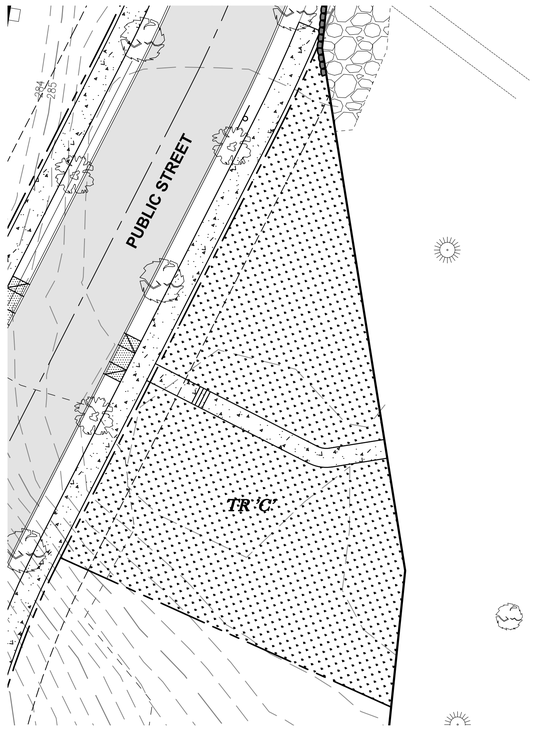
REVISIONS

NO.	DATE	DESCRIPTION

AERIAL AND NEIGHBORHOOD CIRCULATION MAP

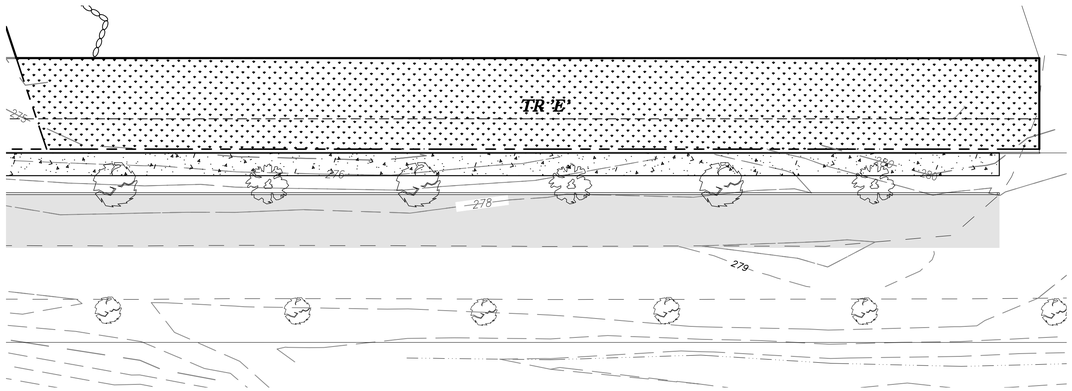
SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_10paer, Layout: 10 AERIAL AND NEIGHBORHOOD CIRCULATION MAP, Plot Date: 8/6/2019 12:02 PM, by: Kyung Han



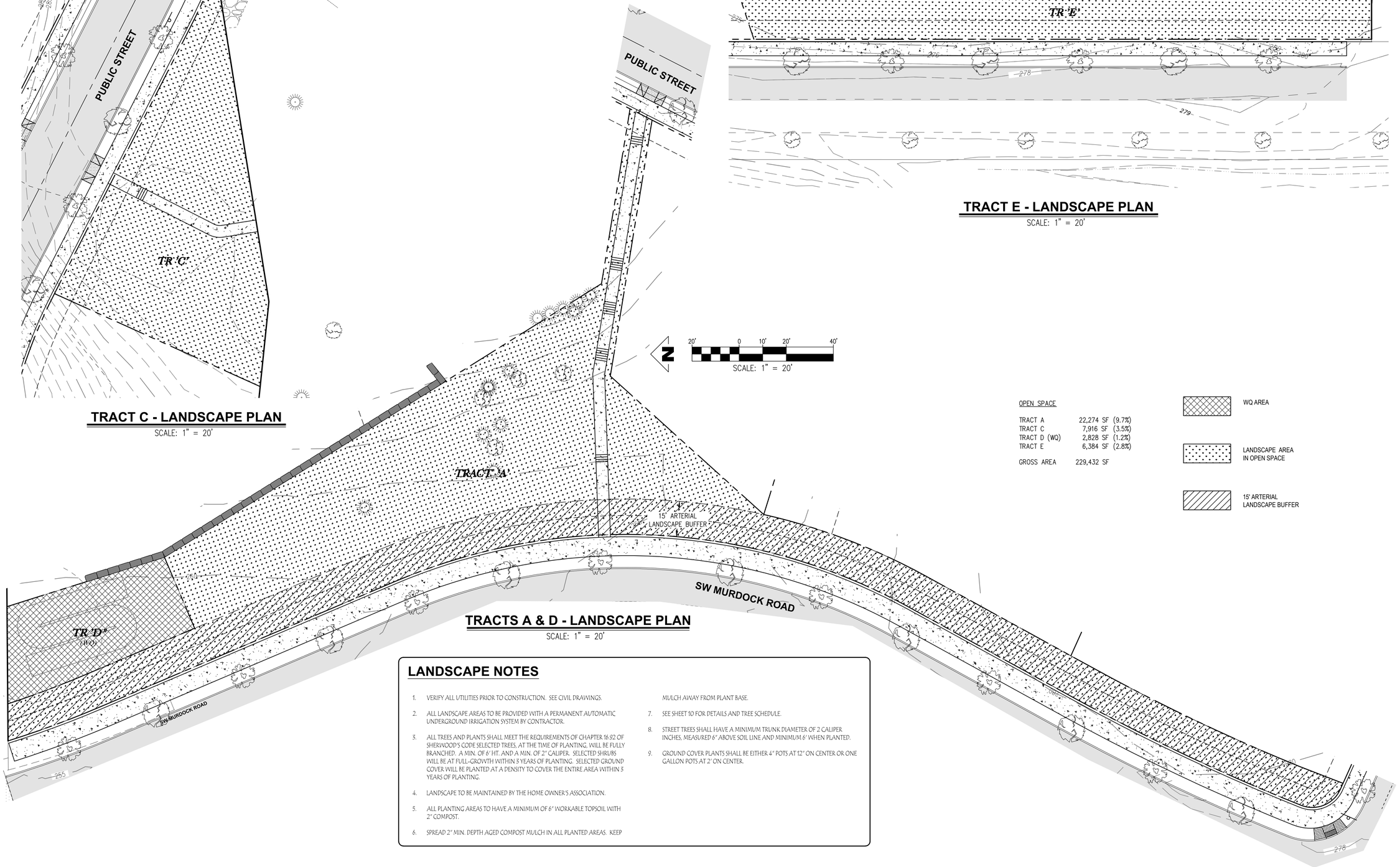
TRACT C - LANDSCAPE PLAN

SCALE: 1" = 20'



TRACT E - LANDSCAPE PLAN

SCALE: 1" = 20'



TRACTS A & D - LANDSCAPE PLAN

SCALE: 1" = 20'

OPEN SPACE

TRACT A	22,274 SF	(9.7%)
TRACT C	7,916 SF	(3.5%)
TRACT D (WQ)	2,828 SF	(1.2%)
TRACT E	6,384 SF	(2.8%)
GROSS AREA	229,432 SF	

WQ AREA

LANDSCAPE AREA IN OPEN SPACE

15' ARTERIAL LANDSCAPE BUFFER

LANDSCAPE NOTES

1. VERIFY ALL UTILITIES PRIOR TO CONSTRUCTION. SEE CIVIL DRAWINGS.
2. ALL LANDSCAPE AREAS TO BE PROVIDED WITH A PERMANENT AUTOMATIC UNDERGROUND IRRIGATION SYSTEM BY CONTRACTOR.
3. ALL TREES AND PLANTS SHALL MEET THE REQUIREMENTS OF CHAPTER 16.92 OF SHERWOOD'S CODE SELECTED TREES, AT THE TIME OF PLANTING, WILL BE FULLY BRANCHED. A MIN. OF 6' HT. AND A MIN. OF 2" CALIPER. SELECTED SHRUBS WILL BE AT FULL-GROWTH WITHIN 3 YEARS OF PLANTING. SELECTED GROUND COVER WILL BE PLANTED AT A DENSITY TO COVER THE ENTIRE AREA WITHIN 3 YEARS OF PLANTING.
4. LANDSCAPE TO BE MAINTAINED BY THE HOME OWNER'S ASSOCIATION.
5. ALL PLANTING AREAS TO HAVE A MINIMUM OF 6" WORKABLE TOPSOIL WITH 2" COMPOST.
6. SPREAD 2" MIN. DEPTH AGED COMPOST MULCH IN ALL PLANTED AREAS. KEEP MULCH AWAY FROM PLANT BASE.
7. SEE SHEET 10 FOR DETAILS AND TREE SCHEDULE.
8. STREET TREES SHALL HAVE A MINIMUM TRUNK DIAMETER OF 2 CALIPER INCHES, MEASURED 6" ABOVE SOIL LINE AND MINIMUM 6' WHEN PLANTED.
9. GROUND COVER PLANTS SHALL BE EITHER 4" POTS AT 12" ON CENTER OR ONE GALLON POTS AT 2' ON CENTER.

SW MURDOCK ROAD SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

OPEN SPACE LANDSCAPE PLAN

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
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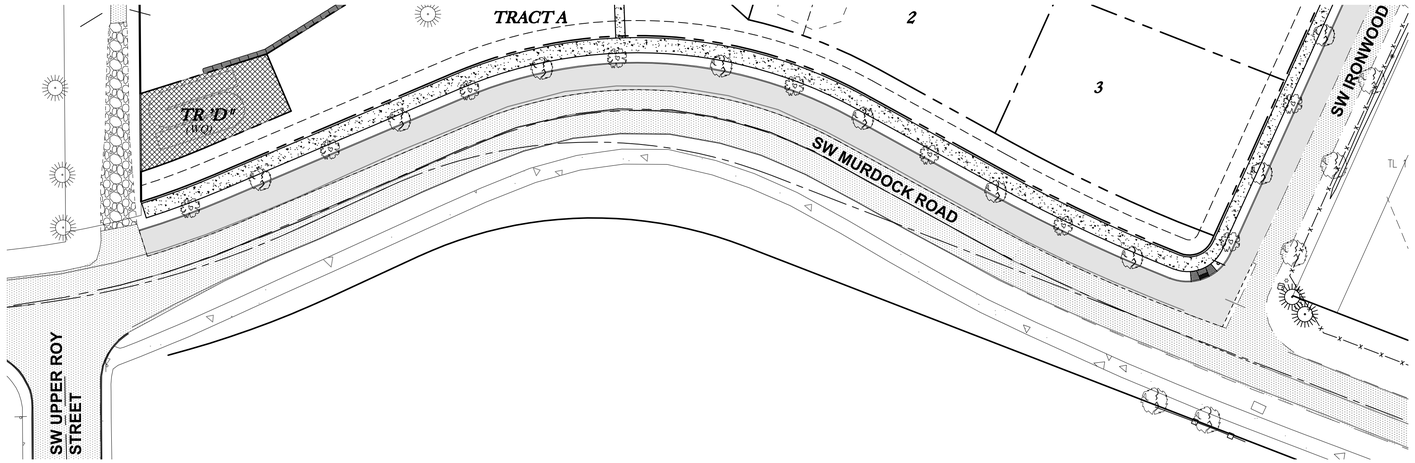
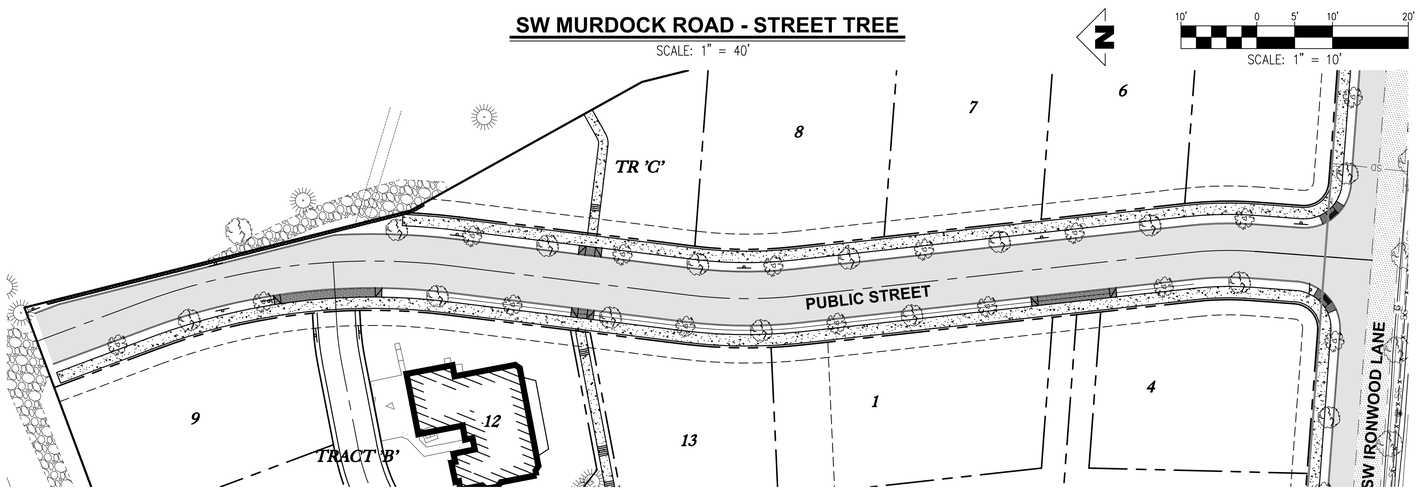
SHEET 11 OF 12

FILE:P:\0200-008 Murdock Subdivision\Engr\plan\0200-008_11plt1, Layout: 11 OPEN SPACE LANDSCAPE PLAN, Plot Date: 8/6/2019 12:12 PM, by: Kyung Han



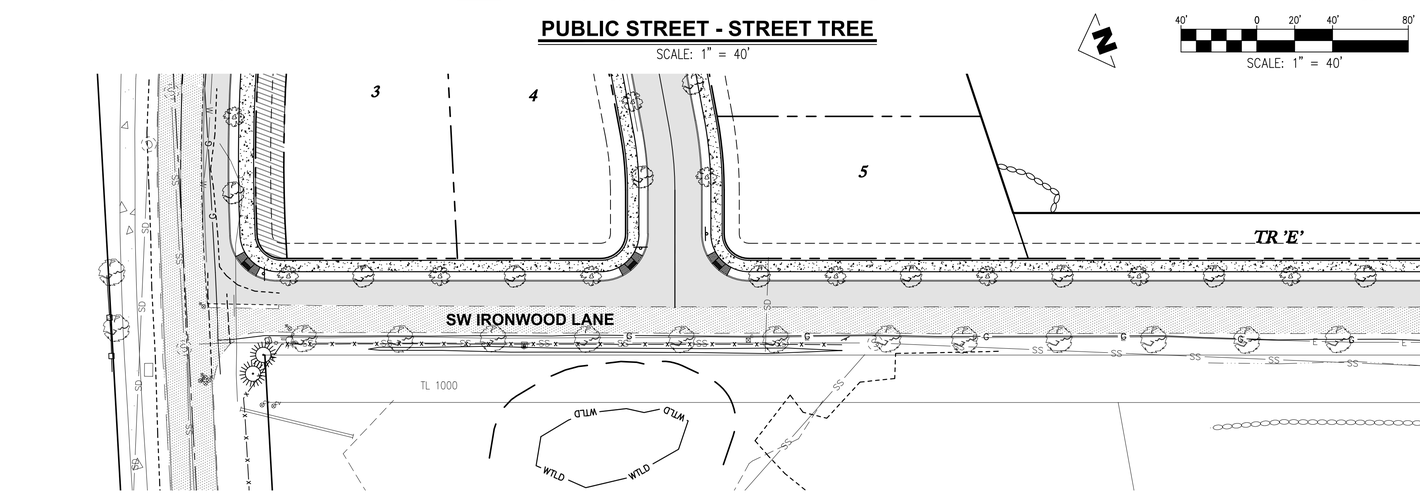
SW MURDOCK ROAD - STREET TREE

SCALE: 1" = 40'



PUBLIC STREET - STREET TREE

SCALE: 1" = 40'



SW IRONWOOD LANE - STREET TREE

SCALE: 1" = 40'

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

STREET TREE PLAN

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 12 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_12plot2, Layout: 12 STREET TREE PLAN, Plot Date: 8/6/2019 12:03 PM, by: Kyung Han

Murdock Rd. PUD

Architectural Pattern Book

Issued To: City of Sherwood

Project Name: Murdock Rd. PUD

Applicant: JT Roth Construction, Inc.

Date: June 2019

12600 SW 72nd Ave, suite 200, Portland, Or. 77223 off 503 639 2639 CCB# 31700

Description

The Murdock Rd. PUD development project is approx. 5.26-acre site located within the Southeast Sherwood Master Plan, east of SW Murdock Road. The development project is being submitted as a 13 lot single family detached development with minimum lot size being 10,000 sq. ft., in compliance with the current zoning overlay. The 13 lots consist of one lot with an existing home and 12 lots intended for new residential construction.

The project is being submitted as a Planned Unit Development (PUD) to allow for flexibility and creativity in the overall site design and layout. As part of the PUD standards, the Applicant has prepared this Pattern Book to describe the architectural design features that guide the design and development of the new residential structures to be constructed on each of the approved lots.

The purpose of this Pattern Book is to act as an illustrative guide on how the PUD standards will be applied.

This Pattern Book shall address the architectural design criteria contained in the Sherwood Zoning and Development Code (section 16.40.020(G) "Architectural Pattern Book").

> ***Architectural Pattern Book: A compendium of architectural elevations, details, and colors of each building type shall be submitted with any PUD application. The designs shall conform to the site plan urban design criteria in Section 16.90.020(G) or any other applicable standards in this Code. A pattern book shall act as the architectural control for the homeowner's association or the commercial owner. An Architectural Pattern Book shall address the following:***
>
> ***a. Illustrative areas within the development application covered by the pattern book.***
> ***b. An explanation of how the pattern book is organized, and how it is to be used.***
> ***c. Define specific standards for architecture, color, texture, materials, and other design elements.***
> ***d. Include a measurement or checklist system to facilitate review of the development for conformity with the pattern book.***
> ***e. Include the following information for each building type permitted outright or conditionally proposed in the PUD:***
>
> ***(1) Massing, facades, elevations, roof forms, proportions, materials, and color palette.***
> ***(2) Architectural relevance or vernacular to the Pacific Northwest.***
> ***(3) Doors, windows, siding, and entrances, including sash and trim details.***
> ***(4) Porches, chimneys, light fixtures, and any other unique details, ornamentation, or accents.***
> ***(5) A fencing plan with details that addresses the relationship between public space and maintaining individual privacy subject to Section 16.58.020***

The proposed Murdock Rd. development project has completed its' pre-app meeting with the City of Sherwood and is preparing the final documents to be submitted for land-use approval, and until such time that the City of Sherwood has approved the application/submittal we will not be able to complete the exact house plan design(s) and exterior elevation features. Once the development has been accepted and approved by the City, defining total number of lots and lot dimensions, we can proceed with the details of the house design and architectural features, utilizing the guidelines defined in this document.

The basis for our house designs will range from a Contemporary to Transitional to Modern to Traditional to Early American and Modern Farmhouse styles that will complement the surrounding community. We have included, in this submittal, examples of homes styles that we believe will meet the demand of the new home market and become an asset to the Sherwood community.

a. Illustrative Areas

The Illustrative areas within the development application covered by this Pattern Book are focused on the architecture design features that each home will uniquely characterize. Each of the 12 house plan designs will be unique to themselves with features that are dissimilar to the other designs.

b. Organization and Use

The organization and use of this Pattern Book is broken down in order to address the criteria listed in the development code standards.

Through the process of design and development of each of the residential structures this criteria shall govern how and where the design features best apply.

The overall design and architecture of the structures are subject to final approval by the Architectural Review Committee (ARC), as shall be outlined within the subdivision CCR's. The CCR's will be drafted once the development project is approved and all conditions are determined.

Building Design

1. All residential structures shall comply with the requirements defined in the CCR's specific to this project.
2. Each structure shall have an individual and distinctive appearance.
3. There shall be no duplicate elevation of a single family home within sight of each other.
4. The mix of housing types shall feature materials that are compatible with the surrounding community and the topography of each lot.
5. Each structure shall be constructed to utilize the characteristics of the lot with the front of the home oriented toward the driveway approach, as shown on the approved design.
6. All new home plans must be drafted and engineered by a qualified person licensed to perform their trade. All engineering shall be stamped and signed by the person(s) performing or inspecting the final engineered plans.
7. The exterior siding shall be comprised of i) composite siding, ii) wood siding, iii) brick, iv) stone, or other materials specifically approved by the ARC.
8. Siding, trim and roof colors will be approved by the ARC with each submittal. No duplication of colors will be allowed, with the exception of roof color.
9. Height of the structure shall comply with existing zoning regulations.

Landscaping

1. Every landscape plan shall have an individual and distinctive design.
2. Landscape with irrigation systems must be completed within 30 days of final inspection (weather permitting)
3. The design and type of plantings are to enhance the building architecture and be consistent with the neighborhood and environment.
4. Extensive use of colored rocks and gravel for ground cover is prohibited.

c. Design Specifics

The specific standards for architecture, color, texture, materials, and other design elements are illustrated with the following examples.

Building Elevations (conceptual)

Contemporary

Transitional

Modern

Traditional

Early American

Modern Farmhouse

The design theme is intended to follow a land use plan that provides for a mix of housing types that are compatible with current trends.

Siding Materials (examples)

(Not limited to these examples). These are to be used to flow with the style of the home and add character.

*(stained cedar T&G *vertical or horizontal)*

(composite lap siding)

(staggered composite siding)

(stained cedar lap siding)

(batt & board)

(accent Shingle)

(smooth panel)

(vertical siding)

Masonry Materials (examples)

Cultured stone/Natural Stone/Brick are versatile materials with many options in order to achieve individuality and uniformity at the same time. There are a multitude of colors and types available to be used to compliment design and color themes. These examples are not intended to dictate exact colors.






Roofing Material (examples)

Composition shingles are the most widely used roofing material. The color choices are noted below.

Weatherwood **Black** **Georgetown Gray** **Colonial Slate**

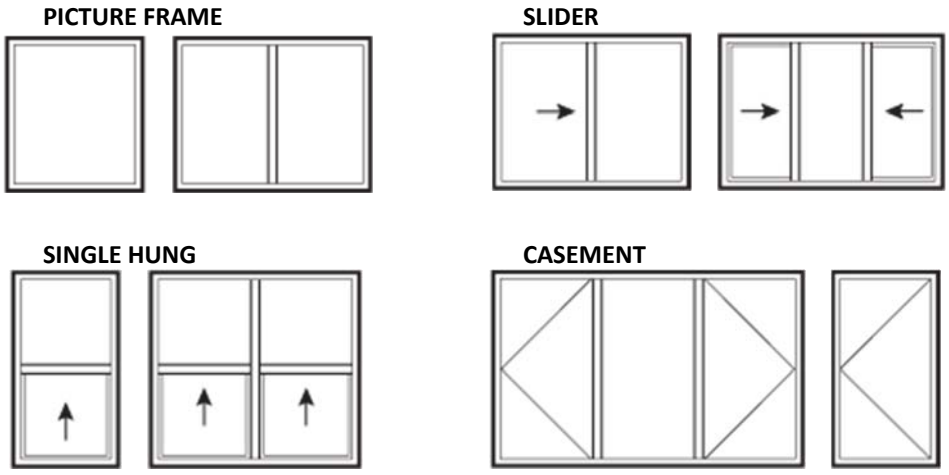
Exterior Lighting (examples)

Examples of exterior lighting that are proposed for exterior use.
Note: Fixture finish color may change based on home style and application. Finish color options include: *Black, *Satin Nickel, *Bronze, *Chrome

Windows Styles (examples)

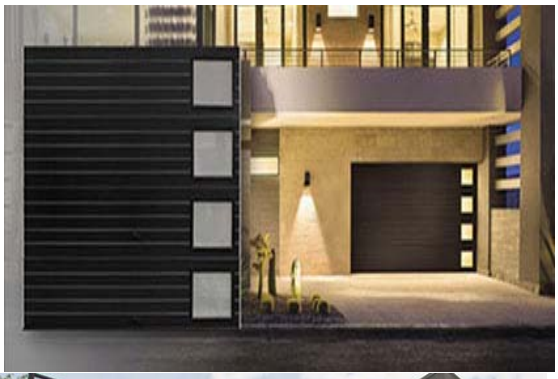
Window frames are a vinyl material. Color options are: *Almond, *Clay, *White, *Black

Example of window types



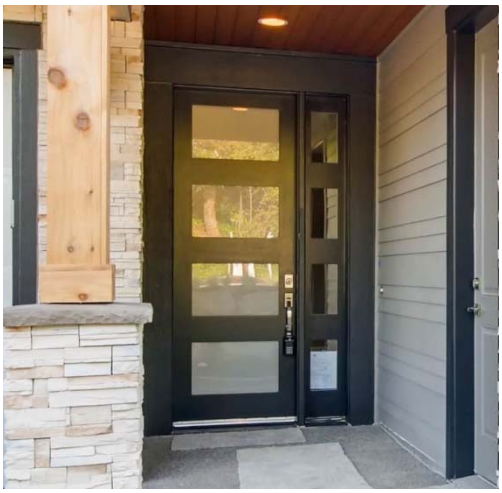
Overhead Doors (examples)

Door design and style will vary with house type. Below are pictures of different door styles that could apply to the finish house design. Finish paint color will vary with color scheme.



Entry Doors/Hardware (examples)

Door style



Exterior Paint (examples)

Sample Color Palette

There are no pre-determined exterior color selections made at this time. The following color palettes are provided only as examples of color opportunities that would be used in making the selections once the homes designs are completed.

Bohemian Black SW 6988	Ibis White SW 7000	Ceiling Bright White 7007	Eider White SW 7014	Simple White SW 7021
Domino SW 6989	Marshmallow SW 7001	Alabaster SW 7008	Repose Gray SW 7015	Alpaca SW 7022
Caviar SW 6990	Downy SW 7002	Pearly White SW 7009	Mindful Gray SW 7016	Requisite Gray SW 7023
Black Magic SW 6991	Toque White SW 7003	White Duck SW 7010	Dorian Gray SW 7017	Functional Gray SW 7024
Inkwell SW 6992	Snowbound SW 7004	Natural Choise SW 7011	Dovetail SW 7018	Backdrop SW 7025
Black Of Night SW 6993	Pure White SW 7005	Creamy SW 7012	Gauntlet Gray SW 7019	Griffin SW 7026
Greenblack SW 6994	Extra White SW 7006	Ivory Lace SW 7013	Black Fox SW 7020	Well-Bred Brown SW 7027

Stain Samples (examples)

*Used for the cedar siding applications

d. Checklist

The following represents an example of the ARC checklist form that will be submitted with each house plan designed specific to each lot. This checklist will be incorporated into the final CCR's for the development.

Architectural Checklist - New Home Construction

Property Owner: _____ *Phone #* _____

Lot # _____ *Property Address* _____

Contractor Name and Phone Number _____

Complete this checklist and submit with full set of plans and samples as necessary. A submitted plan will not be reviewed by ARC until all items required by this form are received. The submittal must be complete and not submitted as "piece-meal".

CHECKLIST

____ **One full set of plans to scale (1/4" or 1/8") to include:*

☐ *Site Plan showing:*

- *-Lot # and house address*
- *-Property corner elevations / contour (topo) lines / easements*
- *-Dimensions for all perimeter boundary lines*
- *-Sq. ft. of lot, sq. ft. of house/garage footprint*
- *-Street Trees, location and type*
- *-Garage and House setback dimensions / Easements*
- *-Finish Floor elevation of Main, Lower, Garage Floor*
- *-Approach and Driveway w/dimensions*
- *-Location of AC units, trash and recycling containers. Must be screened from street view*
- *-Fence location and type, Retaining wall location and type*
- *-Utility meters*
- *-Owner & Contractor name, contact info (phone/email)*

☐ *Front, Side(s), Rear elevations showing:*

- *-Exterior siding and trim materials*
- *-Window locations, size and operable function*
- *-Decks (include stairs if applicable)*
- *-Note height at highest ridge in relationship to the street*

☐ *Front and corner (street side) Landscaping Plan showing:*

- *-Street trees, noting size and type*
- *-Yard trees, noting size and type*
- *-Grass planting areas, noting total coverage area*
- *-Shrub planting areas, noting type, number and size*
- *-Show water features*
- *-Note any exterior lighting*

MATERIALS USED

____ *1. <u>Roof material:</u> *color ☐Weatherwood ☐Black ☐Georgetown Gray ☐Colonial Slate*

____ *2. <u>Building Siding:</u> *type ☐Composite Lap, ☐Cedar Lap, ☐Cedar T&G*
☐ Other describe:_____
** On additional page, submit paint or stain colors for each siding type selected*

____ *3. <u>Exterior Masonry</u>: *type ☐ Cultured Stone describe: _____*
location:_____
☐ Natural Stone describe: _____
location:_____
☐ Brick describe: _____
location:_____
☐ Other describe: _____
location:_____

____ *4. <u>Exterior Lighting</u>: *color ☐Black ☐Chrome ☐Satin Nickel ☐Bronze*
☐Other describe _____

____ *5. <u>Vinyl Windows</u>: *vinyl frame color ☐Black ☐White ☐Almond ☐Clay*

____ *6. <u>Overhead Door</u>: *Describe _____*

____ *7. Entry Door: *Describe _____*
*-Hardware *Describe _____*

____ *8. Exterior Paint Color:* *Body* ______________________________________
Trim ______________________________________
Accent Color ________________________________
Stain Color ________________________________
Garage Door ________________________________
Entry Door ________________________________

Please provide any other information that you would like in regard to this request:

____
____
____
____
____

The undersigned agrees to complete all construction as shown on submitted plans and completed ARC checklist and to not make changes or additions to the ARC approvals without first obtaining prior approval from the City of Sherwood Planning Staff

Owners Signature/s: _____________________________________ *DATE*____________________
_____________________________________ *DATE*____________________

Contractor Signature: ____________________________________ *DATE*____________________

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Staff Use Only

Staff Action: ☐ *Approved* ☐ *Declined*
Comments/Conditions/Follow-up:

____
____
____
____
____
____
____

e. Information for Each Building Type

(1) *Massing, facades, elevations, roof forms, proportions, materials, and color palette.*
**** See information provided above***

(2) *Architectural relevance or vernacular to the Pacific Northwest.*
**** The architectural relevance of the intended building designs and styles is consistent with the current market trends for our metropolitan area and the Pacific NW. The application of the Contemporary and Traditional designs has been applied in our market for several years and the introduction of the Modern and Modern Farmhouse design has adapted to current market demands.***

(3) *Doors, windows, siding, and entrances, including sash and trim details.*

See information provided above

(4) *Porches, chimneys, light fixtures, and any other unique details, ornamentation, or accents.*

The specific details of the architectural features will not be determined until the final house plan designs are completed. And the houses cannot be designed until the plat is approved. Examples have been provided above.

(5) *A fencing plan with details that addresses the relationship between public space and maintaining individual privacy subject to Section 16.58.020*

**** A fence plan delineating the length and location of fencing cannot not be created until the house plan/site plans are completed, which first requires acceptance of the project by the city.***

This completes the Architectural Pattern Book for the Murdock Rd. PUD

Remedial Action Work Plan

KFF Subdivision
23000 SW Murdock Road
Tax Lot 300
Sherwood, Oregon
ESCI File No. 4392

Revised:
August 16, 2017

Prepared for:
JT Roth Construction, Inc.
12600 SW 72nd Avenue
Portland, Oregon 97223

Prepared by:

CREEKSIDE ENVIRONMENTAL CONSULTING, LLC

and

EVREN NORTHWEST, INC.
environmental natural resource consultants

Offices in Portland and Bend, Oregon / Spokane, Washington
P.O. Box 14488, Portland, Oregon 97293
T. 503-452-5561 / E. ENW@EVREN-NW.com

Project No. JR-2017.1 / 351-17028-02

This

Remedial Action Work Plan

for the

KFF Subdivision
23000 SW Murdock Road
Tax Lot 300, Sherwood, Oregon

Has been prepared for the sole benefit and use of our client:

J.T. Roth Construction, Inc.
12600 SW 72nd Avenue
Portland, Oregon 97223

Prepared August 16, 2017 *by:*

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Project Manager, ENW

Paul M. Trone, R.G.
Health & Safety / Waste Management, ENW

Brent Jorgensen

Brent Jorgensen, *Project Manager, Creekside*

Limitations: This Remedial Action Work Plan (Plan) is reflective of site conditions discovered through environmental site assessments as documented in the previous investigations. Required actions described in this plan are expressly and ONLY those required by the ODEQ Record of Decision. The Client is advised that all other environmental agency requirements and regulations are still applicable to the property.

No warranties are expressed or implied concerning potential contaminants or environmental media not addressed through sampling and analysis. Creekside Environmental Consulting, LLC and EVREN Northwest, Inc. are not responsible for conditions or consequences arising from relevant information that is concealed or not fully disclosed at the time of Plan preparation. This Plan was prepared in accordance with generally accepted professional practice in the area at this time for the exclusive use of our client and their agents or authorized third parties. No other warranty, either expressed or implied, is made.

Table of Contents

Tables

Figures

Attachments

Acronyms and Abbreviations

ARLs	Acceptable Risk Levels
bgs	below ground surface
CFR	Code of Federal Regulations
CFSL	clean fill screening level
Client	JT Roth Construction, Inc.
COC	Constituent of Concern
COPC	Constituent of Potential Concern
Creekside	Creekside Environmental Consulting, LLC
Cr(VI)	hexavalent chromium
Cr(III)+Cr(VI)	total chromium
DU	decision unit
ECSI	Environmental Cleanup Site Information
ED	exposure duration
EF	exposure frequency
ENW	EVREN Northwest, Inc.
EPA	US Environmental Protection Agency
ESC	erosion and sediment controls
F&BI	Friedman & Bruya, Inc.
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations
IS	incremental sample
ISM	Incremental Sampling Methodology
KFF	Ken Foster Farms
mg/Kg	milligrams per Kilogram
NPDES	National Pollution Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
OAR	Oregon Administrative Rules
ORS	Oregon Revised Statutes
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RBCs	risk-based concentrations
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SLRBC	screening-level risk-based concentrations
SOW	scope of work
WAM	Waste Authorization Manager
XRF	X-ray fluorescence

1.0 INTRODUCTION

This Remedial Action Work Plan was prepared by Creekside Environmental Consulting, LLC (Creekside) to outline proposed remedial actions at the above-referenced Ken Foster Farms (KFF) Subdivision property located at 23000 SW Murdock Road (Tax Lot 300) in Sherwood, Oregon (subject site; see Figures 1 and 2). Hexavalent chromium (Cr(VI)) impacted soils at the subject property are associated with the former KFF cleanup site (Environmental Cleanup Site Information [ECSI] #2516). Cleanup measures are being implemented to prepare the subject property for residential development. EVREN Environmental, Inc. (ENW) collaborated on this project.

The Remedial Action Work Plan has been developed in conformance with Oregon Department of Environmental Quality's (ODEQ's) Record of Decision (ROD) [1] issued in January 2017.

1.1 Authorization

JT Roth Construction, Inc. (Client) authorized the scope of work (SOW) for this project in July 2017.

1.2 Purpose

This Remedial Action Work Plan has been prepared to attain the degree of cleanup of hazardous substances and control of further release of hazardous substances as established in the ODEQ's ROD for the subject site. These remedial actions are designed to meet the following Remedial Action Objectives (RAOs):

Table 1-1. Remedial Action Objectives

Medium	Remedial Action Objectives
Upland Soil	**RAO 1:** Prevent current and future site residents for parcels developed with residential dwellings from exposure to soils containing Cr(VI) that would result in greater than one in one million additional cancer risk. **RAO 2:** Prevent future open-space users for undeveloped tracts of land from exposure to soils containing Cr(VI) that would result in greater than one in one million additional cancer risk. **RAO 3:** Prevent future construction/excavation users in roadways from exposure to soils containing Cr(VI) that would result in greater than one in one million additional cancer risk. **RAO 4:** Reduce transport of chromium, lead, and mercury in soil runoff to the wetlands. **RAO 5:** The remedial components will not require engineering controls or long term maintenance to be protective.

ODEQ's ROD further identified the following site-specific risk-based concentrations (RBCs), termed Acceptable Risk Levels (ARLs) in milligrams per Kilogram (mg/Kg):

[1] ODEQ, 2017. *Record of Decision*, Ken Foster Farm Site, Sherwood, Oregon, dated January 2017.

Table 1-2. Site-Specific ARLs

Constituent of Concern	Residential User ARL (mg/Kg)	Open-Space User ARL[2] (mg/Kg)	Construction / Excavation User ARL (mg/Kg)	Highly Concentrated Hotspot Level (mg/Kg)
Cr(VI)	*0.3 (background)*	*2.6*	*49*	*29*
Chromium (III)	*120,000*	*200,000*	*530,000*	*1,200,000*
Lead	*400*	*400*	*800*	*4,000*
Mercury	*23*	*39*	*110*	*230*

The objectives are consistent with the requirements set forth in the Environmental Cleanup Rules, Oregon Administrative Rules (OAR) 340-122-0010 to -110, and the Environmental Cleanup Laws, Oregon Revised Statutes (ORS), Chapter 465.

This Remedial Action is intended to mitigate exposure to future residential occupants through removal and off-site disposal of highly impacted soils and onsite consolidation and covering of near-surface soils. Hexavalent chromium Cr(VI) is the primary constituent of concern (COC) and human health risk driver at the site. The default background concentration for Cr(VI) established at the KFF property by ODEQ is 0.3 mg/Kg, which will be used as the remedial action objective concentration in residual surface soil for lots to be developed with residential structures. This concentration is the same as ODEQ's published risk-based concentration for direct contact with soil under a residential exposure setting. A site-specific ARL of 2.6 mg/kg Cr(VI) was calculated by ODEQ to evaluate risk in the open-spaces associated with residential lots (see Attachment 1; note the site-specific RBC for an open-space user are shown as "residential" in the attachment). ODEQ's default RBC for construction workers will be used for roadways (49 mg/Kg).

1.3 Scope

The scope of this Work Plan is to describe all of the components involved in the remedial action selected for the subject property, which includes a combination of soil removal with offsite disposal and consolidation onsite with placement of a protective surface cover.

[2] A site-specific ARL for open-space users was calculated during remedial design following issuance of the ROD. It was calculated using the State's risk-based concentration spreadsheet, assuming an exposure frequency (EF) for an open-space user would equate to visiting a tract of land every day during the summer (EF = 90 days/year), excluding infants (0-2 years), and exposure duration (ED) for children (3-6 year) of 4 years, adolescents (7-16 years) of 14 years, and 12 years as an adult (total ED = 26 years).

2.0 SITE SETTING

2.1 Location and Description

The subject site is located at the east margins of Sherwood, Washington County, Oregon (see Figure 1). The situs address for the subject property is 23000 SW Murdock Road and the parcel is identified by Washington County as tax lot 300, of Washington County tax map 2S133CB (Township 2 South, 1 West, Section 33). The subject property is developed with a single-family residence and two outbuildings, and is irregularly shaped comprising approximately 4.9 acres (see Figure 2).

The subject property is accessed from SW Murdock. The subject property is bordered to the north and east by residential property; to the south by SW Ironwood Lane with residential property further south; and, by SW Murdock Road to the west with residential property further west.

The subject property will be divided into several tracts and residential lots as part of site redevelopment and will include a network of roadways; however, the exact development plans are currently not available and will be developed coincident with this work plan.

2.2 Background

Background information including a summary of all prior investigations, the character and extent of residual impacts to soil and ground water at the site due to historical site use, and results of a risk-based assessment of residual hazardous substances at the site using all available data are presented in ODEQ's January 2017 ROD. Figures 3 and 4 show DEQ Cr(VI) testing results for shallow and deeper soil, respectively. Overall, only 12 of 54 soil samples contained Cr(VI) above the acceptable risk level (ARL) for residential use of 0.3 mg/kg. None of the detected concentrations exceed the ARL for open-space of 2.6 mg/kg.

2.3 Selected Remedial Alternative

The primary components of the Remedial Action include a combination of soil removal with off-site disposal and onsite consolidation with placement of a protective surface cover.

Confirmation testing will be conducted to demonstrate that the lots, areas to be developed with roadways, and tracts meet cleanup goals without the need for engineering controls such as a cap and associated maintenance. Details on residential lot and tract configuration have not been established. The approach for removal, capping and consolidation will be further developed once site redevelopment plans have been advanced. Once more information on lot size and configuration is available, additional testing to assess current conditions on each lot or tract will likely be conducted to inform the remedial design. The following general tasks have been developed. Work related to each task is described in detail in Section 8.

1. Parcels to be developed with single-family residences (including adjacent City right-of-ways and streets):
    a. Excavation and removal of soils containing Cr(VI) above its target ARL of 0.3 mg/Kg. Excavated soil would be transported for offsite disposal at a RCRA Subtitle D Landfill facility.

b. Surficial soil (upper 0.5 feet) will be removed as part of site preparation for grading and development. This soil will be removed from these areas and either consolidated in a tract (see #2, below), and/or transported for offsite disposal as solid waste at a RCRA Subtitle D Landfill facility.

2. Tracts (undeveloped usable open space and water quality):
   a. Excavation, removal and offsite disposal of all soil containing Cr(VI) above ODEQ's site-specific open-space user ARL of 2.6 mg/Kg. Based on DEQ RI results, there are no areas where soil exceeds this ARL; however, this will be confirmed through confirmation samples (Section 8.5); and
   b. Possible consolidation of soils removed from parcels to be developed with single-family residences, and possible other tracts, as applicable. However, consolidated soil will not have a concentration exceeding ODEQ's open-space user ARL of 2.6 mg/Kg;
      i. The consolidation unit, if applicable, will be overlain with a substantial engineered and vegetated soil surface cover (e.g., 1 foot of clean fill per Section 8.3.3).
      ii. Excavation, removal and off-site disposal of all soil containing Cr(VI) above ODEQ's ARL for open space of 2.6 mg/Kg, as confirmed by confirmation sampling (#3 below, Section 8.5).
      iii. ODEQ would record a Notice of No Further Action Determination on the property deed for and Tract where consolidation is conducted, which would describe the purpose and function of the soil consolidation unit, and that any activities that could potentially affect its integrity cannot be conducted without express approval of ODEQ.
3. Roadways: Excavation, removal and offsite disposal of all soil containing Cr(VI) above ODEQ's construction user ARL of 49 mg/Kg. Currently, there are no areas where soil exceeds this ARL; however, this will be confirmed through confirmation samples (Section 8.5);
4. Collection and laboratory analysis of final confirmation soil samples from excavated areas using incremental sampling methodology (ISM).
5. Evaluation of laboratory results against appropriate ARLs (based on future use of parcel as either residential, as an undeveloped tract of land, or as a future roadway).

3.0 REMEDIAL ACTION TASKS

Remedial action tasks outlined in this section are grouped into pre-construction, construction and post-construction phases:

3.1 Pre-Construction

The pre-construction phase includes the following tasks: engineering, permitting, and import fill characterization.

3.1.1 *Pre-Final Design (90% Submittal)*

The Pre-Final Design Report will contain a compilation of major design items reflecting an approximate 90% completion. This report will consist of a site grading plan and development permit set and will serve as the draft design report. The report shall contain the following, as applicable:

- Design criteria/standards
- Final design/analyses calculations
- Drawing index and final drawings
- Final specifications
- Final construction schedule
- Detailed description of remedial action activities to be performed, including methods and equipment for:
  - Mobilization
  - Site preparation
  - Excavation
  - Site restoration, including backfilling and grading
- Estimates of soil volumes to be excavated,
- Detailed site layout drawings, delineating the areas to be excavated
- Excavation methods, including area delineation, slope stabilization, characterization and management of excavated materials, dewatering and water management, and incorporation of confirmation sampling
- Description of permitting requirements, if any, to include:
  - Construction, development, and operating permits required
  - Permitting authorities and specific permit requirements
  - Permit application processing procedures, schedule, and fees
  - Monitoring and compliance testing requirements
- Description of proposed control measures to minimize releases of hazardous substances to all environmental media during construction or installation activities
- Description of proposed surface water runoff control measures during construction
- Identification and description of dust control and noise abatement measures to minimize and monitor environmental impacts of construction or installation activities
- Identification and description of any site security measures necessary to minimize exposure to hazardous situations during remedial action
- Identification and description of transportation requirements, including haul route selection, load limits, truck haul schedule, restricted routes, traffic control needs, accident prevention and response, and decontamination
- Land disposal requirements to include:
  - Identification and description of off-site land disposal facilities
  - Specific treatment/disposal requirements

3.1.2 Final Design (100% Submittal)

The Final Design Report (100% Submittal) will contain all the same major design elements as the 90% Submittal; however, will reflect revision made to incorporate/address any comments received from ODEQ regarding the 90% submittal, as applicable and appropriate.

3.1.3 Permitting

Permits to be acquired include:

- **State of Oregon**
  - National Pollutant Discharge Elimination System (NPDES) 1200C
    - Requirements: see ODEQ Construction Stormwater Permits https://www.oregon.gov/deq/wq/wqpermits/Pages/Stormwater-Construction.aspx
- **City of Sherwood**
  - Demolition
  - Grading
  - Engineering (some or all may not relate specifically to the remedial action): road closure, inspections required, traffic control, surety required (performance bond), granular backfill, trench paving (asphaltic concrete replacement), trench paving (cold plane), bike paths/pedestrian ways and road shoulders, and utility trench plating
  - Erosion Control Permit / Erosion and Sediment Control Plan
  - Tree Removal Permit

3.1.4 Import Fill Characterization

Creekside will prepare a Sampling and Analysis Plan (SAP) to document that fill being imported for the soil cap meets ODEQ's clean fill screening levels (CFSLs), specifically testing for hexavalent chromium and arsenic to ensure concentrations in soil to be imported are not above established background concentrations in this area. Additionally, if fill is to be sourced from agricultural property, imported fill will also be tested for pesticide residues. The SAP for this testing will likely incorporate Incremental Sampling Methodology (ISM) and will be completed once the source for soil fill has been identified.

3.2 Construction

The construction phase is divided into offsite and onsite tasks. An offsite task involves characterizing import soils for use as a clean cap. On-site tasks involve grading soils, separating soils based on the level of Cr(VI) impacts, consolidating less impacted soils on site, and disposing of highly impacted soils off site.

Construction and excavation worker's health and safety is guided by Creekside's Health and Safety Plan (HASP). Management of potentially impacted soil and other media is guided by this work plan and subsequent submittals (see Sections 8.4.1, 8.8 and 20.0).

3.2.1 *Import Fill / Cap Soil*

Pending favorable characterization results, clean fill soil from offsite sources will be imported to construct necessary soil caps and to be used as general fill as part of site redevelopment.

Imported stockpiled soil shall be placed in a stable location and configuration and managed in accordance with the NPDES 1200C permit and the Erosion and Sediment Control Plan. Soil will only be imported from sources that meet clean fill criteria (Section 4.1.4).

3.2.2 *Waste/Impacted Soil Grading*

Grading of onsite waste/impacted soil include: installation of erosion and sediment controls and earthwork. Construction details will be shown on subsequent submittals (Sections 4.1.1 and 4.1.2) and will include at a minimum the following:

- Erosion and Sediment Controls (ESC) – base measures such as inlet protection, perimeter sediment control, gravel construction entrances, etc., must be in place, functional and approved in an initial inspection, prior to commencement of construction activities.
- Gravel Construction Entrances – shall be installed at the beginning of construction and maintained for the duration of the project. Street sweeping and vacuuming may be required to ensure that all paved areas are kept clean for the duration of the project. Run-on and run-off controls shall be in place and functioning prior to beginning substantial construction activities.
- Earthwork – grading and other excavation activities will occur within the grading limits to shown in subsequent submittals (Sections 8.4). Any waste soil removed during grading will be disposed of offsite at a RCRA Subtitle D Landfill such as Hillsboro Landfill.

3.3 Post-Construction

Post-construction tasks include: protective soil cover inspections to confirm adequate coverage, and thickness, as applicable.

4.0 PROPOSED SCHEDULE

Work on the project can begin upon 1) completion of the Prospective Purchasers Agreement, and 2) receiving approval from the ODEQ Project Manager for the proposed work plan. The final report will be submitted to ODEQ within 30 days of receiving the final analytical results. A more detailed construction schedule will be provided in the design plans.

5.0 PERSONNEL DUTIES, RESPONSIBILITIES, AUTHORITIES

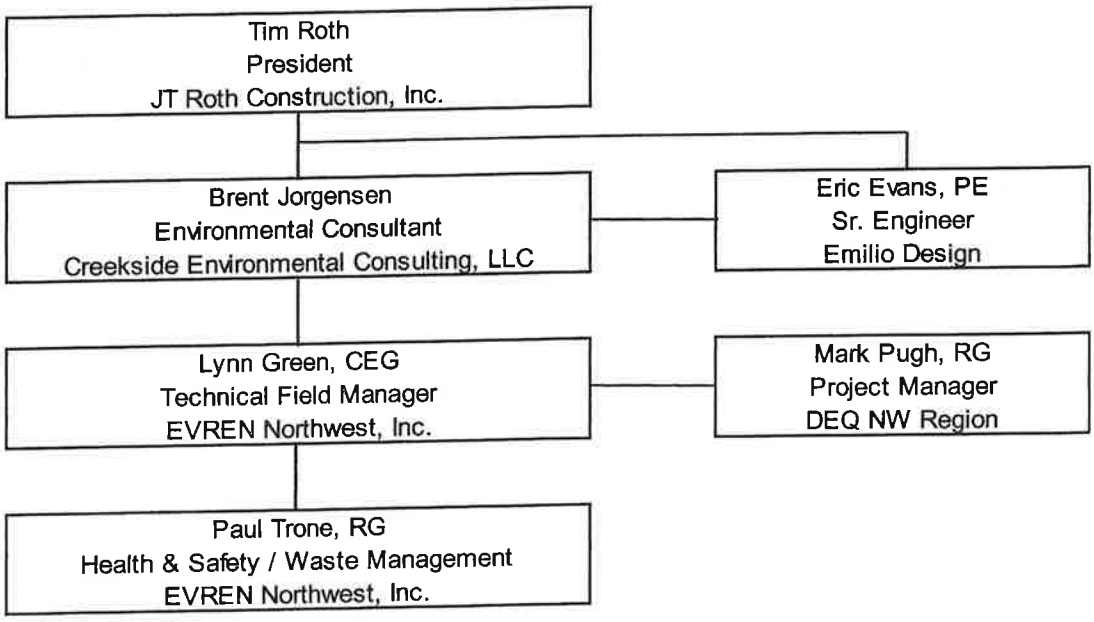
A chart of entity responsibilities, duties and authorities is provided in Table 5-1 on the next page.

Table 5-1. Duties, Responsibilities and Authorities

Name	Role	Company	Phone	Email	Responsibilities	Duties	Authorities
Tim Roth	General Manager Owner	JT Roth Construction, Inc.	Office 503 639 2639	timr@jtrothinc.com	1. Overall Property / Project Management 2. Overall Project Budget and Schedule 3. Overall Personnel Management 4. Overall Compliance with Construction Code	1. Reviews and Approves Budgets and Schedules 2. Negotiates Agreements and Contracts 3. Resolves Design/Construction Conflicts	Property Owner / manager President of the JT Roth Construction, Inc.
Brent Jorgensen	Consultant	Creekside Environmental Consulting, LLC	Cell (503) 780-0474	brent@creeksideenvironmental.com	1. Worker Health and Safety 2. Contaminated Media Management 3. Soil Cap Management 4. Remedial Design /Remedial Action 5. Regulatory liaison	1. Negotiates Agreements and Contracts with JT Roth Construction, Inc. 2. HASP, CMMP, CMP, and RD/RA Work Plan Preparation 3. WAM Permit Application 4. Annual Cap Inspections	Under contract with the JT Roth Construction, Inc. Technical Staff include Oregon Licensed Geologists
Eric Evans	Engineer	Emerio Design, LLC	Office 503.863.1910	eric@emeriodesign.com	1. Grading Plan 2. Erosion and Sediment Control 3. City Permitting	1. Construction Oversight 2. Prepares Plans and Specifications 3. Permit Preparation 4. Construction Storm Water Monitoring	Under contract with the JT Roth Construction, Inc. Oregon Licensed Engineer
Mark Pugh	State Project Manager	Oregon Department of Environmental Quality Northwest Region	Office (503) 229-5587	pugh.mark@deq.state.or.us	1. Regulatory Oversight	1. Ensure that remedy complies with State rules 2. Approve plans, reports, and other documents	Environmental Quality Commission and Governor of the State of Oregon

Notes:
HASP = Health and Safety Plan
CMMP = Contaminated Media Management Plan
CMP - Cap Maintenance Plan
RD / RA = Remedial Design / Remedial Action

6.0 PROJECT ORGANIZATION AND REPORTING RELATIONSHIPS



7.0 CLEANUP LEVELS AND OTHER NUMERIC CRITERIA

7.1 Risk-Based Cleanup – Acceptable Risk Levels

The construction phase is divided into offsite tasks where import soil will be characterized, and imported for use as fill and cap materials, and on-site tasks where soil will be graded in accordance with this work plan, including some offsite disposal and onsite consolidation.

ODEQ allows site closure using a risk-based approach; risk-based cleanup concentrations (RBCs) are derived in accordance with ODEQ's RBDM guidance document. This document provides guidance on the remediation of hazardous substance cleanups as well as petroleum-contaminated sites.

RBCs are based on Oregon unacceptable additional risk criteria for cancer occurrence and for non-carcinogenic health impacts. The State of Oregon considers acceptable additional risk of cancer from contact with carcinogenic constituents at less than one in one million incidences, or, for non-carcinogenic constituents, below the constituent threshold concentration at which health impacts would occur. RBCs are generally used to evaluate sampling analytical results as follows:

- ODEQ's lowest RBC for residential receptors is used as an initial 'conservative' screening of all constituents of interest. If a constituent's concentration exceeds its screening-level RBC (SLRBC), it requires further evaluation and is identified as a constituent of potential concern (COPC). Otherwise, the constituent is considered unlikely to pose unacceptable risk to any human receptor.
- COPCs are further evaluated through a risk-based assessment which evaluates site-specific exposure pathways and receptors against generic ODEQ-provided RBCs.

Should constituents be identified that also exceed their generic, but exposure pathway- and receptor-specific RBCs, then the appropriateness of additional site-specific methods allowed

under the RBDM guidance document will be evaluated (e.g., the development of site-specific ARLs, etc.).[3]

7.2 Other Numeric Criteria

7.2.1 Background Metals

Analytical data will be compared with background concentrations established by the ODEQ[4,5]. ODEQ does not require cleanup for metals concentrations below default background concentrations. Background concentrations are used for screening data for metals in soil as part of the risk assessment.

7.2.2 Clean Fill Screening (Unrestricted Upland Disposal)

Analytical data for imported clean fill will be compared with CFSLs for upland sites established by the ODEQ[6]. ODEQ does not require materials in which contaminant concentrations are less than or equal to CFSLs to be regulated as a solid waste. Rather, these materials may be place at upland locations which are greater than 1,000 feet from a surface water body. CFSLs are used to determine if impacts to soil may require future management and are not used for risk screening.

Please Note: CFSLs do not constitute rulemaking by the Environmental Quality Commission and may not be relied upon to create an enforceable right or benefit, substantive or procedural, enforceable at law or in equity, by any person. Therefore, CFSLs should be considered as general guidance only for best practices during future development of the subject site.

8.0 DESCRIPTION OF REMEDIAL ACTIONS

The scope of work (SOW) proposed in this Remedial Action Work Plan is intended to conform to acceptable remedial actions for properties in the KFF site as defined in the ROD. The SOW includes a combination of remedial approaches, including:

- Additional Surface Soil Characterization
- Excavation and Offsite Disposal
- Consolidation and Capping
- Confirmation soil sampling

Incremental sampling methodology (ISM) will be used for additional characterization sampling and for confirmation that remedial action objectives have been met in soil 0-3 feet bgs Each of

[3] ODEQ, October 2017. Revised RBDM Data Table.

[4] ODEQ, March 2013. Development of Oregon Background Metals Concentrations in Soil: Technical Report, Land Quality Division Cleanup Program.

[5] ODEQ, October 28, 2002. Default Background Concentrations for Metals, Memo from Toxicology Workgroup to DEQ Cleanup, Table 1 – Oregon DEQ Suggested Default Background Concentrations for Inorganic Contaminants in Various Environmental Media.

[6] ODEQ, July 2014. Clean Fill Determinations: Internal Management Directive, last updated July 23, 2014, by Bill Mason. Clean Fill Table for Uplands last updated by Bill Mason, ODEQ-Eugene, June 10, 2014.

the residential tax lots, tracts of land, and roadways comprising TL300 will be designated as a decision unit (DU). ISM consists of collecting many small increments of soil (grab samples) from a given DU, and compositing them into one larger sample. The relatively large soil sample is thoroughly homogenized and subsampled in the laboratory. The resulting contaminant concentrations represent the average concentration for the entire DU. This sampling procedure will minimize effects of heterogeneity (micro scale and short scale) in the soil to provide a more accurate representation of average contaminant concentrations within each DU. A stainless-steel push probe will be used for sample collection and will be decontaminated between each DU. Confirmation sampling will occur at each of the proposed residential parcels prior to placement of fill, cover, and or site improvements.

Thirty (30) to fifty (50) sample increments collected from 0.0 to 0.5 foot and 2 to 3 feet below ground surface (bgs) will comprise each incremental sample (IS). Additionally, two (2) replicates will be collected from one of the DUs for Quality Assurance / Quality Control (QA/QC) purposes. Following sample collection, each IS will be further processed at the analytical laboratory (dried, sieved, subsampled, etc.) and analyzed for the COC identified at the site. Soil sample results will be evaluated relative to the cleanup goals identified in Section 1.2. Once all the data have been gathered, they will be evaluated in a report in support of site regulatory closure.

All laboratory subsampling and sample preparations will be conducted in accordance with EPA's *Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples* (EPA, 2003).

Records shall be kept of all field activities and observations. Records shall include samples collected, samplers involved with each sample, time, weather, and observations concerning materials textures, colors, odors, and other relevant data. All record-keeping shall be performed in appropriate field books or clipboards with appropriate forms. All field records will be kept secure always.

8.1 Pre-Field Activities

Prior to initiating remedial activities:

- A site-specific Health and Safety Plan will be developed.
- The contractor will ensure and plan for all work to be performed by employees and subcontractors trained and licensed to work with hazardous materials according to federal Hazardous Waste Site Operations (HAZWOPER) under 40 Code of Federal Regulations (CFR) 1910.120.
- A utility clearance will be obtained for all proposed land disturbing activities prior to work initiation.
- Ensure all necessary permits required by the City and ODEQ have been obtained.

8.2 Additional Soil Characterization Sampling

Prior to development of a 90% Submittal, ISM will be used to additionally characterize soil at each of the proposed residential tax lots and proposed tracts of land comprising the proposed development.

8.2.1 Incremental Sampling Locations

The locations targeted for sampling within each DU will correspond to the future residential lots, tracts and roadways for the planned development. Decision units will be divided into a grid pattern of approximately 30 to 50 grids each. Increments (grab samples of equal mass) will be collected from the center node of each increment grid (grid-center systematic sampling) resulting in collection of 30 to 50 increment samples from each of the DUs. Grid locations will be distributed evenly within the DUs to ensure that the entire decision unit population was equally represented in the final multi-increment samples.

8.2.2 Incremental Sampling Depth

Increment samples from each DU will be collected from 0 to 0.5 feet below the ground surfaces and 2 to 3 feet below the ground surfaces (or above the bedrock surface, if encountered prior to this depth interval).

8.2.3 Decision Unit Replication

Two replicates that are independent from the original incremental sampling locations (center node of each grid) will be collected within one of the DUs, one set from each depth interval (two sets of replicates). Each replicate will consist of 30 to 50 increments, and each increment will be collected within one of the 30 to 50 grids. To achieve independence, the replicate samples will be collected away from the initial sample at random locations in each grid.

8.2.4 Laboratory Sub-Sampling and Compositing

The increments collected from each DU, including the two replicates, will be dried, sieved, sub-sampled and composited at the laboratory, and one ISM sample per DU will be analyzed, plus replicates. An ISM sub-sampling and compositing standard operating procedure prepared by Friedman & Bruya, Inc. (F&BI) of Seattle, Washington (Attachment 2).

8.2.5 Sample Labeling and Handling

Samples collected for laboratory analysis will be transferred using fresh nitrile (or other appropriate composition) sampling gloves and placed in an appropriate sample container provided by the laboratory so that minimal headspace remains.

The samples will be labeled as follows:

- Sample Designation, or Identification
- Location
- Date and time of collection
- Medium
- Project number
- Name of sampler(s)
- Analysis required
- Preservation (if applicable)

Samples will be immediately placed in cooled storage until they are delivered to F&BI. Chain-of-custody protocols will be followed.

8.2.6 Laboratory Analysis

The target COC for this investigation is Cr(VI). The samples will be analyzed according to the Analysis Plan shown in Table 8-1.

Table 8-1. Analysis Plan

Analytical Method	Constituents	Soil
EPA 7196	Hexavalent chromium	DU Samples
Standard Methods	pH	Select discrete samples

EPA = US Environmental Protection Agency

Sample containers, preservatives, and holding times for each analytical method are provided in Table 8-2.

Table 8-2. Analytical Protocol

Analyte(s)	Analytical Method	Container and preservative	Laboratory MDL (mg/Kg)	Holding time	Preservation
Soil:					
Hexavalent chromium	EPA Method 7196	8-oz Clear wide mouth glass, minimum headspace	0.2	14-days	ice

8.3 Excavation and Off-Site Disposal of Soils

The RAOs are to remove all Cr(VI)-impacted soil exceeding 0.3 mg/Kg from areas to be developed with residential structures, to removal all Cr(VI)-impacted soil exceeding 2.6 mg/Kg from areas to be developed as open tracts, and to removal all Cr(VI)-impacted soil exceeding 49 mg/Kg from areas to be developed with roadways.

8.3.1 Soil Excavation

Contaminated soils containing Cr(VI) will be excavated, as appropriate based on final development designs, under the supervision of a registered Oregon geologist. Depth of excavation will be determined based on future development plans such that RAOs are achieved (no institutional controls on parcels to be developed with residential dwellings). Contaminated soils will be excavated as necessary below the original grade level, or until the bedrock surface is encountered. Confirmation data (Section 8.5) will be used to determine if depth of soil excavation successfully removed impacted soils, or if further excavation is warranted to meet RAOs. Additionally, during excavation, soils will be field screened for total chromium (Cr[III]+Cr[VI]) using an X-ray fluorescence meter (XRF) to determine if highly-enriched concentration of total chromium in soil is present (indicator of possible enrichment of Cr(VI). Visual observation for

evidence of high levels of Cr (green, greenish gray, or greenish yellow typical, waste remnants, etc.) will also be utilized in the field to determine appropriate depth of excavation. Soil lithology, field screening results, and other observations during excavation will be recorded into a field notebook maintained by the field geologist.

8.3.2 Soil Disposal

Excavated contaminated soils may be direct-loaded onto awaiting dump trucks and transported for disposal to Waste Management's Hillsboro landfill. The Hillsboro landfill is permitted to accept the type of soil that would be excavated from the KFF site (RCRA Subtitle D landfill). Prior to acceptance of the material, a soil profile based on testing results will be provided to the landfill.

8.4 Soil Consolidation and Protective Cover

This cleanup option has elements of both excavation and capping and may utilize the existing onsite engineered soil cell. Waste soils excavated may be consolidated in open space tracts of land and then covered with a protective layer of soil with vegetation (Section 8.4.1).

8.4.1 Description of Surface Soil Consolidation Cells

Following preparation of a site development plan, further information will be provided that details the location of soil consolidation cells, as applicable. Soils that have been consolidated will be covered. Based on DEQ RI data, none of the previously sampled locations of surface soil had concentrations of Cr(VI) above 2.6 mg/kg and therefore, soil placed in consolidation cells, and residual soil in excavated tract areas, will likely meet the RAO for open-space. This will be verified through testing after placement of site soil in a consolidation cell, and on residual surfaces of excavated tracts, prior to placement of protective cover. Although potential risk to open-space users would be addressed (provided the results are below 2.6 mg/kg), the expression (appearance) of visually contaminated soil or of decomposed tannery waste due to long-term erosion or rodent activity remains a concern. To address this concern, JT Roth will not place visually contaminated soil (i.e., green, yellow, white or buff colored material, leather scraps, or bone fragments) within the upper 1-foot of soil relocated to a consolidation cell. With the addition of a 1-foot cover over all sides of the tract there would be a total of two (2) feet of soil with no visual indications of tannery waste. Because the bottom of this (2-foot) interval would be below the typical depth of burrowing gophers or voles, this will address the concern of tannery waste being brought to the surface by burrowing animals. In addition, the one (1)-foot soil cover will be engineered for long term stability, which may include compaction, vegetation, shoring, and adequate drainage, to prevent exposure of underlying impacted soil and potential impacts to the downslope riparian zone and wetland.

Clean fill soil to be imported to the site have not been identified at this time; however, any clean fill material imported to the site as cap material will be tested to ensure concentrations of total chromium and lead are at or below ODEQ's default background soil concentrations for the South Willamette Valley, as defined in their Clean Fill Determination Guidance. Soil with contaminant concentrations at or below the clean fill guidelines will be considered suitable for use as capping material.

8.4.2 Additional Protective Surface Cover

All areas outside of the tracts will also be covered with a surface cover to ensure that residents are not exposed to residual tannery waste. The cover will be a minimum one-foot of clean soil in areas not otherwise overlain by hardscaping (e.g., interior public and private streets, concrete sidewalks and driveways and house foundations). In areas overlain by hardscape, the hardscaping will be considered the protective surface cover.

8.5 Confirmation Soil Sampling

ISM will be used for sampling remediated areas to verify that cleanup objectives have been met. Where impacted soils are left in place, sufficient soil samples will be collected to estimate the lateral and vertical extent and volume of impacted soil left in place. If soil is excavated to the bedrock surface, then additional soil testing would not be required in those areas.

8.5.1 Incremental Sampling Locations

The locations targeted for sampling in DUs will correspond to each future residential lot, each undeveloped tract of land, and each roadway segment. Each decision unit will be divided into a grid pattern of approximately 50 grids each. Increments (grab samples of equal mass) will be collected from the center node of each increment grid (grid-center systematic sampling) resulting in collection of 50 increment samples from each of the DUs. Grid locations will be distributed evenly within the decision units to ensure that the entire decision unit population was equally represented in the final multi-increment samples.

8.5.2 Incremental Sampling Depth

Increment samples from each decision unit will be collected from 0 to 0.5 feet below the excavated surfaces and 2 to 3 feet below the excavated surfaces (or above the bedrock surface, if encountered prior to this depth interval).

8.5.3 Decision Unit Replication

Two replicates that are independent from the original incremental sampling locations (center node of each grid) will be collected within one of the decision units from both depth intervals (two sets of replicates). Each replicate will consist of 50 increments, and each increment will be collected within one of the 50 grids. To achieve independence, the replicate samples will be collected away from the initial sample at random locations in each grid.

8.5.4 Laboratory Sub-Sampling and Compositing

The increments collected from each decision unit, including the two replicates, will be dried, sieved, sub-sampled and composited at the laboratory, and one ISM sample per DU will be analyzed, plus replicates. An ISM sub-sampling and compositing standard operating procedure prepared by Friedman & Bruya, Inc. (F&BI) of Seattle, Washington, is included as Attachment 2.

8.5.5 *Sample Labeling and Handling*

Samples collected for laboratory analysis will be transferred using fresh nitrile (or other appropriate composition) sampling gloves and placed in an appropriate sample container provided by the laboratory so that minimal headspace remains.

The samples will be labeled as follows:

- Sample Designation, or Identification
- Location
- Date and time of collection
- Medium
- Project number
- Name of sampler(s)
- Analysis required
- Preservation (if applicable)

Samples will be immediately placed in cooled storage until they are delivered to F&BI. Chain-of-custody protocols will be followed.

8.5.6 *Laboratory Analysis*

The target COC for this investigation is Cr(VI). The samples will be analyzed according to the Analysis Plan shown in Table 8-1.

Sample containers, preservatives, and holding times for each analytical method are provided in Table 8-2.

8.6 Project Completion (Construction Completion) Report

At the completion of the remedial action construction phases, a final inspection and draft Project Completion Report will be prepared for ODEQ review and comment. A final Project Completion Report will be submitted for ODEQ approval addressing ODEQ's comments on the draft report. The Project Completion Report will include at a minimum:

- Results of the final inspection, including a brief description of any problems discovered during the final inspection and the resolution of those problems, as necessary.
- A summary of work conducted in accordance with the approved plans and specifications, as-builts showing the extent of hardscapes, buildings and placement of surface soil cover, and certification by an Oregon-Registered Professional that the work was performed in accordance with all plans and specifications;
- Explanation of any modifications to the approved plans and specifications, and why these modifications were necessary;
- Copy of final permits, as necessary;

- Results of confirmation soil sampling, including data validation, and certification that the required remedial action criteria have been attained, and/or sampling results verifying that the remediation performs according to design specifications;
- Explanation of any additional inspections, operation, and maintenance activities to be undertaken at the site;
- Unique tax lot identification for sub-divided lots that have been remediated.
- Locations of areas that require engineering and/or institutional controls.
- As-built drawings.

9.0 DESIGN OBJECTIVES

Remedial action design objectives are as follows:

- To perform the remedial action efficiently and cost-effectively, without interfering with or otherwise affecting the condition and construction operations at the property.
- To perform the field work in a safe manner for technical and construction personnel.
- To document information and data generated under this Remedial Action Work Plan that is valid for the intended use.
- To have the final implemented remedy meet the RAOs (see Table 1-1).

10.0 APPLICABLE FEDERAL, STATE OR LOCAL LAWS

The following laws applicable to the proposed scope of work have been identified. All entities listed in Table 5-1 are responsible for adhering to all federal, state and local laws and ensuring that any subcontractors do so as well.

Federal:
NPDES 1200-C (Construction Storm Water Permit):

- Title 40 Code of Federal Regulations (CFR) §122.26; §122.28; §123.25; §450.21
  - How Incorporated into Remedial Design and Implementation: Required because more than one acre is being disturbed, and regulates how construction storm water shall be managed.
- Non-Hazardous and Hazardous Waste:
  - Title 40 CFR §258; §260, §261.2, §261.3, §261.4, §261.6, §261.7, §261.8, §261.9, §262, and §263
    - How Incorporated into Remedial Design and Implementation: Governs the identification, management and disposal of non-hazardous and hazardous wastes apply to the management of landfilled debris removed while constructing the buttress fill slope. These regulations also pertain to the management of construction and demolition debris generated during implementation of the remedial action.

- Hazardous Waste Operations (HAZWOPER):
  - Title 40 CFR 1910.120(a)(1)(i-v) and 1926.65(a)(1)(i-v)
    - How Incorporated into the Remedial Design and Implementation: applies to groups of employers and employees who are conducting remedial actions at the subject site; provides guidelines for the proper level of training for workers constructing the buttress fill slope; provides guidance for developing a Health and Safety Plan with instructions on how to recognize and avoid physical and chemical hazards that may exist at the site; and details instructions for responding to a chemical or medical emergency.

State of Oregon:

- Hazardous Substance Remedial Action Rules
  - 340-122-0010 to 340-122-0090
    - How Incorporated into the Remedial Design and Implementation: Authority delegated to the state that governs the identification, management and disposal of non-hazardous and hazardous wastes apply to the management of landfilled debris removed while constructing the buttress fill slope. These regulations also pertain to the management of construction and demolition debris generated during the remedial action.
- Hazardous Waste:
  - Oregon Administrative Rules (OAR) 340-100-0010(2)(ee); 340-101-0004; 340-101-0033; 340-102-0011
    - How Incorporated into the Remedial Design and Implementation: Provides environmental cleanup rules that govern the design, selection, approval and implementation of the selected remedial action at the subject site.

City (Sherwood):

- Buildings and Construction
- Land Development Code

11.0 PERMITTING REQUIREMENTS

See 3.1.3.

12.0 OFF-SITE DISPOSAL

Any soil removed from the site shall be taken to a RCRA Subtitle D landfill, such as Waste Management's Hillsboro Landfill in Hillsboro, Oregon. Once the waste profile is approved, Waste Management will provide a Waste Authorization Manager (WAM) approval, which must be presented by the waste hauler driver at the landfill gate.

13.0 SITE ACCESS

As we understand, no access agreements are required for the remedial action work.

14.0 PILOT STUDIES

No pilot studies are necessary for this remedial action.

15.0 ADDITIONAL SAMPLING

See Sections 8.2 and 8.5.

16.0 PROPERTY SURVEYS

A property survey will be included in the 90% submittal.

17.0 DESIGN AND IMPLEMENTATION PROBLEMS

No design or remedial action implementation problems are anticipated.

18.0 ENGINEERING AND INSTITUTIONAL CONTROLS

Based on the RAOs for this project, no engineering controls are anticipated to be needed to achieve protective conditions. However, if residual contamination is above applicable ARLs, an institutional control such as an engineered soil cap requiring maintenance may be required by ODEQ.

ODEQ will record a Notice of No Further Action on the deed for each residential lot or tract requiring engineering or institutional controls.

It is anticipated that this work will be performed under terms of a Prospective Purchaser Agreement in the form of a consent judgment. The consent judgment will be recorded on the property, as required for Prospective Purchaser Agreements. A Certification of Completion will be requested following completion of the consent judgment scope of work. The Certification of Completion also would be recorded on the property deed to memorialize the liability release and other legal protections that run with the land, and long term cap maintenance if applicable

19.0 CONSTRUCTION METHODS AND EQUIPMENT

Construction will employ the use of the following types of equipment:

- Excavators, dozers, scrapers, front end loaders, and graders
- Dump trucks, and support trucks
- Power tools, sensors and meters
- Various hand tools

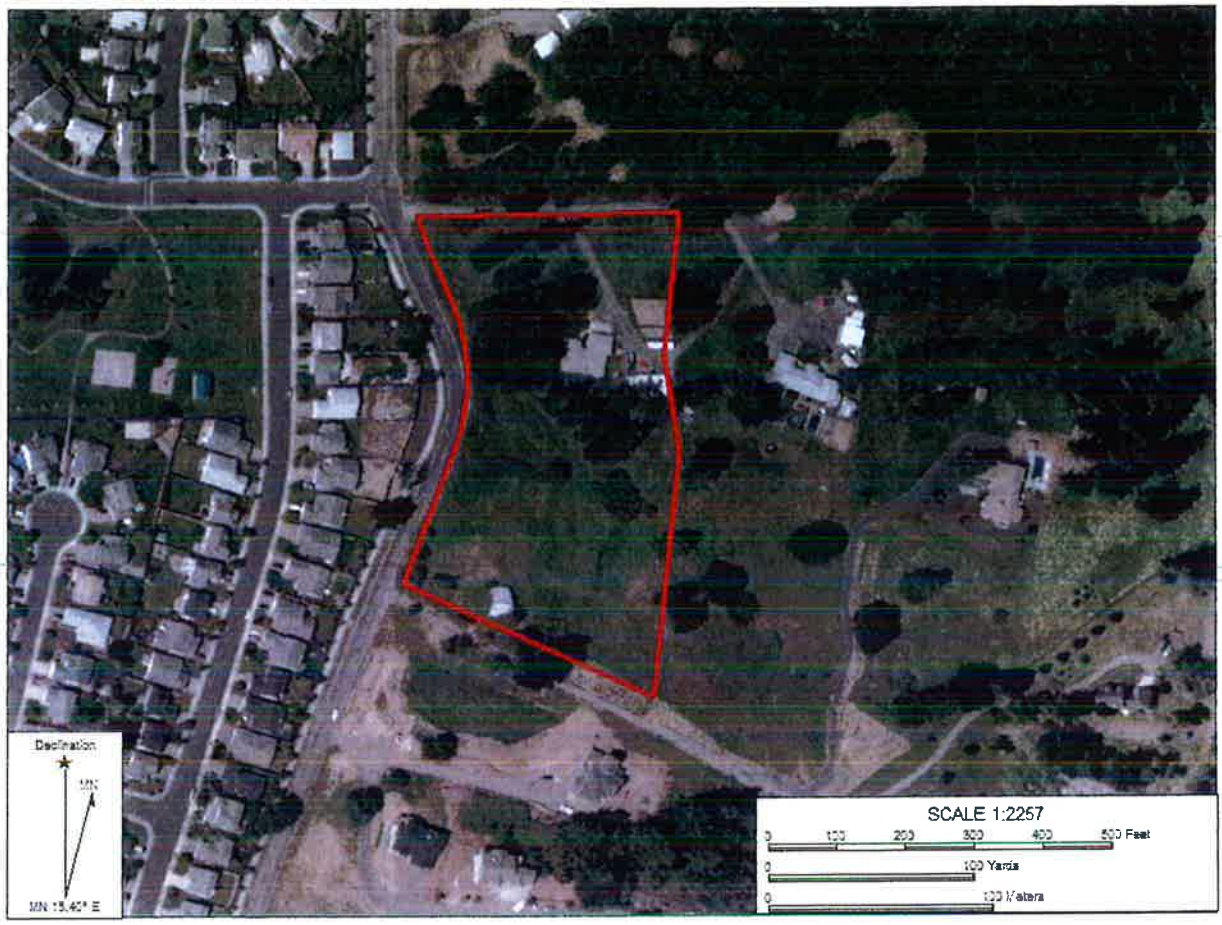
20.0 DOCUMENTATION AND VALIDATION OF REMEDIAL ACTIONS

Creekside will observe and document site grading, removal and consolidation actions. To cover the key intervals of each construction phase, Creekside will coordinate site visits with ownership to observe and document key transitions or activities in each phase of construction. Detailed field

notes of construction work and supporting photographs will be taken during each site visit. These notes and photographs will be compiled into field reports for distribution to ownership and ODEQ on a weekly basis. Work conducted on the dates of each site visit, personnel/contractor/utility performing work, location of soil grading, soil and water management and disposal, summary of testing results, waste disposal receipts and maps/photos of work will be submitted.

This information, along with a post-construction elevation survey, will be used to develop a set of as-built plans for the development. These as-builts will be the basis for confirming that the grading was completed as specified, and furthermore, that minimum surface cover requirements have been maintained over the entire footprint of the subject site. The as-built drawings and a summary of remedial action construction will be presented in a final RD/RA Installation Report.

FIGURES

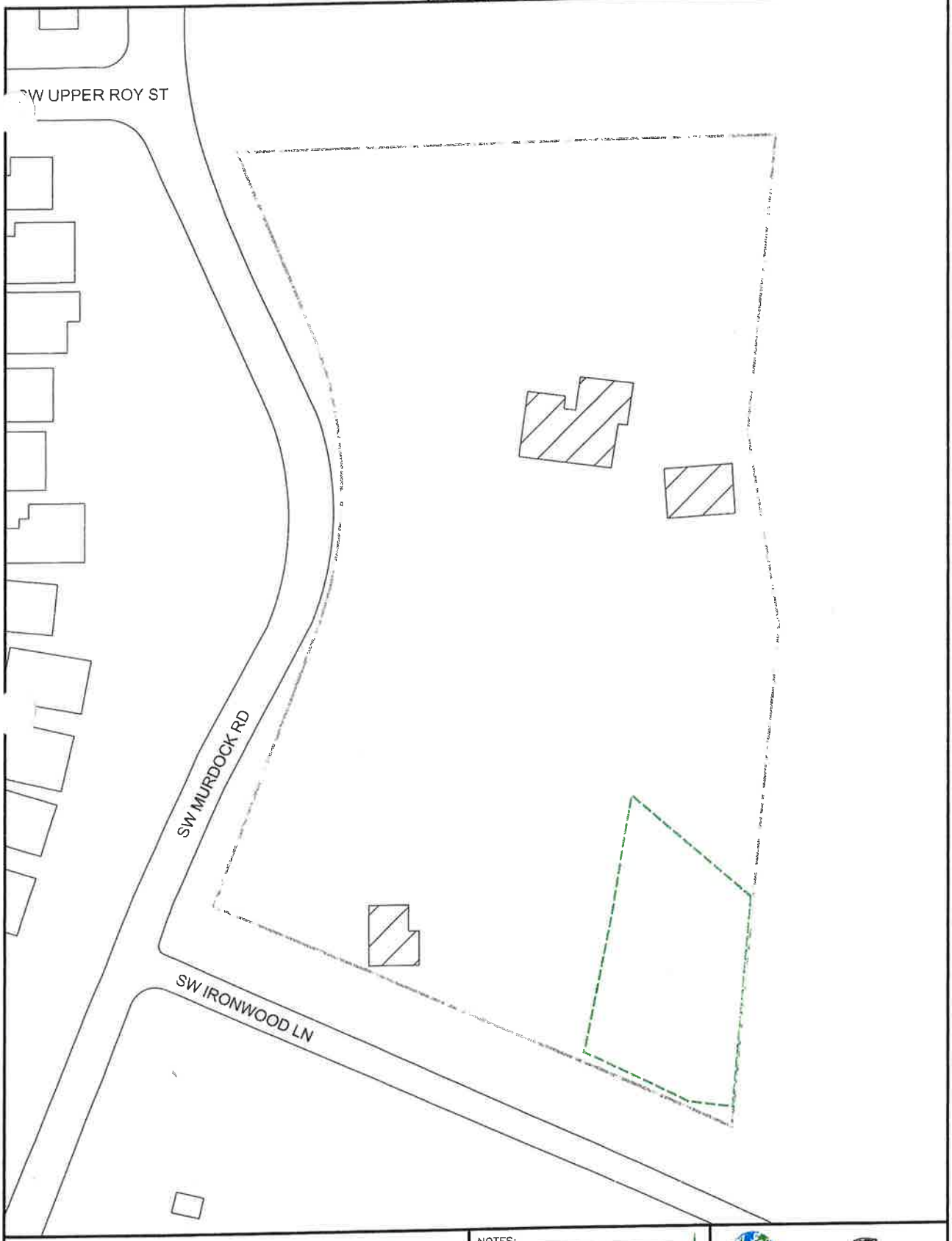


Quadrangle, 1/4, 1/4: SHERWOOD NW, OR
Date: Jun 30, 2014

Location: 045.352323° N, 122.824674° W

	Date Drawn: 6/27/2017 CAD File Name: 351-17028-01-fig1ev_map(v01) Drawn By: JOB Approved By: LDG	Former Ken Foster Farms 23000 SW Murdock Road Sherwood, Oregon	**Site Vicinity Map**	Project No. 351-17028-02 Figure No. **1**

DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
J. BIGELOW	06/15/2017	P. TRONE	06/15/2017	L. GREEN	06/15/2017	351-17028(v01)



LEGEND:

- SUBJECT BUILDINGS
- SUBJECT PROPERTY BOUNDARIES
- BUILDING LOCATIONS
- ENGINEERED SOILS

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH MAP DATED 2015 AND ENW FIELD NOTES.
2. ALL BUILDING, STREET, AND FEATURE LOCATIONS ARE APPROXIMATE.
3. SYMBOLS REPRESENT LOCATION AND DO NOT ALWAYS REPRESENT EXACT SHAPE, SIZE, OR ORIENTATION

N

APPROXIMATE SCALE

0 40 80 FEET

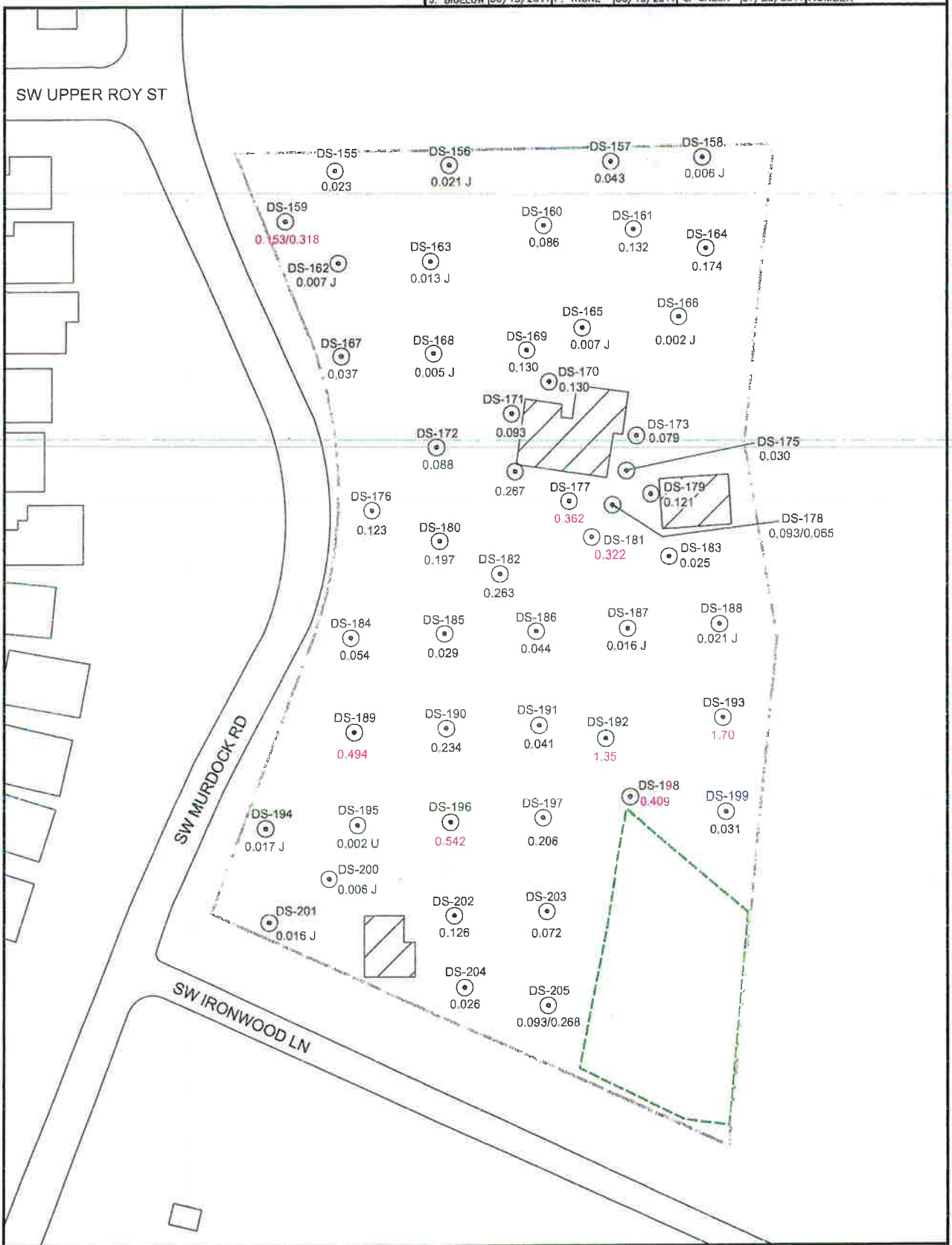
EVREN NORTHWEST INC.
environmental cultural resource consultants
PO BOX 14488, PORTLAND, OREGON 97293
P: (503)452-5561, E: ENW@EVREN-NW.COM

FIGURE 2

SITE PLAN

FORMER KEN FOSTER FARMS
23000 SW MURDOCK ROAD
SHERWOOD, OREGON

DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
J. BIGELOW	08/15/2017	P. TRONE	08/15/2017	L. GREEN	07/25/2017	351-17028(v01)



LEGEND:

- SUBJECT BUILDINGS
- SUBJECT PROPERTY BOUNDARIES
- BUILDING LOCATIONS
- APPROXIAMTE LOCATON OF ENGINEERED SOIL CELL
- DS-155 KENNEDY JENKS SAMPLE LOCATION

0.002 CrVI RESULTS

1.70 CrVI > RAO (0.30)

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH MAP DATED 2015 AND ENW FIELD NOTES.
2. ALL BUILDING, STREET, AND FEATURE LOCATIONS ARE APPROXIMATE.
3. SYMBOLS REPRESENT LOCATION AND DO NOT ALWAYS REPRESENT EXACT SHAPE, SIZE, OR ORIENTATION
4. J = THE INTERNAL STANDARD ASSOCIATED WITH THE ANALYTE IS OUT OF CONTROL LIMITS. THE REPORTED CONCENTRATION IS AN ESTIMATE.

APPROXIMATE SCALE

0 40 80 FEET

EVREN NORTHWEST
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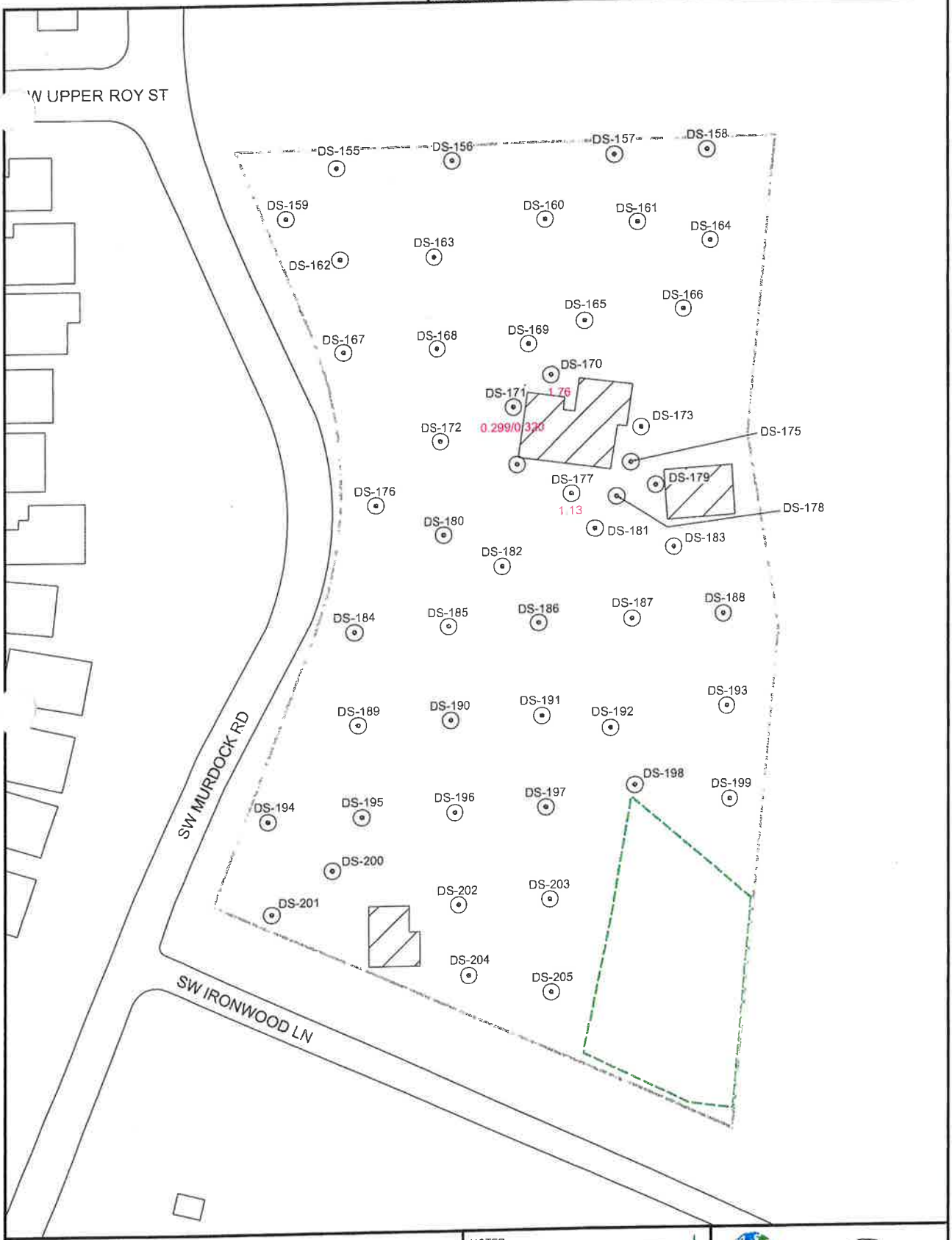
FIGURE 3

SURFACE SOIL SAMPLE LOCATION DIAGRAM
(CHROMIUM VI RESULTS)

FORMER KEN FOSTER FARMS
23000 SW MURDOCK ROAD
SHERWOOD, OREGON

DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
J. BIGELOW	06/15/2017	P. TRONE	06/15/2017	L. GREEN	07/25/2017	351-17028(v01)



LEGEND:

- SUBJECT BUILDINGS
- SUBJECT PROPERTY BOUNDARIES
- BUILDING LOCATIONS
- APPROXIMATE LOCATION OF ENGINEERED SOIL CELL
- DS-155 KENNEDY JENKS SAMPLE LOCATION
- 0.002 CrVI RESULTS
- 0.002 CrVI > RAO (0.30)

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH MAP DATED 2015 AND ENW FIELD NOTES.
2. ALL BUILDING, STREET, AND FEATURE LOCATIONS ARE APPROXIMATE.
3. SYMBOLS REPRESENT LOCATION AND DO NOT ALWAYS REPRESENT EXACT SHAPE, SIZE, OR ORIENTATION.
4. J = THE INTERNAL STANDARD ASSOCIATED WITH THE ANALYTE IS OUT OF CONTROL LIMITS. THE REPORTED CONCENTRATION IS AN ESTIMATE.

APPROXIMATE SCALE

0 40 80 FEET

EVREN NORTHWEST INC
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FIGURE 4

SUBSURFACE SOIL SAMPLE LOCATION DIAGRAM
(CHROMIUM VI RESULTS)

FORMER KEN FOSTER FARMS
23000 SW MURDOCK ROAD
SHERWOOD, OREGON

ATTACHMENT 1

Risk-Based Calculations: Open-Space User

RISK-BASED CONCENTRATIONS

CAS	Chemical	Key	Res. RBCss	Note	Urban Res. RBCss	Note	Occ. RBCss	Note	Constr. Worker RBCss	Note	Excav. Worker RBCss	Note	Res. RBCso	Note	Urban Res. RBCso	Note	Occ. RBCso	Note	Res. RBCsi	Note	Urban Res. RBCsi	Note	Occ. RBCsi	Note	Res. RBCsw	Note	Urban Res. RBCsw	Note	Occ. RBCsw	Note
Contaminated Medium →			Soil mg/kg (ppm)										Soil mg/kg (ppm)						Soil mg/kg (ppm)						Soil mg/kg (ppm)					
Exposure Pathway →			Soil Ingestion, Dermal Contact, and Inhalation RBCss										Volatilization to Outdoor Air RBCso						Vapor Intrusion into Buildings RBCsi						Leaching to Groundwater RBCsw					
Receptor Scenario →			Residential		Urban Residential		Occupational		Construction Worker		Excavation Worker		Residential		Urban Residential		Occupational		Residential		Urban Residential		Occupational		Residential		Urban Residential		Occupational	
Direct or Indirect Pathway (see notes)			DOS		DOS		DOS		DOS		DOS		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
83-32-9	Acenaphthene	nc, v	7,300	>Csat	9,400	>Csat	76,000	>Csat	21,000	>Csat	560,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat
107-13-1	Acrylonitrile	c, v	2.1		2.6		4.0		40		1,100		5.1		12		6.9		0.31		0.72		1.8		0.0013		0.0016		0.0017	
309-00-2	Aldrin	c, v	0.030		0.078		0.13		1.1		39	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	0.085		0.10		0.10	
120-12-7	Anthracene	nc, v	38,000	>Csat	47,000	>Max	340,000	>Csat	110,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat
7440-38-2	Arsenic	c, nv	0.87		1.0		1.9		15		420		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
7440-39-3	Barium	nc, nv	20,000		31,000		220,000		69,000		-	>Max	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
56-55-3	Benz(a)anthracene	c, v	1.2		0.34		2.9		24	>Csat	640	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	3.4		2.3		4.5	
71-43-2	Benzene	c, v	20		24		37		380		11,000	>Csat	46		110		88		0.82		1.8		3.1		0.085		0.10		0.10	
92-87-5	Benzidine	c, nv	0.0044		0.0012		0.0100		0.082		2.2		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.00023		0.00012		0.00070	
50-32-8	Benzo(a)pyrene (BaP equivalents)	c, nv	0.13		0.034		0.28		2.4		87	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	3.8		1.8		-	>Csat
205-99-2	Benzo(b)fluoranthene	c, nv	1.3		0.34		2.9		24	>Csat	670	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
207-08-9	Benzo(k)fluoranthene	c, nv	13	>Csat	3.4		29	>Csat	240	>Csat	6,700	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
7440-41-7	Beryllium	c, nv	6,600		7,300		6,700		170,000		-	>Max	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
117-81-7	Bis(2-ethylhexyl)phthalate	c, nv	88		97		190	>Csat	1,300	>Csat	37,000	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
75-27-4	Bromodichloromethane	c, v	10		12		14		220		6,300	>Csat	8.4		22		11		0.16		0.37		0.52		0.0016		0.0021		0.0021	
75-25-2	Bromoform	c, v	140		170		260		2,700	>Csat	74,000	>Csat	320		750		380		32		76		110		0.17		0.20		0.22	
74-83-9	Bromomethane	nc, v	77		88		780		390		10,000	>Csat	690		680		760		5.2		5.2		17		0.14		0.13		0.40	
7440-43-9	Cadmium	c, nv	8,000		5,700		8,000		220,000		-	>Max	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
56-23-5	Carbon tetrachloride	c, v	17		21		34		320		8,800	>Csat	53		140		65		0.47		1.1		1.8		0.047		0.065		0.066	
108-90-7	Chlorobenzene	nc, v	880	>Csat	1,160	>Csat	5,700	>Csat	4,300	>Csat	120,000	>Csat	-	>Csat	-	>Csat	-	>Csat	200		300		-	>Csat	5.5		9.4		27	
124-48-1	Chlorodibromomethane (dibromochloromethane)	c, v	10		12		17		270		8,800	>Csat	13		31		14		0.97		2.1		2.9		0.0099		0.011		0.011	
75-00-3	Chloroethane (ethyl chloride)	nc, v	270,000	>Csat	320,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat	620		480		1,300	
67-66-3	Chloroform	c, v	18		22		29		410		11,000	>Csat	15		36		17		0.12		0.29		0.41		0.013		0.016		0.015	
74-87-3	Chloromethane	nc, v	2,400	>Csat	2,900	>Csat	25,000	>Csat	25,000	>Csat	790,000	>Csat	-	>Csat	-	>Csat	-	>Csat	84		86		300		3.8		3.4		8.1	
12789-03-6	Chlordane	c, v	3.8		4.2		7.4		61	>Csat	1,700	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	1.7		2.1		2.1	
16065-83-1	Chromium (III)	nc, nv	280,000		236,000		-	>Max	530,000		-	>Max	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
18540-29-9	Chromium (VI)	c, nv	2.6		0.87		6.3		40		1,400		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
218-01-9	Chrysene	c, nv	130	>Csat	34	>Csat	280	>Csat	2,400	>Csat	67,000	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
7440-50-8	Copper	nc, nv	6,300		6,200		47,000		14,000		380,000		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
74-90-8	Cyanide (hydrogen cyanide) *	nc, nv	75		84		700		210		5,800		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
72-54-8	DDD (4,4'-Dichlorodiphenyldichloroethane)	c, nv	4.6		6.6		12		96		2,800	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	4.7		4.7		3.9	
72-55-9	DDE (4,4'-Dichlorodiphenyldichloroethylene)	c, v	3.8		4.5		8.2		68		1,900		-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	6.1		7.4		7.5	
50-29-3	DDT (4,4'-Dichlorodiphenyltrichloroethane)	c, nv	3.8		4.8		8.6		67		1,800	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	36		40		70	
53-70-3	Dibenz(a,h)anthracene	c, nv	0.13		0.034		0.29		2.4		87	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
95-50-1	1,2-Dichlorobenzene	nc, v	3,700	>Csat	4,400	>Csat	38,000	>Csat	20,000	>Csat	680,000	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	81		88		180	
106-46-7	1,4-Dichlorobenzene	c, v	97		82		84		1,300	>Csat	38,000	>Csat	32		75		36		3.9		5.1		13		0.38		0.27		0.25	
91-94-1	3,3-Dichlorobenzidine	c, nv	2.6		3.0		5.1		42	>Csat	1,200	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.58		0.67		1.00	
75-34-3	1,1-Dichloroethane	c, v	160		180		280		3,200	>Csat	93,000	>Csat	220		510		240		18		42		61		0.16		0.20		0.20	
75-35-4	1,1-Dichloroethene	nc, v	2,900	>Csat	3,500	>Csat	20,000	>Csat	13,000	>Csat	370,000	>Csat	-	>Csat	-	>Csat	-	>Csat	210		210		690		11		11		30	
156-59-2	cis-1,2-Dichloroethene	nc, v	280		310		2,300	>Csat	730	>Csat	20,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	1.1		1.6		4.5	
156-60-5	trans-1,2-Dichloroethene	nc, v	2,800	>Csat	3,100	>Csat	23,000	>Csat	7,100	>Csat	200,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	12		12		41	
111-44-4	Dichloroethyl ether	c, v	0.80		0.64		1.3		18		480		2.1		4.3		6.9		2.1		4.9		4.9		0.00071		0.00067		0.00067	
75-09-2	Dichloromethane	c, v	650		170		1,800		12,000	>Csat	240,000	>Csat	-	>Csat	-	>Csat	-	>Csat	140		280		880		0.79		0.44		2.4	
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	nc, nv	1,100	>Csat	1,300	>Csat	8,200	>Csat	2,700	>Csat	74,000	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	3.8		3.8		16	
60-57-1	Dieldrin	c, nv	0.070		0.084		0.14		1.2		33	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.041		0.037		0.030	
606-20-2	2,6-Dinitrotoluene	nc, nv	32		38		280		80		2,200	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	1.7		1.6		7.9	
621-64-7	Di-N-propylnitrosamine (N-nitroso-di-N-propylamine)	c, nv	0.16		0.19		0.33		2.7		74		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.0031		0.0026		0.0054	
123-91-1	1,4-Dioxane	c, v	12		14		24		210		5,800		110		260		370		118		250		370		0.0081		0.0092		0.012	
86-30-6	Diphenylnitrosamine	c, nv	230	>Csat	280	>Csat	470	>Csat	3,800	>Csat	110,000	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	36		39		46	
106-93-4	EDB (1,2-dibromoethane)	c, v	0.44		0.53		0.73		9.8		290		0.68		1.6		0.64		0.047		0.11		0.16		0.00048		0.00044		0.00056	
107-06-2	EDC (1,2-dichloroethane)	c, v	8.8		12		16		280		5,600	>Csat	13		38		18		0.30		0.71		1.0		0.011		0.013		0.013	
115-29-7	Endosulfan (alpha+beta)	nc, v	620	>Csat	750	>Csat	4,600	>Csat	1,600	>Csat	46,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat
72-20-8	Endrin	nc, nv	32	>Csat	38	>Csat	280	>Csat	90	>Csat	2,200	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
100-41-4	Ethylbenzene	c, v	83		110		160		1,700	>Csat	43,000	>Csat	140		-	>Csat	160		5.8		13		17		0.82		0.94		4.8	
206-44-0	Fluoranthene	nc, nv	4,800	>Csat	4,800	>Csat	30,000	>Csat	10,000	>Csat	280,000	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
86-73-7	Fluorene	nc, v	5,200	>Csat	6,200	>Csat	47,000	>Csat	14,000	>Csat	380,000	>Csat	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat
50-00-0	Formaldehyde	c, v	67		68		84		1,800		44,000	>Csat	180		440		600		180		440		630		0.0078		0.0087		0.0094	
76-44-8	Heptachlor	c, v	0.23		0.28		0.46		4.0		110		13		160		230		68		160		230		0.018		0.083		0.046	
1024-57-3	Heptachlor Epoxide	c, v	0.12		0.14		0.24		2.0		58		-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	0.016		0.018		0.016	
118-74-1	Hexachlorobenzene	c, v	0.68		0.67		0.83		11		320		3.9		9.3		13		2.9		8.3		13		0.011		0.060		0.044	
319-84-6	alpha-Hexachlorocyclohexane (alpha-HCH)	c, nv	0.18		0.21		0.36		3.0		83	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.023		0.026		0.025	
58-89-9	gamma-Hexachlorocyclohexane (Lindane)	c, nv	1.0		1.2		2.1		17		470	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.13		0.13		0.13	
67-72-1	Hexachloroethane	c, v	19		24		32		370		10,000	>Csat	32		75		38		2.3		8.3		7.5		0.020		0.024		0.027	
193-39-5	Indeno(1,2,3-cd)pyrene	c, nv	1.3	>Csat	0.34		2.9	>Csat	24	>Csat	670	>Csat	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-	>Csat	-	>Csat	-	>Csat
7439-92-1	Lead	UA, nv	400	L	400	L	800	L	800	L	800		L	NV	-	NV	-	NV	-	NV	-	NV	-	NV	30	L	30	L	30	L
7439-96-5	Manganese	nc, nv	3,600		3,600		29,000		8,300		230,000		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	

RISK-BASED CONCENTRATIONS

Medium →		GROUNDWATER (µg/L) Ingestion, Dermal & Inhalation from Tapwater RBC$_{tw}$						GROUNDWATER (µg/L) Volatilization to Outdoor Air RBC$_{wo}$					
Route →		Residential		Urban Residential		Occupational		Residential		Urban Residential		Occupational	
Direct or Indirect Pathway (see notes)		DCW		DCW		DCW		IWV		IWV		IWV	
Chemical	Key		Note		Note		Note		Note		Note		Note
Acenaphthene	nc, v	960		1,000		3,000		-	>S	-	>S	-	>S
Acrylonitrile	c, v	0.18		0.23		0.28		1,700		21,000		8,800	
Aldrin	c, v	0.0004		0.0042		0.0042		-	>S	-	>S	-	>S
Anthracene	nc, v	-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
Arsenic	c, nv	0.17		0.21		0.21		-	NV	-	NV	-	NV
Barium	nc, nv	4,700		6,300		33,000		-	NV	-	NV	-	NV
Benz(a)anthracene	c, v	0.064		0.043		0.17		-	>S	-	>S	-	>S
Benzene	c, v	1.7		2.0		2.1		12,000		28,000		14,000	
Benzidine	c, nv	0.00002		0.00004		0.0016		-	NV	-	NV	-	NV
Benzo(a)pyrene (BaP equivalents)	c, nv	0.022		0.011		0.044		-	NV	-	NV	-	NV
Benzo(b)fluoranthene	c, nv	0.29		0.11		0.44		-	NV	-	NV	-	NV
Benzo(k)fluoranthene	c, nv	-	>S	-	>S	-	>S	-	NV	-	NV	-	NV
Beryllium	c, nv	-	>S	-	>S	-	>S	-	NV	-	NV	-	NV
Bis(2-ethylhexyl)phthalate	c, nv	16		22		33		-	NV	-	NV	-	NV
Bromodichloromethane	c, v	0.61		0.82		0.65		8,200		12,000		6,000	
Bromoform	c, v	12		16		16		400,000		1,200,000		300,000	
Bromomethane	nc, v	13		13		39		120,000		170,000		130,000	
Cadmium	c, nv	-	>S	-	>S	-	>S	-	NV	-	NV	-	NV
Carbon tetrachloride	c, v	1.7		2.0		2.1		6,600		16,000		7,700	
Chlorobenzene	nc, v	120		120		280		-	>S	-	>S	-	>S
Chlorodibromomethane (dibromochloromethane)	c, v	0.83		0.77		0.77		16,000		36,000		17,000	
Chloroethane (ethyl chloride)	nc, v	28,000		33,000		93,000		-	>S	-	>S	-	>S
Chloroform	c, v	0.86		1.0		0.96		6,000		13,000		6,300	
Chloromethane	nc, v	310		280		780		1,700,000		1,700,000		1,800,000	
Chlordane	c, v	0.47		0.20		0.21		-	>S	-	>S	-	>S
Chromium (III)	nc, nv	20,000		47,000		200,000		-	NV	-	NV	-	NV
Chromium (VI)	c, nv	0.20		0.16		0.80		-	NV	-	NV	-	NV
Chrysene	c, nv	-	>S	-	>S	-	>S	-	NV	-	NV	-	NV
Copper	nc, nv	1,200		1,300		6,600		-	NV	-	NV	-	NV
Cyanide (hydrogen cyanide)	nc, nv	29		19		95		-	NV	-	NV	-	NV
DDD (4,4'-Dichlorodiphenyldichloroethane)	c, nv	0.13		0.13		0.074		-	NV	-	NV	-	NV
DDE (4,4'-Dichlorodiphenyldichloroethylene)	c, v	0.17		0.21		0.21		-	>S	-	>S	-	>S
DDT (4,4'-Dichlorodiphenyltrichloroethane)	c, nv	0.78		0.69		1.4		-	NV	-	NV	-	NV
Dibenz(a,h)anthracene	c, nv	0.029		0.011		0.044		-	NV	-	NV	-	NV
1,2-Dichlorobenzene	nc, v	370		480		1,400		-	>S	-	>S	-	>S
1,4-Dichlorobenzene	c, v	1.8		2.3		2.1		19,000		46,000		21,000	
3,3-Dichlorobenzidine	c, nv	0.27		0.60		1.0		-	NV	-	NV	-	NV
1,1-Dichloroethane	c, v	10		13		13		61,000		140,000		68,000	
1,1-Dichloroethene	nc, v	480		460		1,400		2,200,000		2,200,000		2,400,000	
cis-1,2-Dichloroethene	nc, v	81		80		240		-	>S	-	>S	-	>S
trans-1,2-Dichloroethene	nc, v	610		600		2,800		-	>S	-	>S	-	>S
Dichloroethylether	c, v	0.081		0.082		0.060		22,000		53,000		36,000	
Dichloromethane	c, v	48		37		200		6,400,000		7,900,000		1.3E+07	
2,4-Dichlorophenoxyacetic acid (2,4-D)	nc, nv	280		280		1,200		-	NV	-	NV	-	NV
Dieldrin	c, nv	0.0004		0.0001		0.0060		-	NV	-	NV	-	NV
2,6-Dinitrotoluene	nc, nv	6.3		8.1		42		-	NV	-	NV	-	NV
Di-n-propylnitrosamine (N-nitroso-di-n-propylamine)	c, nv	0.000		0.043		0.038		-	NV	-	NV	-	NV
1,4-Dioxane	c, v	1.8		2.0		2.4		3,200,000		7,000,000		4,500,000	
Diphenylnitrosamine	c, nv	44		48		57		-	NV	-	NV	-	NV
EDB (1,2-dibromoethane)	c, v	0.058		0.034		0.034		780		1,700		780	
EDC (1,2-dichloroethane)	c, v	0.54		0.78		0.76		8,200		18,000		9,000	
Endosulfan (alpha-beta)	nc, v	170		170		-	>S	-	>S	-	>S	-	>S
Endrin	nc, nv	3.4		4.1		9.6		-	NV	-	NV	-	NV
Ethylbenzene	c, v	5.9		5.7		6.4		38,000		91,000		43,000	
Fluoranthene	nc, nv	-	>S	-	>S	-	>S	-	NV	-	NV	-	NV
Fluorene	nc, v	310		560		1,300		-	>S	-	>S	-	>S
Formaldehyde	c, v	1.7		2.0		1.9		6,000,000		1.4E+07		8,500,000	
Heptachlor	c, v	0.0087		0.0081		0.0060		-	>S	-	>S	-	>S
Heptachlor epoxide	c, v	0.0084		0.0069		0.0063		-	>S	-	>S	-	>S
Hexachlorobenzene	c, v	0.097		0.046		0.046		-	>S	-	>S	-	>S
alpha Hexachlorocyclohexane (alpha HCH)	c, nv	0.025		0.026		0.027		-	NV	-	NV	-	NV
gamma-Hexachlorocyclohexane (Lindane)	c, nv	0.16		0.16		0.16		-	NV	-	NV	-	NV
Hexachloroethane	c, v	1.3		1.6		1.3		18,000		46,000		22,000	
Indeno(1,2,3-cd)pyrene	c, nv	-	>S	0.11		-	>S	-	NV	-	NV	-	NV
Lead	nc, nv	15	L	15	L	15	L	-	NV	-	NV	-	NV
Manganese	nc, nv	960		750		3,900		-	NV	-	NV	-	NV

Medium →	GROUNDWATER (µg/L) Vapor Intrusion into Buildings RBC$_{wi}$						GROUNDWATER (µg/L) GW in Excavation RBC$_{we}$		SOIL GAS (µg/m³) Vapor Intrusion into Buildings RBC$_{sv}$						AIR (µg/m³) Inhalation RBC$_{air}$					
Route →	Residential		Urban Residential		Occupational		Construction & Excavation Worker		Residential		Urban Residential		Occupational		Residential		Urban Residential		Occupational	
Direct or Indirect Pathway (see notes)	IWV		IWV		IWV		DCW		IGA		IGA		IGA		DCA		DCA		DCA	
Chemical		Note		Note		Note		Note	1	Note	1	Note	1	Note		Note		Note		Note
Acenaphthene	-	>S	-	>S	-	>S	-	>S	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv
Acrylonitrile	2,700		6,600		9,500		390		32		79		160		0.18		0.33		0.18	
Aldrin	-	>S	-	>S	-	>S	3.3		0.49		1.1		2.2		0.0022		0.0060		0.0026	
Anthracene	-	>S	-	>S	-	>S	-	>S	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv
Arsenic	-	NV	-	NV	-	NV	6,200		-	NV	-	NV	-	NV	0.0006		0.0050		0.0029	
Barium	-	NV	-	NV	-	NV	2.7E+07		-	NV	-	NV	-	NV	2.0		2.9		2.2	
Benz(a)anthracene	-	>S	-	>S	-	>S	-	>S	-	>Pv	-	>Pv	-	>Pv	0.045		0.078		0.11	
Benzene	830		2,000		2,800		1,900		360		810		1,600		1.4		3.3		1.6	
Benzidine	-	NV	-	NV	-	NV	17		-	NV	-	NV	-	NV	0.000078		0.00011		0.00018	
Benzo(a)pyrene (BaP equivalents)	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.0046		0.0070		0.011	
Benzo(b)fluoranthene	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.048		0.070		0.11	
Benzo(k)fluoranthene	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Beryllium	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.0049		0.011		0.0061	
Bis(2-ethylhexyl)phthalate	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Bromodichloromethane	650		1,600		2,300		460		59		140		330		0.39		0.70		0.33	
Bromoform	140,000		330,000		470,000		14,000		2,600		4,700		11,000		8.9		23		11	
Bromomethane	8,200		8,200		27,000		1,200		4,100		4,100		22,000		29		20		22	
Cadmium	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.0061		0.014		0.0016	
Carbon tetrachloride	350		840		1,800		1,900		350		840		2,000		1.9		4.3		2.0	
Chlorobenzene	280,000		280,000		-	>S	10,000		41,000		41,000		220,000		390		390		220	
Chlorodibromomethane (dibromochloromethane)	3,600		8,000		13,000		610		81		180		400		0.48		0.89		0.45	
Chloroethane (ethyl chloride)	-	>S	-	>S	-	>S	2,400,000		6,100,000		6,100,000		4.4E+07		41,000		41,000		44,000	
Chloroform	400		1,100		1,600		730		69		260		630		0.47		1.1		0.53	
Chloromethane	100,000		100,000		330,000		22,000		73,000		73,000		380,000		370		370		380	
Chlordane	-	>S	-	>S	-	>S	-	>S	22		56		-	>Pv	0.11		0.24		0.12	
Chromium (III)	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	4.1E+15		4.1E+15		4.4E+15	
Chromium (VI)	-	NV	-	NV	-	NV	8,400		-	NV	-	NV	-	NV	0.000086		0.000081		0.00015	
Chrysene	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.43		0.70		1.1	
Copper	-	NV	-	NV	-	NV	8,400,000		-	NV	-	NV	-	NV	4.1E+15		4.1E+15		4.4E+15	
Cyanide (hydrogen cyanide)	-	NV	-	NV	-	NV	91,000		-	NV	-	NV	-	NV	3.2		3.2		3.5	
DDD (4,4'-Dichlorodiphenyldichloroethane)	-	NV	-	NV	-	NV	31		-	NV	-	NV	-	NV	0.16		0.27		0.16	
DDE (4,4'-Dichlorodiphenyldichloroethylene)	-	>S	-	>S	-	>S	-	>S	23		62		-	>Pv	0.11		0.27		0.13	
DDT (4,4'-Dichlorodiphenyltrichloroethane)	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.11		0.27		0.13	
Dibenz(a,h)anthracene	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
1,2-Dichlorobenzene	-	>S	-	>S	-	>S	27,000		160,000		160,000		640,000		210		210		880	
1,4-Dichlorobenzene	2,100		5,000		7,100		1,300		260		470		1,100		0.26		2.3		1.1	
3,3-Dichlorobenzidine	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	0.083		0.078		0.036	
1,1-Dichloroethane	4,300		10,000		14,000		10,000		1,400		3,200		7,700		8.8		19		7.7	
1,1-Dichloroethene	110,000		110,000		340,000		44,000		180,000		180,000		880,000		210		210		880	
cis-1,2-Dichloroethene	-	>S	-	>S	-	>S	18,000		-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv
trans-1,2-Dichloroethene	-	>S	-	>S	-	>S	160,000		-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv
Dichloroethylether	9,800		21,000		30,000		91		6.6		16		37		0.033		0.075		0.037	
Dichloromethane	470,000		1,100,000		3,300,000		840,000		110,000		190,000		1,200,000		600		770		1,200	
2,4-Dichlorophenoxyacetic acid (2,4-D)	-	NV	-	NV	-	NV	77,000		-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Dieldrin	-	NV	-	NV	-	NV	2.4		-	NV	-	NV	-	NV	0.0021		0.0062		0.0027	
2,6-Dinitrotoluene	-	NV	-	NV	-	NV	6,300		-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Di-n-propylnitrosamine (N-nitroso-di-n-propylamine)	-	NV	-	NV	-	NV	670		-	NV	-	NV	-	NV	0.0058		0.013		0.0051	
1,4-Dioxane	1,300,000		3,100,000		4,800,000		3,400		440		1,000		2,600		3.2		8.2		2.5	
Diphenylnitrosamine	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	4.2		6.9		4.7	
EDB (1,2-dibromoethane)	180		410		880		27		3.6		8.6		38		0.019		0.047		0.020	
EDC (1,2-dichloroethane)	1,100		2,700		3,900		830		84		200		470		0.42		0.59		0.47	
Endosulfan (alpha-beta)	-	>S	-	>S	-	>S	-	>S	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv
Endrin	-	NV	-	NV	-	NV	170		-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Ethylbenzene	2,400		5,700		8,200		4,600		370		2,100		4,900		4.4		10		4.9	
Fluoranthene	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Fluorene	-	>S	-	>S	-	>S	-	>S	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv	-	>Pv
Formaldehyde	2,600,000		6,000,000		8,500,000		1,300		170		400		840		0.34		2.0		0.94	
Heptachlor	-	>S	-	>S	-	>S	1.6		1.7		4.0		8.4		0.0084		0.020		0.0094	
Heptachlor epoxide	-	>S	-	>S	-	>S	3.2		0.84		2.0		4.7		0.0042		0.0099		0.0047	
Hexachlorobenzene	-	>S	-	>S	-	>S	-	>S	4.7		11		27		0.024		0.056		0.027	
alpha Hexachlorocyclohexane (alpha HCH)	-	NV	-	NV	-	NV	18		-	NV	-	NV	-	NV	0.0061		0.014		0.0066	
gamma-Hexachlorocyclohexane (Lindane)	-	NV	-	NV	-	NV	100		-	NV	-	NV	-	NV	0.036		0.083		0.040	
Hexachloroethane	2,200		5,300		7,600		940		200		470		1,100		0.58		2.3		1.1	
Indeno(1,2,3-cd)pyrene	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Lead	-	NV	-	NV	-	NV	-	>S	-	NV	-	NV	-	NV	-	>Pv	-	>Pv	-	>Pv
Manganese	-	NV	-	NV	-	NV	3,200,000		-	NV	-	NV	-	NV	0.28		0.28		0.32	

RISK-BASED CONCENTRATIONS

Contaminated Medium → SOIL mg/kg (ppm)

Exposure Pathway → Soil Ingestion, Dermal Contact, and Inhalation RBC_{ss} / Volatilization to Outdoor Air RBC_{so} / Vapor Intrusion into Buildings RBC_{si} / Leaching to Groundwater RBC_{sw}

Receptor Scenario →

Direct or Indirect Pathway (see notes)

CAS	Chemical	Key	Residential	Note	Urban Residential	Note	Occupational	Note	Construction Worker	Note	Excavation Worker	Note
94-74-6	MCPA ((4-chloro-2-methylphenoxy)acetic acid)	nc, nv	53		63		410	>Csat	130		3,700	>Csat
7439-97-6	Mercury	nc, nv	38		47		380		110		2,800	
1634-04-4	MTBE (methyl t-butyl ether)	c, v	610		720		1,100		12,000	>Csat	320,000	>Csat
91-20-3	Naphthalene	c, v	20		26		23		480	>Csat	16,000	>Csat
7440-02-0	Nickel	c, nv	64,000		87,000		62,000		-	>Max	-	>Max
87-86-5	Pentachlorophenol	c, nv	2.2		2.6		4.0		34		560	
11097-69-1	Polychlorinated biphenyls (Total PCBs)	c, v	0.49		0.60		0.74		8.4	>Csat	230	>Csat
98-82-8	Iso-Propylbenzene (cumene)	nc, v	5,900	>Csat	7,000	>Csat	57,000	>Csat	27,000	>Csat	760,000	>Csat
129-00-0	Pyrene	nc, v	3,600	>Csat	3,800	>Csat	21,000	>Csat	7,400	>Csat	210,000	>Csat
7440-22-4	Silver	nc, nv	380		780		5,100		1,800		40,000	
100-42-5	Styrene	nc, v	13,000	>Csat	16,000	>Csat	130,000	>Csat	88,000	>Csat	-	>Max
1746-01-6	2,3,7,8-TCDD (dioxin) equivalents	c, v	8.0E-06		0.000012		0.000018		0.00017		0.0046	
127-18-4	Tetrachloroethene (PCE)	c, v	840	>Csat	680	>Csat	1,000	>Csat	19,000	>Csat	280,000	>Csat
108-88-3	Toluene	nc, v	8,700	>Csat	12,000	>Csat	94,000	>Csat	28,000	>Csat	770,000	>Csat
8001-35-2	Toxaphene	c, nv	1.0		1.2		2.1		17		470	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	nc, v	640,000	>Csat	830,000	>Csat	-	>Max	-	>Max	-	>Max
71-55-6	1,1,1-Trichloroethane	nc, v	53,000	>Csat	110,000	>Csat	870,000	>Csat	470,000	>Csat	-	>Max
79-00-5	1,1,2-Trichloroethane	c, v	16		19		28		330		8,800	>Csat
79-01-6	Trichloroethylene	mut, v	5.7		18		51		130		2,700	>Csat
75-69-4	Trichlorofluoromethane (Freon 11)	nc, v	13,000	>Csat	16,000	>Csat	130,000	>Csat	92,000	>Csat	-	>Max
88-06-2	2,4,6-Trichlorophenol	c, nv	140		120		210		1,700		47,000	>Csat
95-63-6	1,2,4-Trimethylbenzene	nc, v	190		220		2,000	>Csat	2,000	>Csat	54,000	>Csat
108-67-8	1,3,5-Trimethylbenzene	nc, v	1,200	>Csat	1,600	>Csat	12,000	>Csat	3,600	>Csat	58,000	>Csat
75-01-4	Vinyl chloride	c, v	1.4		0.80		4.4		34		900	>Csat
1330-20-7	Xylenes	nc, v	2,400	>Csat	2,800	>Csat	20,000	>Csat	20,000	>Csat	540,000	>Csat

CAS	Vol. Residential	Note	Vol. Urban Residential	Note	Vol. Occupational	Note	VI Residential	Note	VI Urban Residential	Note	VI Occupational	Note	Leach Residential	Note	Leach Urban Residential	Note	Leach Occupational	Note
94-74-6	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.17		0.17		0.61	
7439-97-6	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
1634-04-4	1,300		3,300		1,800		23		78		110		0.42		0.50		0.84	
91-20-3	26		58		83		26		58		83		0.30		0.37		0.34	
7440-02-0	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
87-86-5	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	0.27		0.23		0.17	
11097-69-1	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	0.88		1.1		1.1	
98-82-8	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	170		170		-	>Csat
129-00-0	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat
7440-22-4	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	-		-		-	
100-42-5	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	280		280		880	
1746-01-6	0.040		0.084		0.13		0.048		0.084		0.13		0.000023		0.000031		0.000031	
127-18-4	-	>Csat	-	>Csat	-	>Csat	11		25		36		1.7		1.8		1.9	
108-88-3	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	140		140		490	
8001-35-2	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	1.8		1.2		0.63	
76-13-1	-	>Max	-	>Max	-	>Max	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat
71-55-6	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	330		300		160	
79-00-5	27		61		24		1.2		2.9		4.2		0.024		0.030		0.028	
79-01-6	16		23		81		0.12		0.28		2.2		0.013		0.063		0.097	
75-69-4	-	>Csat	-	>Csat	-	>Csat	730		730		-	>Csat	160		97		280	
88-06-2	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV	8.7		8.8		8.8	
95-63-6	910		910		860		64		84		210		4.8		4.4		12	
108-67-8	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	-	>Max	37		49		110	
75-01-4	21		29		8.9		0.17		0.21		2.2		0.0002		0.0014		0.010	
1330-20-7	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	-	>Csat	29		37		100	

For a complete explanation of notes please see "Notes to Accompany Risk-Based Concentrations for Individual Chemicals".

WARNING: Both non-cancer and cancer endpoints must be calculated for these substances to show all the lowest RBCs.

RISK-BASED CONCENTRATIONS

Medium → GROUNDWATER (µg/L): Ingestion, Dermal & Inhalation from Tapwater RBC_tw; Volatilization to Outdoor Air RBC_wo; Vapor Intrusion into Buildings RBC_wi

Chemical	Note	Tapwater Residential	Note	Tapwater Urban Residential	Note	Tapwater Occupational	Note	Outdoor Air Residential	Note	Outdoor Air Urban Residential	Note	Outdoor Air Occupational	Note	Vapor Intrusion Residential	Note	Vapor Intrusion Urban Residential	Note	Vapor Intrusion Occupational	Note
MCPA ((4-chloro-2-methylphenoxy)acetic acid)	nc, nv	13		13		47		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
Mercury	nc, nv	10.0		8.4		46		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
MTBE (methyl t-butyl ether)	c, v	63		64		[illegible]		1,400,000		1,200,000		1,800,000		280,000		810,000		670,000	
Naphthalene	c, v	0.04		0.79		0.72		14,000		-	>S	18,000		3,300		7,700		11,000	
Nickel	c, nv	-	>S	-	>S	-	>S	-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
Pentachlorophenol	c, nv	0.18		0.16		0.12		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
Polychlorinated biphenyls (Total PCBs)	c, v	0.023		[illegible]		0.026		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
iso-Propylbenzene (cumene)	nc, v	780		770		2,000		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
Pyrene	nc, v	-	>S	-	>S	-	>S	-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
Silver	nc, nv	170		160		[illegible]		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
Styrene	nc, v	2,000		2,000		6,700		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
2,3,7,8-TCDD (dioxin) equivalents	c, v	2.4E-07		4.2E-07		4.2E-07		0.050		0.28		0.11		0.032		0.077		0.11	
Tetrachloroethylene (PCE)	c, v	44		45		46		-	>S	-	>S	-	>S	14,000		34,000		48,000	
Toluene	nc, v	1,100		1,200		5,200		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
Toxaphene	c, nv	0.004		0.005		0.040		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	nc, v	82,000		87,000		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
1,1,1-Trichloroethane	nc, v	13,000		13,000		37,000		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
1,1,2-Trichloroethane	c, v	1.0		1.3		1.3		18,000		43,000		21,000		2,400		8,000		11,000	
Trichloroethylene	MA, v	0.48		2.8		3.3		3,300		6,900		23,000		200		420		3,700	
Trichlorofluoromethane (Freon 11)	nc, v	1,300		1,300		[illegible]		-	>S	-	>S	-	>S	140,000		140,000		460,000	
2,4,6-Trichlorophenol	c, nv	18		17		18		-	NV	-	NV	-	NV	-	NV	-	NV	-	NV
1,2,4-Trimethylbenzene	nc, v	24		23		81		-	>S	-	>S	-	>S	22,000		26,000		-	>S
1,3,5-Trimethylbenzene	nc, v	200		210		600		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S
Vinyl chloride	c, v	0.11		0.066		0.48		1,400		1,700		5,900		45		53		580	
Xylenes	nc, v	190		210		630		-	>S	-	>S	-	>S	-	>S	-	>S	-	>S

GROUNDWATER (µg/L) GW in Excavation RBC_we; SOIL GAS (µg/m³) Vapor Intrusion into Buildings RBC_sv; AIR (µg/m³) Inhalation RBC_air

Chemical	Excavation Construction & Excavation Worker	Note	Soil Gas Residential	Note	Soil Gas Urban Residential	Note	Soil Gas Occupational	Note	Air Residential	Note	Air Urban Residential	Note	Air Occupational	Note
MCPA ((4-chloro-2-methylphenoxy)acetic acid)	1,700		-	NV	-	NV	-	NV	-	nPv	-	nPv	-	nPv
Mercury	-	>S	-	NV	-	NV	-	NV	1.2		1.2		1.3	
MTBE (methyl t-butyl ether)	53,000		[illegible]		28,000		47,000		[illegible]		[illegible]		47	
Naphthalene	[illegible]		84		160		360		0.32		0.78		0.36	
Nickel	-	>S	-	NV	-	NV	-	NV	0.042		[illegible]		0.047	
Pentachlorophenol	53		-	NV	-	NV	-	NV	3.1		8.1		2.4	
Polychlorinated biphenyls (Total PCBs)	30		3.6		8.1		22		0.016		[illegible]		0.017	
iso-Propylbenzene (cumene)	51,000		330,000		330,000		1,800,000		1,000		1,000		1,000	
Pyrene	-	>S	-	nPv	-	nPv	-	nPv	-	nPv	-	nPv	-	nPv
Silver	1,700,000		-	NV	-	NV	-	NV	4.1E+18		4.1E+18		4.4E+18	
Styrene	170,000		810,000		810,000		4,400,000		4,700		4,100		4,400	
2,3,7,8-TCDD (dioxin) equivalents	0.00046		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Tetrachloroethylene (PCE)	34,000		8,400		28,000		47,000		42		36		47	
Toluene	220,000		4,100,000		4,100,000		2.2E+07		22,000		23,000		22,000	
Toxaphene	18		-	NV	-	NV	-	NV	0.004		0.001		0.006	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	-	>S	2.4E+07		2.4E+07		1.3E+08		130,000		130,000		130,000	
1,1,1-Trichloroethane	1,100,000		4,100,000		4,100,000		2.2E+07		20,000		20,000		22,000	
1,1,2-Trichloroethane	1,000		140		330		770		0.03		1.8		0.77	
Trichloroethylene	430		96		220		2,900		0.47		1.0		3.0	
Trichlorofluoromethane (Freon 11)	180,000		370,000		370,000		3,100,000		2,300		2,300		3,100	
2,4,6-Trichlorophenol	11,000		-	NV	-	NV	-	NV	3.6		8.3		4.0	
1,2,4-Trimethylbenzene	1,700		8,700		8,700		31,000		26		26		31	
1,3,5-Trimethylbenzene	16,000		-	nPv	-	nPv	-	nPv	-	nPv	-	nPv	-	nPv
Vinyl chloride	680		130		160		2,800		0.53		0.90		2.8	
Xylenes	23,000		87,000		91,000		440,000		410		410		440	

Ψ WARNING: Both non-cancer and cancer endpoints must be calculated for these substances to show all the lowest RBCs.

Exposure Factors: Reasonable Maximum Exposure

Parameter (unit)	Symbol	Residential	Note	Urban Residential	Note	Occupational	Note	Construction Worker	Note	Excavation Worker	Note
ACCEPTABLE RISK LEVELS											
Acceptable Risk Level - Carcinogens	ARLc	1.00E-06	1	=		=		=		=	
Acceptable Risk Level - Noncarcinogens	ARLn	1	1	=		=		=		=	
EXPOSURE PARAMETERS											
Averaging Time - Carcinogen (yr)	ATc	70	3	=		=		=		=	
Averaging Time - Noncarcinogen (yr)	ATn	26	3	11	2	25	3	1	3	1	3
Averaging Time - Noncarcinogen, Child (yr)	ATnc	6	3	6	3	NA		NA		NA	
Body Weight - Adult (kg)	BWa	80	3	=		=		=		=	
Body Weight - Child (kg)	BWc	15	3	=		NA		NA		NA	
Exposure Duration - Adult (yr)	ED	26	3	11	4	25	3	1	21	1	6
Exposure Duration - Child (yr)	EDc	14	3	6	4	NA		NA		NA	
Exposure Frequency (day/yr)	EF	90	3	175	3c	250	6	250	6	9	6
Exposure Time (hr/day)	ET	24		24		8		8		8	
Event Frequency - Groundwater (events/day)	EvF	1	24	1	24	2	24	2	6	=	
Event Time - Groundwater (hr/event) (age adjusted)	t_{event}	0.67	25	0.62	25	2	24	2	6	=	
Soil Ingestion Rate - Adult (mg/day)	IRS	100	6	100	6	100	6	330	21	330	21
Soil Ingestion Rate - Child (mg/day)	IRSc	200	4	200	4	NA		NA		NA	
Water Ingestion Rate - Adult (L/day)	IRW	2.5	3a	2.5	3a	0.7	4a	NA		NA	
Water Ingestion Rate - Child (L/day)	IRWc	0.78	3b	=		NA		NA		NA	
Skin Surface Area - Adult to Soil (cm^2)	SA	6032	4	6032	4	3527	4	3527	4	3527	4
Skin Surface Area - Child to Soil (cm^2)	SAc	2373	3	=		NA		NA		NA	
Skin Surface Area - Adult to Groundwater (cm^2)	SAw	20900	3	20900	3	3527	3	6032	4	6032	4
Skin Surface Area - Child to Groundwater (cm^2)	SAwc	6378	3	6378	3	NA		NA		NA	
Soil to Skin Adherence Factor - Adult (mg/cm^2-day)	AF	0.07	5a	0.07	5a	0.12	5b	0.30	5c	0.30	5c
Soil to Skin Adherence Factor - Child (mg/cm^2-day)	AFc	0.20	5d	=		NA		NA		NA	
AGE-ADJUSTED EXPOSURE FACTORS											
Ingestion Factor - Soil (mg-yr/kg-d)	IFSadj	202	7	86	7a	NA		NA		NA	
Ingestion Factor - Water (L-yr/kg-d)	IFWadj	1.10	7	0.47	7a	NA		NA		NA	
Surface Area Tapwater-age adjusted (cm2-yr/kg)	SAwadj	5350	7	3857	7	NA		NA		NA	
Surface Area Factor - Skin (mg-yr/kg-d)	SFSadj	506	7	216	7a	NA		NA		NA	
SITE PARAMETERS											
Soil Bulk Density (g/cm^3)	ρ_b	1.70	8	=		=		=		=	
Soil Particle Density (g/cm^3)	ρ_s	2.74	9	=		=		=		=	
Soil Porosity	n	0.38	8	=		=		=		=	
Air Content - Vadose Zone Soils	n_a	0.26	10	=		=		=		=	
Air Content - Cap. Fringe Soils	n_{acap}	0.038	10	=		=		=		=	
Air Content - Foundation Cracks	n_{acrk}	0.26	10	=		=		=		=	
Water Content - Vadose Zone Soils	n_w	0.12	8	=		=		=		=	
Water Content - Cap. Fringe Soils	n_{wcap}	0.342	8	=		=		=		=	
Water Content - Foundation Cracks	n_{wcrk}	0.12	11	=		=		=		=	
Vadose Zone Thickness (cm)	L_v	295	12	=		=		=		=	
Capillary Fringe Thickness (cm)	L_{cap}	5.00	8	=		=		=		=	
Fraction Organic Carbon (shallow soil)	f_{oc}	0.005	8a	=		=		=		=	
Depth to Groundwater (cm)	L_w	300	8	=		=		=		=	
Groundwater Dilution-Attenuation Factor	DAF	60	19	=		=		=		=	
SOIL CONTAMINATION PARAMETERS											
Thickness of Contaminated Surface Soils (cm)	L_{ss}	100	8	=		=		=		=	
Fraction of Site with Surface Soil Contamination	f_{ss}	0.50	16	=		=		=		=	
Thickness of Clean Surface Soils (cm)	L_c	100	8	=		=		=		=	
Thickness of Subsurface Contamination (cm)	L_s	200	8	=		=		=		=	
Soil Gas Attenuation Factor for Chlorinated Hydrocarbons	AF_{ch}	200	23	200	23	1000	23	NA		NA	
Soil Gas Attenuation Factor for Petroleum Hydrocarbons	AF_{ph}	200	23	200	23	1000	23	NA		NA	
Fraction of Site with Subsurface Vol. To Outdoor Air	f_{so}	0.50	17	=		=		=		=	
Thickness of Clean Soils Under Building (cm)	L_{cb}	100	8	=		=		=		=	
Thickness of Contaminated Soils Under Building (cm)	L_{sb}	200	8	=		=		=		=	
Fraction of Contaminated Soils Under Building	f_{sb}	0.50	18	=		=		=		=	
Particulate Emission Factor for Soils (kg/m^3)	PEF	7.58E-10	13	=		=		=		=	
BUILDING PARAMETERS											
Building Air Exchange Rate (1/day)	ER	24	14	=		48	14	NA		NA	
Building Height (Indoor air mixing zone) (cm)	L_B	200	8	=		300	8	NA		NA	
Foundation Wall Thickness (cm)	L_{crk}	15	8	=		=		NA		NA	
Foundation Crack Fraction	f_{crk}	0.0010	15	=		=		NA		NA	
VOLATILIZATION FACTORS											
Averaging time for Volatilization -Adults (yr)	t_{vol}	25	16	=		=		=		=	
Averaging time for Volatilization -Children (yr)	t_{volc}	6	16	=		NA		NA		NA	
Max. Soil to Building Vol. Factor (kg/m^3)	$VF_{sb}max$	3.88E-03	18	3.88E-03	18	1.29E-03	18	NA		NA	
Max. Surface Soil Vol. Factor - Adult (kg/m^3)	$VF_{ss}max$	1.57E-05	16	1.57E-05	16	1.57E-05	16	1.57E-05	16	1.57E-05	16
Max. Surface Soil Vol. Factor - Child (kg/m^3)	$VF_{ss}max$	6.53E-05	16	=		NA		NA		NA	
Max. Soil to Outdoor Air Vol. Factor - Adult (kg/m^3)	$VF_{so}max$	3.13E-05	17	3.13E-05	17	3.13E-05	17	NA		NA	
Volatile Organics Dispersion Term (g/m^2-s per kg/m^3)	Q/C	6.88E+01	13	=		=		=		=	
MISCELLANEOUS PARAMETERS											
Ideal Gas Law Constant (m^3-atm/K-mol)	R	8.21E-05	20	=		=		=		=	
Absolute Temperature (K)	T	2.93E+02	20	=		=		=		=	

Additional Information for Early Life-Stage Factor Calculations

Early Life-Stage Factors - Residential	Symbol	0 - 2 Years		3 - 6 Years		7 - 16 Years		17 - 26 Years		Total	
(See Note 22)			Note		Note		Note		Note		Note
Exposure Duration (yr)	ED	0		4		10		12		26	
Body Weight (kg)	BW	15		15		80		80		NA	
Soil Ingestion Rate (mg/day)	IRs	200		200		100		100		NA	
Air Inhalation Rate (m^3/day)	IRa	10		10		20		20		NA	
Water Ingestion Rate (L/day) - adults	IRw	0.78		0.78		2.5		2.5		NA	
Age-dependent Adjustment Factor	ADAF	10		3		3		1		NA	
Soil to Skin Adherence Factor (mg/cm^2)	AF	0.2		0.2		0.07		0.07		NA	
Skin Surface Area - Adult to Soil (cm^2)	SA	2690		2690		6032		6032		NA	
Skin Surface Area - to tapwater (cm2)	SAtw	6378		6378		20900		20900		NA	
Adjusted Exposure Duration (yr)	EDadj	0		12		30		12		54	
Ingestion Factor - Soil (mg-yr/kg-d)	IFSadj	0		160		36		15		213	
Ingestion Factor - Water (L-yr/kg-d)	IFWadj	0		1		1		0		2	
Surface Area Factor - Skin (mg-yr/kg-d)	SFSadj	0		430		158		63		652	
Surface Area Tapwater-age adjusted (cm2-yr/kg)	Sawr_ad	0		5102		7838		3135		16075	

Early Life-Stage Factors - Urban Residential	Symbol	0 - 2 Years		3 - 6 Years		7 - 16 Years		17 - 26 Years		Total	
(See Note 22)			Note		Note		Note		Note		Note
Exposure Duration (yr)	ED	2		4		0		5		11	
Adjusted Exposure Duration (yr)	EDadj	20		12		0		5		37	
Ingestion Factor - Soil (mg-yr/kg-d)	IFSadj	267		160		0		6		433	
Ingestion Factor - Water (L-yr/kg-d)	IFWadj	1.04		0.624		0		0.16		2	
Surface Area Tapwater-age adjusted (cm2-yr/kg)	Sawu_ad	8504		5102		0		1306		14913	
Surface Area Factor - Skin (mg-yr/kg-d)	SFSadj	717		430		0		26		1174	

Early Life-Stage Factors - Vinyl Chloride Residential	Symbol	0 - 6 Years		0 - 6 Years		7 - 30 Years		7 - 70 Years		Total	
(See Note 22)			Note		Note		Note		Note		Note
Exposure Duration (yr)	ED	6		6		24		64		100	
Adjusted Exposure Duration (yr)	EDadj	6		6		24		64		100	
Ingestion Factor - Soil (mg-yr/kg-d)	IFSadj	80		80		30		80		270	
Ingestion Factor - Water (L-yr/kg-d)	IFWadj	0.3		0.3		0.8		2.0		3.4	
Surface Area Factor - Skin (mg-yr/kg-d)	SFSadj	190		190		127		338		844	

Early Life-Stage Factors - Vinyl Chloride Urban Residential	Symbol	0 - 6 Years		0 - 6 Years		7 - 11 Years		7 - 70 Years		Total	
(See Note 22)			Note		Note		Note		Note		Note
Exposure Duration (yr)	ED	6		6		5		64		81	
Adjusted Exposure Duration (yr)	EDadj	6		6		5		64		81	
Ingestion Factor - Soil (mg-yr/kg-d)	IFSadj	80		80		6.3		80		246	
Ingestion Factor - Water (L-yr/kg-d)	IFWadj	0.3		0.3		0.2		2.0		2.8	
Surface Area Factor - Skin (mg-yr/kg-d)	SFSadj	190		190		26		338		744	

For explanation of notes, please see "Notes to Accompany Risk-Based Concentrations for Individual Chemicals."

ATTACHMENT 2

Laboratory ISM SOP

1.0 SCOPE, APPLICATION, AND SUMMARY

1.1 This Standard Operating Procedure (SOP) is used by Friedman and Bruya, Inc. (F&BI) to prepare soil and solid samples that require sieve and/or drying prior to extraction and analysis, including sub samples collected for soil multi increment sampling.

1.2 Deviation from the procedures outlined in this SOP may sometimes be needed, due to specific project requirements, or due to laboratory circumstances. Deviations are documented using the extraction worksheet, analysis logs, and/or other documents such as the non-conformance report form.

2.0 METHOD BASIS

The following regulatory method serves as the basis for this standard operating procedure. Adherence to the minimum criteria set forth in this method is a general data quality objective of this SOP.

2.1 State of Alaska Department of Environmental Conservation, "Draft Guidance on Multi Increment Soil Sampling", March 2009.

3.0 DEFINITIONS

3.1 A list of definitions for terms used in this SOP may be found in the F&BI Quality Assurance Manual, appendix F.

4.0 SAFETY

4.1 The most important safety measure is to handle all samples and equipment in an appropriate manner to ensure a minimum of personal danger and exposure to potentially hazardous chemicals.

4.2 When samples are handled, appropriate personal protection equipment (PPE) should be used. Gloves, lab coat, and goggles are all available for use.

4.3 Glassware can break at any time, so caution needs to be used at all times when handling it. Cut resistant gloves are available for use.

4.4 MSDSs for all chemicals in the lab are available to all employees. They are located in the GC room, and all employees are strongly encouraged to read them.

4.5 Analysts are required to complete general safety training prior to performing any analysis. Details of initial and on-going safety training are provided in the F&BI Quality Assurance Manual and "Training" SOP.

4.6 If uncertain about the safety of a material or procedure or in the event that a spill or other potentially hazardous situation arises, notify your supervisor or any chemist immediately.

5.0 INTERFERENCES

5.1 Certain sample matrices may not be amenable to sieving, such as peat or tundra. Alternate sample processing measures would be required for those media.

6.0 APPARATUS AND EQUIPMENT

6.1 #10 Sieve – particle size <2mm

6.2 Drying Pans (Aluminum or Pyrex)

6.3 Stainless Steel Scoopula

6.4 Analytical Balance

6.5 4 oz. or 8 oz. Glass Jars with Lid

6.6 Steel Baking Sheet or Other Tray

6.7 Stainless Steel Bowl

7.0 REAGENTS AND CHEMICALS

7.1 Methylene Chloride, pesticide grade or better

7.2 Alconox

8.0 SAMPLE HANDLING, PRESERVATION, AND PREPARATION

8.1 Before preparing the samples, double check the sample identification on the container to that listed on the Chain of Custody. Document that the sample ID has been checked by initialing the extraction worksheet.

8.1.1 If more than one container exists for the sample, write the corresponding letter of the container used in the extraction on the extraction paperwork.

8.2 Note any unexpected sample characteristics on the extraction worksheet under "Observations" heading.

8.3 Sample Moisture Determination Procedure

8.3.1 The analyst will perform the following to determine if the sample will require

a drying procedure. Drying should only be performed if necessary.

8.3.2 Visually inspect the sample to determine if free liquid is present. Samples containing a visible liquid layer will require drying prior to sieve preparation.

8.3.3 For samples that do not contain free liquid but appear moist, a small amount of sample (~10.0 grams) will be tested in the sieve. The sample will require the drying procedure if sample fines do not pass through the sieve screen.

8.4 Sample Drying Procedure

8.4.1 Assign F&B sample ID to a drying pan.

8.4.2 Empty the entire contents of the sample container into the drying pan to a depth of ½ to 1 inch in thickness.

8.4.3 Place drying pan in fume hood at ambient temperature until processing.

8.4.4 Drying at elevated temperatures, i.e. "baking" is not allowed. Turning the soil can be used to facilitate the drying process.

8.4.5 Drying is acceptable for less temperature sensitive contaminants such as metals, PCBs, DRO, RRO, etc. Drying may not be appropriate for some contaminants, including volatile constituents or PAHs. If samples are processed for non-appropriate testing, the data will be estimated and qualified appropriately.

8.5 Sieve Procedure

8.5.1 Wash sieve with warm water and Alconox and allow to dry.

8.5.2 For samples requiring organic analysis, triple rinse sieve screen with methylene chloride and allow to dry.

8.5.3 Place entire contents of sampling container or drying pan into the sieve. The minimum amount of sample required for sieve preparation is 30 g.

8.5.4 Shake sieve for 2 minutes.

8.5.5 Remove sample collection tray from sieve and collect the entire contents into a labeled 4 oz. or 8 oz. glass jar.

8.5.6 When multiple sub samples are sieved, the entire contents of each sieved sub sample will be poured into a stainless steel bowl, stirred for a minimum of 30 seconds and collected for sample analysis.

9.0 SAMPLE ANALYSIS

9.1 Wash a steel baking sheet or other tray with warm water and Alconox and allow to dry.

9.2 For samples requiring organic analysis, triple rinse the tray with methylene chloride and allow to dry.

9.3 Pour the entire contents of the sample into the tray to a depth of no more than ½ inch.

9.4 Individual aliquots of sample will be randomly scooped from a minimum of 20 distinctly different areas of the tray and added to the extraction vessel until the required sample amount is reached.

10.0 QUALITY CONTROL AND CORRECTIVE ACTIONS

General quality control procedures are outlined in the corresponding F&B analytical method SOPs. F&BI QC procedures are described in sections 12 and 13 of the QA Manual. If, following corrective actions, quality control results still fail, or if corrective actions are not possible, then affected results are reported with appropriate qualifying flags.

The minimum requirements for QC samples analyzed with each preparation batch (within 24 hours) of up to 20 samples are:
1 sample duplicate

11.0 DATA ARCHIVAL

11.1 The hardcopy of the QA paperwork is filed in the extraction room on the paperwork desk.

11.2 The extraction paperwork for each project is filed in the downstairs filing cabinets with the hardcopies of the final reports.

12.0 HAZARDOUS WASTE MANAGEMENT AND POLLUTION PREVENTION

12.1 Hazardous waste managements procedures are found in the F&BI QA Manual section 10, and the "Disposal" SOP.

12.2 Actions that can result in the reduction or elimination of chemical wastes and chemical pollutants associated with this SOP are strongly encouraged. Such actions should be discussed with the Executive Committee for approval prior to implementation.

END OF DOCUMENT

Clean Water Services

August 02, 2019

JT ROTH CONSTRUCTION INC
12600 SW 72ND AVE #200
TIGARD OR 97223

Re: 23000 SW Murdock Road – Amended Service Provider Letter
CWS file 18-002736 (Tax map 2S133CB Tax lot 00300)

Clean Water Services has reviewed the Service Provider Letter issued on October 8, 2018 for file 18-002736. District staff has review the submitted request for amendment materials including site conditions and updated project description including lot line adjustment of Tax lot 100. Staff concurs that the above referenced project will not significantly impact the existing Sensitive Area found near the site. In light of this result, this document will serve as your Service Provider Letter as required by Resolution and Order 19-5 Section 3.02.1. All required permits and approvals must be obtained and completed under applicable local, state, and federal law.

This letter does NOT eliminate the need to protect Sensitive Areas if they are subsequently identified with the project site.

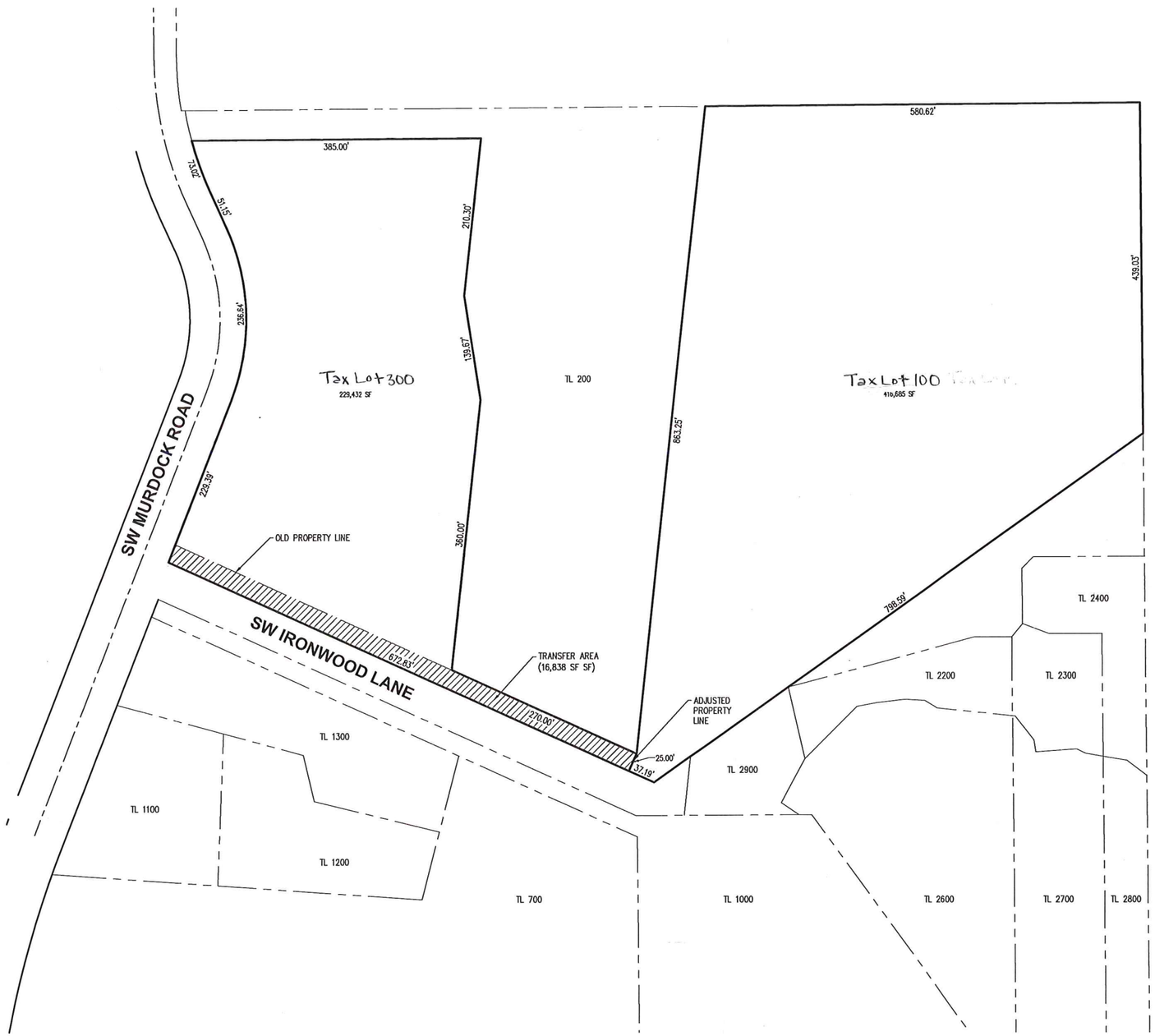
If you have any questions, please feel free to contact me at (503) 681-3653.

Sincerely,

Lindsey Obermiller
Environmental Plan Review

Attachments (2)

2550 SW Hillsboro Highway • Hillsboro, Oregon 97123
Phone: (503) 681-3600 • Fax: (503) 681-3603 • cleanwaterservices.org



80' 0 40' 80' 160'

SCALE: 1" = 80'

11"X17" @ HALF SCALE

CWS FILE NO. 18-002736
Approved
Clean Water Services
FOR ENVIRONMENTAL REVIEW
By KO. Date 8/2/2019
SPL ATTACHMENT 1 OF 2

AMENDMENT

TRANSFER AREA		16,838 SF
	BEFORE PLA	AFTER PLA
TRACT 1	212,594 SF	229,432 SF
TRACT 2	433,523 SF	416,685 SF

SW MURDOCK ROAD &
SW IRONWOOD LANE
TAX MAP T2S R1W 33CB
TAX LOTS 100 & 300
WASHINGTON COUNTY, OREGON

PROPERTY LINE ADJUSTMENT PLAN

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 2 OF 3

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_PLA, Layout: PLA, Plot Date: 7/9/2019 3:14 PM, by: Kyung Hon

LEGEND

BOUNDARY LINE

EASEMENT

CWS FILE NO. 18-002736
Approved
Clean Water Services
FOR ENVIRONMENTAL REVIEW
By RO. Date 8/2/2019
SPL ATTACHMENT 2 OF 2
AMENDMENT

PROPOSED MURDOCK PUD SETBACKS

FRONT: 15 FT.
GARAGE: 20 FT.
REAR: 20 FT. (EXCEPT LOTS 1 & 4 15 FT.)
SIDE: 5 FT.
STREET: 15 FT.

GROSS AND NET SQUARE FOOTAGES

LOT 1	11,355 SQUARE FEET	
LOT 2	10,572 SQUARE FEET	
LOT 3	12,177 SQUARE FEET	
LOT 4	10,117 SQUARE FEET	
LOT 5	11,116 SQUARE FEET	
LOT 6	10,032 SQUARE FEET	
LOT 7	10,031 SQUARE FEET	
LOT 8	10,725 SQUARE FEET	
LOT 9	10,455 SQUARE FEET	
LOT 10	11,233 SQUARE FEET	
LOT 11	13,630 SQUARE FEET	
LOT 12	12,777 SQUARE FEET	
LOT 13	10,260 SQUARE FEET	
SW MURDOCK ROAD RIGHT-OF-WAY	8,222 SQUARE FEET	
SW IRONWOOD LANE RIGHT-OF-WAY	656 SQUARE FEET	
PUBLIC STREET RIGHT-OF-WAY	33,514 SQUARE FEET	
TRACT A USABLE OPEN SPACE	22,274 SQUARE FEET	
TRACT B PRIVATE STREET	3,138 SQUARE FEET	
TRACT C USABLE OPEN SPACE	7,916 SQUARE FEET	
TRACT D WATER QUALITY	2,828 SQUARE FEET	
TRACT E USABLE OPEN SPACE	6,384 SQUARE FEET	
GROSS SQUARE FOOTAGE =	229,414 SQUARE FEET	
DEDUCTIONS FROM GROSS SQUARE FOOTAGE:		
RIGHT-OF-WAY (SW MURDOCK RD, SW IRONWOOD LN & PUBLIC ST) =	42,393 SQUARE FEET	
PRIVATE STREET (TRACT B) =	3,138 SQUARE FEET	
USABLE OPEN SPACE (TRACT A, C, AND E)	36,574 SQUARE FEET	
WATER QUALITY TRACT (TRACT D) =	2,828 SQUARE FEET	
TOTAL =	84,933 SQUARE FEET IN DEDUCTIONS	
GROSS SQUARE FOOTAGE	229,414 SQUARE FEET	
-DEDUCTIONS	84,933 SQUARE FEET	
NET SQUARE FOOTAGE =	144,481 SQUARE FEET	OR 3.32 NET ACRES

N

50' 0 25' 50' 100'

SCALE: 1" = 50'

SW MURDOCK ROAD
SUBDIVISION/PUD
TAX MAP T2S R1W 33CB
TAX LOT 00300
WASHINGTON COUNTY, OREGON

PRELIMINARY PLAT

REVISIONS

NO.	DATE	DESCRIPTION

EMERIO Design
6445 SW FALLBROOK PL. SUITE 100
BEAVERTON, OREGON 97008
PH: (503)-746-8812

SHEET 03 OF 12

FILE:P:\0200-008 Murdock Subdivision\dwg\plan\0200-008_03ppl4, Layout: 03 PRELIMINARY PLAT, Plot Date: 6/28/2019 11:27 AM, by: Kyung Hen

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

November 6, 2018
Project No. 18-5044

J.T. Roth
J.T. Roth Construction, Inc.
12600 SW 72nd Avenue, #200
Portland, Oregon 97223
timr@jtrothinc.com

Via email with hard copies mailed

SUBJECT: GEOTECHNICAL ENGINEERING REPORT
MURDOCK SUBDIVISION
23000 SW MURDOCK ROAD
SHERWOOD, OREGON

This report presents the results of a geotechnical engineering study conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our investigation was to evaluate subsurface conditions at the site and to provide geotechnical recommendations for site development. This geotechnical study was performed in accordance with GeoPacific Proposal No. P-6709, dated September 7, 2018, and your subsequent authorization of our proposal and *General Conditions for Geotechnical Services*.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The site is located on the northeast corner of the intersection of SW Murdock Road and SW Ironwood Lane within a residential and rural residential area in Sherwood, Oregon (Figure 1). The site consists of a single tax lot and totals approximately 4.88 acres in size. Topography at the site is gently to moderately sloping with grades of about 5 to 15 percent throughout the majority of the site and with slopes of up to about 25 percent along the drainage that runs through the southeastern and central portions of the site. A single family residence constructed in 1990 and an outbuilding of unknown construction date are located on the northern portion of the site (Figure 2). A large barn is located on the southwestern portion of the site. The residence and outbuilding are surrounded by landscape vegetation and trees (Figure 2). The remainder of the site consists primarily of tall grass fields and occasional trees and brush.

Preliminary site plans indicate that the proposed development will consist of a 14 lot subdivision for single family homes, new public streets, storm water disposal facility, and associated underground utilities. The existing home on the northern portion of the site will be retained on Lot 5 but the outbuilding to the east of the existing home and the barn on the southwestern portion of the site will be removed during development of the site. We anticipate that the homes will be constructed with typical spread foundations and wood framing, with maximum structural loading on column footings and continuous strip footings on the order of 10 to 35 kips, and 2 to 4 kips respectively. A grading plan has not been provided, however, we anticipate cuts and fills on the order of ten feet or less.

REGIONAL AND LOCAL GEOLOGIC SETTING

Regionally, the subject site lies within the Willamette Valley/Puget Sound lowland, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. A series of discontinuous faults subdivide the Willamette Valley into a mosaic of fault-bounded, structural blocks (Yeats et al., 1996). Uplifted structural blocks form bedrock highlands, while down-warped structural blocks form sedimentary basins. Valley-fill sediment in the adjacent basin achieves a maximum thickness of 1,500 feet and overlies Miocene Columbia River Basalt at depth (Madin, 1990; Yeats et al., 1996).

Locally, the site is situated on an uplifted structural block of Columbia River Basalt (Schlicker and Finlayson, 1979). The Columbia River Basalt formation is differentiated into several members. The basalt underlying the subject site is part of the Wanapum Basalt member, which is typically dark gray to black and displays blocky to columnar jointing (Burns et al, 1997). Interflow zones between flows are typically vesicular, scoriaceous, and brecciated, and sometimes include sedimentary rocks. Where highly weathered, the upper portion of the basalt is altered to a distinctive red-brown clayey silt known as laterite or residual soil.

REGIONAL SEISMIC SETTING

At least three potential source zones capable of generating damaging earthquakes are thought to exist in the region. These include the Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone, as discussed below.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that include the central Portland Hills Fault, the western Oatfield Fault, and the eastern East Bank Fault. These faults occur in a northwest-trending zone that varies in width between 3.5 and 5.0 miles. The combined three faults vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years) sediment (Madin, 1990). The Portland Hills Fault occurs along the Willamette River at the base of the Portland Hills, and is about 11 miles southwest of the site. The Oatfield Fault occurs along the western side of the Portland Hills, and is about 9 miles southwest of the site. The accuracy of the fault mapping is stated to be within 500 meters (Wong, et al., 2000). No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW-trending faults that lies about 9 miles southwest of the subject site. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment (Yeats et al., 1996; Werner et al., 1992). A geologic reconnaissance and photogeologic analysis study conducted for the Scoggins Dam site in the Tualatin Basin revealed no evidence of deformed geomorphic surfaces along the structural zone (Unruh et al., 1994). No seismicity has been recorded on the Gales Creek Fault or Newberg Fault; however, these faults are considered to be potentially active because they may connect with the seismically active Mount Angel Fault and the rupture plane of the 1993 M5.6 Scotts Mills earthquake (Werner et al. 1992; Geomatrix Consultants, 1995).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year (Goldfinger et al., 1996). A growing body of geologic evidence suggests that prehistoric subduction zone earthquakes have occurred (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). This evidence includes: (1) buried tidal marshes recording episodic, sudden subsidence along the coast of northern California, Oregon, and Washington, (2) burial of subsided tidal marshes by tsunami wave deposits, (3) paleoliquefaction features, and (4) geodetic uplift patterns on the Oregon coast. Radiocarbon dates on buried tidal marshes indicate a recurrence interval for major subduction zone earthquakes of 250 to 650 years with the last event occurring 300 years ago (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). The inferred seismogenic portion of the plate interface lies approximately 50 miles west of the Portland Basin at depths of between 20 and 40 kilometers below the surface.

FIELD EXPLORATION

Our site-specific exploration for this report was conducted on September 18, 2018. Eight exploratory test pits were excavated with a medium sized backhoe to depths ranging between 1 and 13 feet at the approximate locations shown on Figure 2. It should be noted that exploration locations were located in the field by pacing or taping distances from apparent property corners and other site features shown on the plans provided. As such, the locations of the explorations should be considered approximate.

A GeoPacific geologist continuously monitored the field exploration program and logged the test pits. Soils observed in the explorations were classified in general accordance with the Unified Soil Classification System. During exploration, our geologist also noted geotechnical conditions such as soil consistency, moisture and groundwater conditions. Logs of the test pits are attached to this report. The following report sections are based on the exploration program and summarize subsurface conditions encountered at the site. Rock hardness was classified in accordance with Table 1, modified from the ODOT Rock Hardness Classification Chart.

Table 1. Rock Hardness Classification Chart

ODOT Rock Hardness Rating	Field Criteria	Unconfined Compressive Strength	Typical Equipment Needed For Excavation
Extremely Soft (R0)	Indented by thumbnail	<100 psi	Small excavator
Very Soft (R1)	Scratched by thumbnail, crumbled by rock hammer	100-1,000 psi	Small excavator
Soft (R2)	Not scratched by thumbnail, indented by rock hammer	1,000-4,000 psi	Medium excavator (slow digging with small excavator)
Medium Hard (R3)	Scratched or fractured by rock hammer	4,000-8,000 psi	Medium to large excavator (slow to very slow digging), typically requires chipping with hydraulic hammer or mass excavation)
Hard (R4)	Scratched or fractured w/ difficulty	8,000-16,000 psi	Slow chipping with hydraulic hammer and/or blasting
Very Hard (R5)	Not scratched or fractured after many blows, hammer rebounds	>16,000 psi	Blasting

Undocumented Fill: Fill was not encountered in test pits TP-1, TP-2, TP-3, TP-5, TP-6, and TP-7. Undocumented fill was encountered in test pit TP-4 to depths of 5 feet below ground surface (bgs). Undocumented fill was encountered in test pit TP-8 to depths of 1.5 feet bgs. The fill consisted generally of very stiff, gravelly silt (ML), boulders, and subangular basalt fragments. Woody debris was encountered within the fill in test pit TP-4 at approximately 4.5 feet bgs. The original ground surface appeared to be located at about 5 feet bsg in TP-4. It is likely that additional areas of undocumented fill may exist in the vicinity of the existing structures and driveways.

A large soil cell used to stockpile formerly chromium contaminated soils from neighboring properties is located on the southeast portion of the site. Recent soil sampling indicates that the contamination is no longer present at levels that constitute a danger to human health and the environment within the soil cell soils. This soil cell is approximately 70 feet by 100 feet and approximately 4-6 feet thick. The soil cell is located at the ground surface and would be considered undocumented fill. It is our understanding that the entire soil cell will be removed prior to development of the site.

Topsoil Horizon: In all test pits, the ground surface is directly underlain by a topsoil horizon consisting of dark brown, moderately to highly organic silt with fine roots throughout. Topsoil thickness in test pits was between approximately 1 to 10 inches. However, there is the potential for some tree roots and thicker topsoil zones in the wooded areas on site.

Residual Soil: Underlying the topsoil, the test pits encountered stiff to very stiff, silt (ML) and gravelly silt residual soil. The residual soil was typically light reddish brown in color with orange and gray mottling. Highly weathered basalt clasts were common within the residual soil. The residual soil was encountered in all test pits and transitioned to less weathered basalt bedrock with boulders as discussed below.

Columbia River Basalt: Underlying the residual soil in test pits TP-1 through TP-8, test pits encountered weathered basalt bedrock materials belonging to the Columbia River Basalt formation. The basalt encountered was typically moderately weathered and was generally very medium hard (R3) to hard (R4). Where encountered, basalt resulted in practical refusal on medium hard (R3) to hard (R4) basalt in all of the test pits at depths between 1.5 and 13 feet using a medium size backhoe with 2-foot-wide bucket and rock teeth. The basalt extended beyond the maximum depth of exploration, where encountered.

Soil Moisture and Groundwater

On September 17, 2018, groundwater seepage was not encountered in test pits excavated to maximum depths of 13 feet bgs. Soil moisture ranged from dry to moist in the test pits. The groundwater conditions reported above are for the specific date and locations indicated, and therefore may not necessarily be indicative of other times and/or locations. It is anticipated that groundwater conditions will vary depending on the time of year, rainfall, local subsurface conditions, changes in site utilization, and other factors. During periods of heavy and prolonged precipitation, shallow perched groundwater conditions can occur over fine-grained native deposits such as those beneath the site, particularly during the wet season.

CONCLUSIONS AND RECOMMENDATIONS

Our investigation indicates that the proposed development is geotechnically feasible, provided that the recommendations of this report are incorporated into the design and construction phases of the project. The proposed development should not adversely affect, nor be adversely affected by adjoining properties, provided the project plans and our recommendations are followed and adequate construction monitoring is implemented during earthwork operations. In our opinion, the greatest geotechnical constraints for project development are the presence of shallow, medium hard rock underlying much of the site and the removal of any undocumented fill or structures that exist on the site. Practical refusal was achieved on medium hard (R3) to hard (R4) basalt in all test pits at depths of 1 to 13 feet.

Site Preparation

Areas of proposed buildings, streets, and areas to receive fill should be cleared of vegetation and any organic and inorganic debris. Existing buried structures (such as septic tanks) should be demolished and any cavities structurally backfilled. Inorganic debris and organic materials from clearing should be removed from the site.

Organic-rich topsoil should then be stripped from construction areas of the site or where engineered fill is to be placed. The estimated average necessary depth of removal in undisturbed areas for moderately organic soils is about 4 to 10 inches. Deeper removals may be necessary in highly treed areas of the site. The final depth of soil removal will be determined on the basis of a site inspection after the stripping/ excavation has been performed. Stripped topsoil should preferably be removed from the site. Any remaining topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative.

Any remaining undocumented fills and subsurface structures (tile drains, basements, driveway and landscaping fill, old utility lines, drywells, septic leach fields, etc.) should be removed and the excavations backfilled with engineered fill. Undocumented fill was encountered in the graded lawn area northeast of the residence to depths of approximately 5 feet bgs, and on the east side of the barn on the southern portion of the site to depths of approximately 1.5 feet bgs. We anticipate that

additional areas of undocumented fill likely exist in the vicinity of the existing structures and driveways.

Once stripping of a particular area is approved, the area must be ripped or tilled to a depth of at least 12 inches, moisture conditioned, root-picked, and compacted in-place prior to the placement of engineered fill or crushed aggregate base for pavement. Exposed subgrade soils should be evaluated by the geotechnical engineer. For large areas, this evaluation is normally performed by proof-rolling the exposed subgrade with a fully loaded scraper or dump truck. For smaller areas where access is restricted, the subgrade should be evaluated by probing the soil with a steel probe. Soft/loose soils identified during subgrade preparation should be compacted to a firm and unyielding condition, over-excavated and replaced with engineered fill (as described below), or stabilized with rock prior to placement of engineered fill. The depth of overexcavation, if required, should be evaluated by the geotechnical engineer at the time of construction.

Undocumented Fill Removal

We recommend that the zone of undocumented fill encountered in test pits TP-4 and TP-8, and any other undocumented fill encountered on site, be removed and replaced with engineered fill. The fill encountered in TP-4 and TP-8 did not appear to have been compacted as engineered fill. The depth of fill in test pit TP-4 was about 5 feet. The depth of fill in test pit TP-8 was about 1.5 feet. We anticipate that the majority of the undocumented fill will be suitable for re-use provided any organic debris is removed and the soils moisture-conditioned (dried) to allow compaction to project specifications.

Engineered Fill

In general, we anticipate that soils from planned cuts and utility trench excavations will be suitable for use as engineered fill provided they are adequately moisture conditioned prior to compacting. Imported fill material should be reviewed by GeoPacific prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill.

All grading for the proposed construction should be performed as engineered grading in accordance with the applicable building code at time of construction with the exceptions and additions noted herein. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill. Placement of boulders greater than 12 inches in size may be feasible in deeper fill areas, provided the boulders are surrounded in properly compacted engineered fill and boulders are not nested or stacked. Specific recommendations should be provided by GeoPacific in the field based on the quantity and size of rock materials being generated in the cuts.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 95% of the maximum dry density determined by ASTM D698 (Standard Proctor) or equivalent. We anticipate that aeration of native soil will be necessary for compaction operations. Field density testing should conform to ASTM D2922 and D3017, or D1556. All engineered fill should be observed and tested by the project geotechnical engineer or his representative. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more

testing. Because testing is performed on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency.

Site earthwork will be impacted by soil moisture and shallow groundwater conditions. Earthwork in wet weather would likely require extensive use of cement or lime treatment, or other special measures, at considerable additional cost compared to earthwork performed under dry-weather conditions.

Keyways, Benching, and Subdrains for Fill Slopes

Keying and benching will be required on this project where engineered fills are proposed on hillsides. Engineered fill placed on existing sloped areas inclining steeper than an approximately 20 percent grade should be constructed on a keyway and benches in accordance with the typical designs shown in the attached Fill Slope Detail (Figure 4). Keyways should have a minimum depth of three feet on the downhill size, and a minimum width of ten feet. Keyways should be excavated at the toe of the fill slope and extend perpendicular to the downslope direction. Additional removal of weakened or soft soils may be required depending on the conditions observed during construction. Benches and keyways should be roughly horizontal in the down slope direction, but may slope up to a 10 percent grade along a topographic contour. Keyways sloping more than a 20 percent grade along a topographic contour should be benched or configured as approved by the geotechnical engineer or his designated representative. Actual determination and dimensions of keyways should be decided once final planning is complete, and under the direction of the geotechnical engineer.

Keyways should include a subdrain consisting of a minimum 3-inch-diameter, ADS Heavy Duty Grade (or equivalent), perforated plastic pipe enveloped in a minimum of 3 cubic feet per lineal foot of 2"- ½", open-graded gravel drain rock wrapped with geotextile filter fabric (Mirafi 140N or equivalent). A minimum 0.5 percent gradient should be maintained throughout all subdrain pipes and outlets. GeoPacific should inspect keyways, subdrains and benching prior to fill placement. Subdrains may be eliminated at the discretion of the geotechnical engineer.

Excavating Conditions and Utility Trenches

Subsurface test pit exploration indicates that soft (R2) to hard (R4) basalt underlies the site at shallow depths. In some areas, we expect utility trenches less than about 10 feet below existing grade can be excavated in the soft basalt using conventional large trackhoe equipment. However, practical refusal on medium hard (R3) to hard (R4) basalt bedrock was reached in all of the test pits at depths ranging from 1.5 to 13 feet, with the medium-sized backhoe used in our exploration. Medium hard Columbia River Basalt typically contains clay seams and fractures, and can be excavated employing a rock bucket and ripper tooth. Some use of pneumatic rock breaker attachments may be necessary, particularly in deeper utility trench excavations

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

Soft, saturated soils and groundwater may be encountered in utility trenches, particularly during the wet season. We anticipate that dewatering systems consisting of ditches, sumps and pumps would be adequate for control of perched groundwater. Regardless of the dewatering system used, it should be installed and operated such that in-place soils are prevented from being removed along with the groundwater. Trench bottom stabilization, such as one to two feet of compacted crushed aggregate base, may be necessary in deeper trenches.

Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321. We recommend that trench backfill be compacted to at least 95% of the maximum dry density obtained by Standard Proctor ASTM D698 or equivalent. Initial backfill lift thickness for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

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

Erosion Control Considerations

During our field exploration program, we did not observe soil types near the ground surface that would be considered highly susceptible to erosion. In our opinion, the primary concern regarding erosion potential will occur during construction, in areas that have been stripped of vegetation. Erosion at the site during construction can be minimized by implementing the project erosion control plan, which should include judicious use of straw waddles and silt fences. If used, these erosion control devices should be in place and remain in place throughout site preparation and construction.

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

Wet Weather Earthwork

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

content is difficult to control, the following recommendations should be incorporated into the contract specifications.

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

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

Spread Foundations

The proposed residential structures may likely be supported on shallow foundations bearing on competent undisturbed, native soils and/or engineered fill, appropriately designed and constructed as recommended in this report. Native soils underlying the site are generally very stiff to hard and should provide adequate support of the structural loads

Foundation design, construction, and setback requirements should conform to the applicable building code at the time of construction. For maximization of bearing strength and protection against frost heave, spread footings should be embedded at a minimum depth of 12 inches below exterior grade. The recommended minimum widths for continuous footings supporting wood-framed walls without masonry are 12 inches for single-story, 15 inches for two-story, and 18 inches for three-story structures. Minimum foundation reinforcement should consist of a No. 4 bar at the top of the stem walls, and a No. 4 bar at the bottom of the footings. Concrete slab-on-grade reinforcement should consist of No. 4 bars placed on 24-inch centers in a grid pattern.

The anticipated allowable soil bearing pressure is 2,000 lbs/ft^2 for footings bearing on competent, non-expansive, native soil and/or engineered fill. A maximum chimney and column load of 40 kips is recommended for the site. The recommended maximum allowable bearing pressure may be increased by 1/3 for short-term transient conditions such as wind and seismic loading. For heavier loads, the geotechnical engineer should be consulted. The coefficient of friction between on-site soil and poured-in-place concrete may be taken as 0.42, which includes no factor of safety. The maximum anticipated total and differential footing movements (generally from soil expansion

and/or settlement) are 1 inch and ¾ inch over a span of 20 feet, respectively. We anticipate that the majority of the estimated settlement will occur during construction, as loads are applied. Excavations near structural footings should not extend within a 1H:1V plane projected downward from the bottom edge of footings.

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

Our recommendations are for house construction incorporating raised wood floors and conventional spread footing foundations. If living space of the structures will incorporate basements, a geotechnical engineer should be consulted to make additional recommendations for retaining walls, water-proofing, underslab drainage and wall subdrains. After site development, a Final Soil Engineer's Report should either confirm or modify the above recommendations.

Footing and Roof Drains

If the proposed structures will have raised floors, and no concrete slab-on-grade floors are used, perimeter footing drains would not be required based on soil conditions encountered at the site and experience with standard local construction practices. Where it is desired to reduce the potential for moist crawl spaces, footing drains may be installed. If concrete slab-on-grade floors are used, perimeter footing drains should be installed as recommended below.

Where used, perimeter footing drains should consist of 3 or 4-inch diameter, perforated plastic pipe embedded in a minimum of 1 ft^3 per lineal foot of clean, free-draining drain rock. The drain pipe and surrounding drain rock should be wrapped in non-woven geotextile (Mirafi 140N, or approved equivalent) to minimize the potential for clogging and/or ground loss due to piping. Water collected from the footing drains should be directed to the local storm drain system or other suitable outlet. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. The footing drains should include clean-outs to allow periodic maintenance and inspection. In our opinion, footing drains may outlet at the curb, or on the back sides of lots where sufficient fall is not available to allow drainage to the street.

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

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

Pavement Design

For design purposes, we used an estimated resilient modulus of 9,000 for compacted native soil. Table 2 presents our recommended minimum pavement section for dry weather construction.

Table 2. Recommended Minimum Dry-Weather Pavement Section

Material Layer	Light-duty Public Streets	Compaction Standard
Asphaltic Concrete (AC)	3 in.	92% of Rice Density AASHTO T-209
Crushed Aggregate Base ¾"-0 (leveling course)	2 in.	95% of Modified Proctor AASHTO T-180
Crushed Aggregate Base 1½"-0	8 in.	95% of Modified Proctor AASHTO T-180
Subgrade	12 in.	95% of Standard Proctor AASHTO T-99 or equivalent

Any pockets of organic debris or loose fill encountered during ripping or tilling should be removed and replaced with engineered fill (see *Site Preparation* section). In order to verify subgrade strength, we recommend proof-rolling directly on subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas that pump, rut, or weave should be stabilized prior to paving.

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

Seismic Design

The Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon HazVu: 2018 Statewide GeoHazards Viewer indicates that the site is in an area where *very strong* ground shaking is anticipated during an earthquake. Structures should be designed to resist earthquake loading in accordance with the methodology described in the 2015 International Building Code (IBC) with applicable Oregon Structural Specialty Code (OSSC) revisions (current 2014). We recommend Site Class D be used for design per the OSSC, Table 1613.5.2 and as defined in ASCE 7, Chapter 20, Table 20.3-1. Design values determined for the site using the USGS (United States Geological Survey) 2018 Seismic Design Maps Summary Report are summarized in Table 3 and are based upon existing soil conditions.

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

Parameter	Value
Location (Lat, Long), degrees	45.352, -122.825
Probabilistic Ground Motion Values, 2% Probability of Exceedance in 50 yrs	
Peak Ground Acceleration (PGA_M)	0.449 g
Short Period, S_s	0.938 g
1.0 Sec Period, S_1	0.417 g
Soil Factors for Site Class D:	
F_a	1.125
F_v	1.583
$SD_s = 2/3 \times F_a \times S_s$	0.703 g
$SD_1 = 2/3 \times F_v \times S_1$	0.440 g
Seismic Design Category	D

Soil Liquefaction

The Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon HazVu: 2018 Statewide GeoHazards Viewer indicates that the site not mapped as an area considered to be at risk of soil liquefaction during an earthquake. Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a liquid in response to ground shaking caused by strong earthquakes. Soil liquefaction typically occurs in loose sands and granular soils located below the water table, and fine-grained soils with a plasticity index less than 15. The subsurface profile observed within our test pit explorations which extended to a maximum depth of 13 feet bgs, indicated that the site is underlain generally by stiff to very stiff SILT (ML) and soft to hard ROCK (R2-R4) which are not considered susceptible to liquefaction. Static groundwater was not encountered in our test pit explorations.

UNCERTAINTIES AND LIMITATIONS

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

Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations. The checklist attached to this report outlines recommended geotechnical observations and testing for the project. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

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

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

Stephen Morris
Staff Scientist

EXPIRES: 06/30/2019
James D. Imbrie, G.E., C.E.G.
Principal Geotechnical Engineer

Attachments: References
Figures
- Figure 1 – Vicinity Map
- Figure 2 – Site Aerial Map and Exploration Locations
- Figure 3 – Site Plan and Exploration Locations
- Figure 4 – Fill Slope Detail

Test Pit Logs (TP-1 through TP-8)

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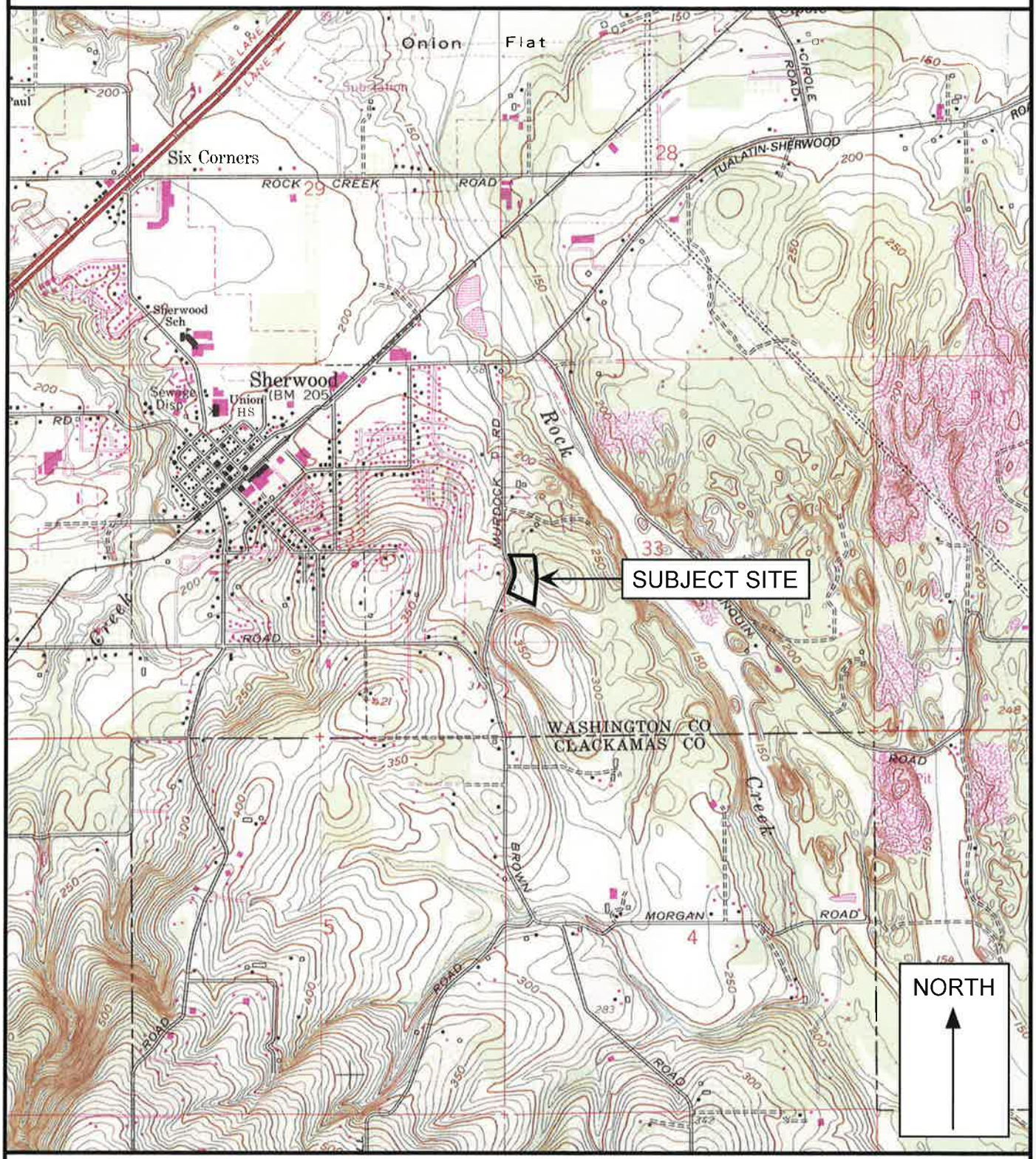
VICINITY MAP



Legend

Approximate Scale 1 in = 2,000 ft

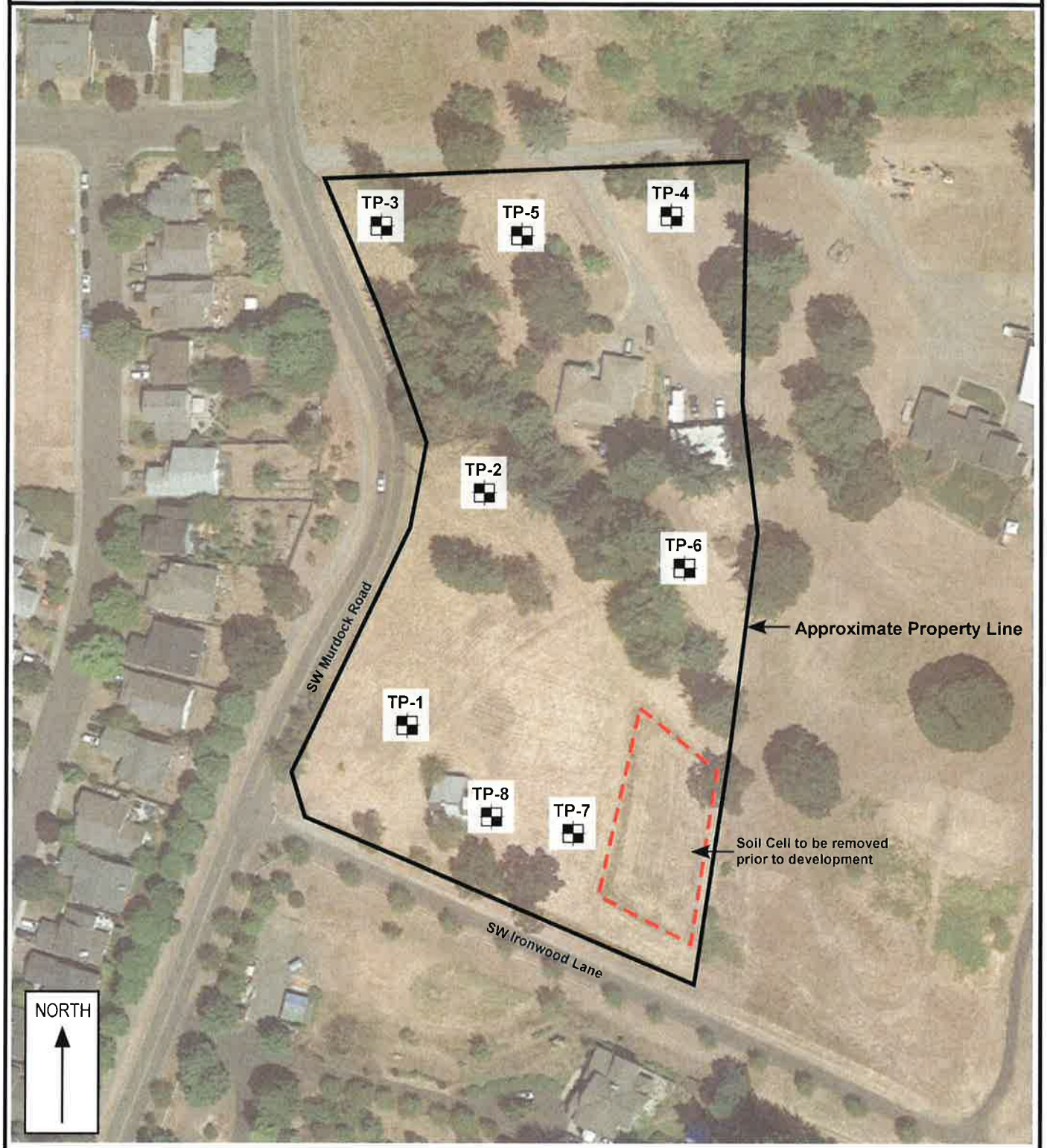
Date: 11/06/18
Drawn by: SM

Base map: U.S. Geological Survey 7.5 minute Topographic Map Series, Sherwood, Oregon Quadrangle, 1961 (Photorevised 1984)

Project: Murdock Subdivision Sherwood, Oregon	Project No. 18-5044	FIGURE 1

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

SITE MAP AND EXPLORATION LOCATIONS



LEGEND

TP-6 Test Pit Designation
Approximate Location of Test Pit Exploration

0 200
Approximate Scale (Feet)

Date: 11/06/18
Drawn by: SM

Project: Murdock Subdivision Sherwood, Oregon	Project No. 18-5044	FIGURE 2

GeoPacific Engineering, Inc.
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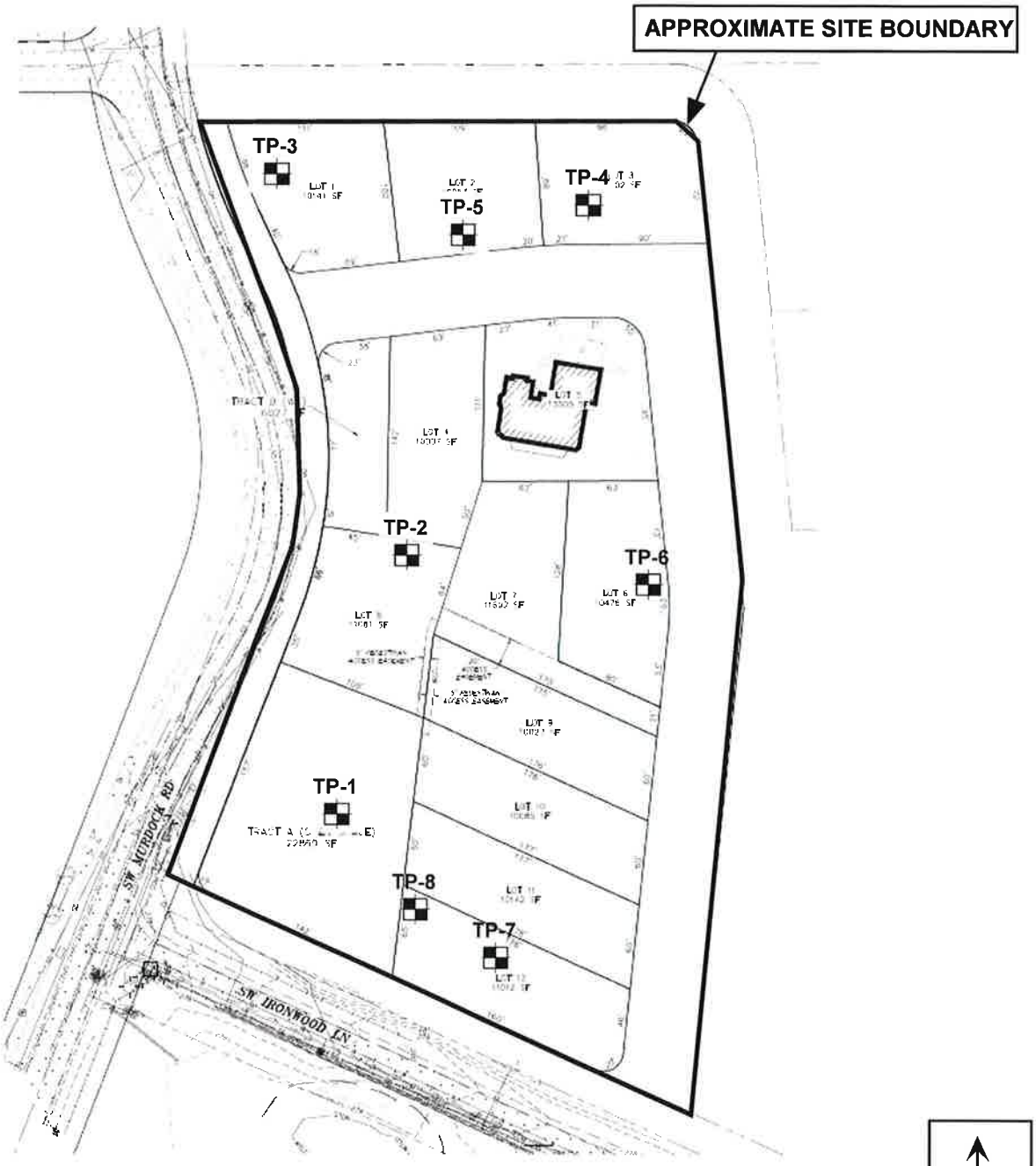
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

SITE PLAN MAP AND EXPLORATION LOCATIONS



Legend:

TP-6 Test Pit Designation

Approximate Location of Test Pit Exploration

APPROXIMATE SCALE
1" = 120'

60 0 60 120

Date: 11/05/18
Drawn by: SM

Project:	Project No.	
Murdock Subdivision 23000 SW Murdock Road Sherwood, Oregon	18-5044	FIGURE 3

GeoPacific Engineering, Inc.
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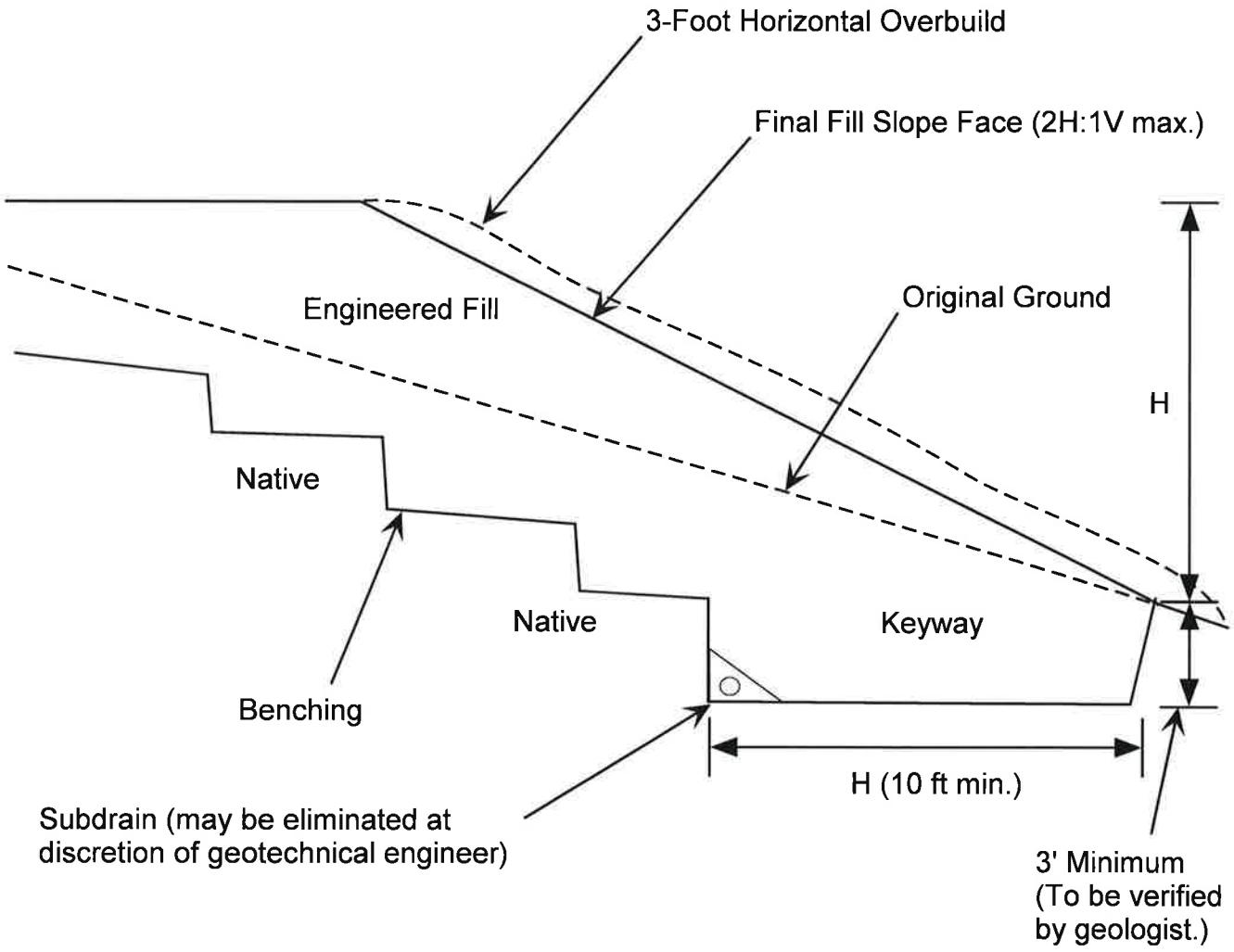
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

FILL SLOPE DETAIL

TYPICAL KEYWAY, BENCHING & FILL SLOPE DETAIL



Recommended subdrain is minimum 3-inch-diameter ADS Heavy Duty grade (or equivalent), perforated plastic pipe enveloped in a minimum of 3 cubic feet per lineal foot of 2" to 1/2" open-graded gravel drain rock wrapped with geotextile filter fabric (Mirafi 140N or equivalent).

Project:	Project No.	
Murdock Subdivision 23000 SW Murdock Road Sherwood, Oregon	18-5044	FIGURE 4

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Sherwood, Oregon 97140
Tel: (503) 625-4455 Fax: (503) 625-4405

TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP- 1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, dry, trace organic material on surface (Residual Soil)
2						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 1.5 Feet.
3						
4						Note: No seepage or groundwater encountered.
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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Sherwood, Oregon 97140
Tel: (503) 625-4455 Fax: (503) 625-4405

TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-2**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Highly organic SILT (OL-ML), dark brown, fine roots throughout, loose, dry (Topsoil Horizon)
2	4.5					Stiff to very stiff SILT (ML), light reddish brown, fine roots to 3 feet, slight orange and gray mottling, micaceous, dry (Residual Soil)
3	4.5					
4	4.0					
5						
6						
7						Medium stiff sandy SILT (ML), dark brown, slight orange and gray mottling, micaceous, moist (Residual Soil)
8						
9						
10						
11						Medium (R2) to Medium Hard (R3) BASALT, trace light reddish brown silty sand matrix, gray to light brown, damp (Columbia River Basalt Formation)
12						
13						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 12.5 Feet.
14						
15						Note: No seepage or groundwater encountered.
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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Sherwood, Oregon 97140
Tel: (503) 625-4455 Fax: (503) 625-4405

TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-3**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.0					Highly organic SILT (OL-ML), dark brown, fine roots throughout, loose, dry (Topsoil Horizon)
2	4.5					Stiff to very stiff SILT (ML), light reddish brown, fine roots to 3 feet, orange and gray mottling, micaceous, dry (Residual Soil)
3	4.5					
4	3.0					
5						
6						Medium stiff SILT (ML), dark brown, slight to strong orange and gray mottling, micaceous, moist (Residual Soil)
7						
8						
9						
10						
11						
12						
13						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 13 Feet.
14						
15						Note: No seepage or groundwater encountered.
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-4**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Moderately organic SILT (OL-ML), dark brown, fine roots throughout, loose, mois (Topsoil Horizon)
2	4.5					Stiff gravelly SILT (ML) with boulders and gray weathered basalt fragments, light reddish brown, trace fine roots throughout, dry to damp, woody debris and organ- ic matter at 4.5 feet (Undocumented Fill)
3	4.5					
4	4.5					
5						
6						Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, damp (Residual Soil)
7						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 6.5 Feet.
8						
9						Note: No seepage or groundwater encountered.
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-5**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Moderately organic SILT (OL-ML), dark brown, roots throughout, dry (Topsoil Horizon)
2						Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, dry, fine roots to 1.5 feet (Residual Soil)
3						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 2 Feet.
4						Note: No seepage or groundwater encountered.
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

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

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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Sherwood, Oregon 97140
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TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-6**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Moderately organic SILT (OL-ML), dark brown, roots throughout, dry (Topsoil Horizon)
						Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, dry, fine roots throughout (Residual Soil)
2						
3						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 1 Foot.
4						
5						Note: No seepage or groundwater encountered.
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-7**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Moderately organic SILT (OL-ML), dark brown, fine roots throughout, loose, dry (Topsoil Horizon)
2	4.5					Stiff to very stiff SILT (ML), light reddish brown, fine roots to 3 feet, orange and gray mottling, micaceous, dry (Residual Soil)
3	4.5					
4	4.5					
5						Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, dry (Residual Soil)
6						Soft (R2) to Medium Hard (R3) BASALT, trace light reddish brown silty sand matrix, gray to light brown, damp (Columbia River Basalt Formation)
7						
8						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 7 Feet.
9						
10						Note: No seepage or groundwater encountered.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

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TEST PIT LOG

Project: Murdock Road Subdivision Sherwood, Oregon	Project No. 18-5044	Test Pit No. **TP-8**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Moderately organic SILT (OL-ML), dark brown, fine roots throughout, loose, dry (Topsoil Horizon)
2						Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, dry, woody debris within first foot (Undocumented Fill)
3						Loose gravelly SILT (ML), with boulders and gray weathered basalt fragments, light reddish brown, dry (Residual Soil)
4						Practical Refusal on Medium Hard (R3) to Hard (R4) Basalt at 3 Feet.
5						Note: No seepage or groundwater encountered.
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 9/18/18
Logged By: SM
Surface Elevation:

BETA Version

Fire Hydrant Flow Calculator

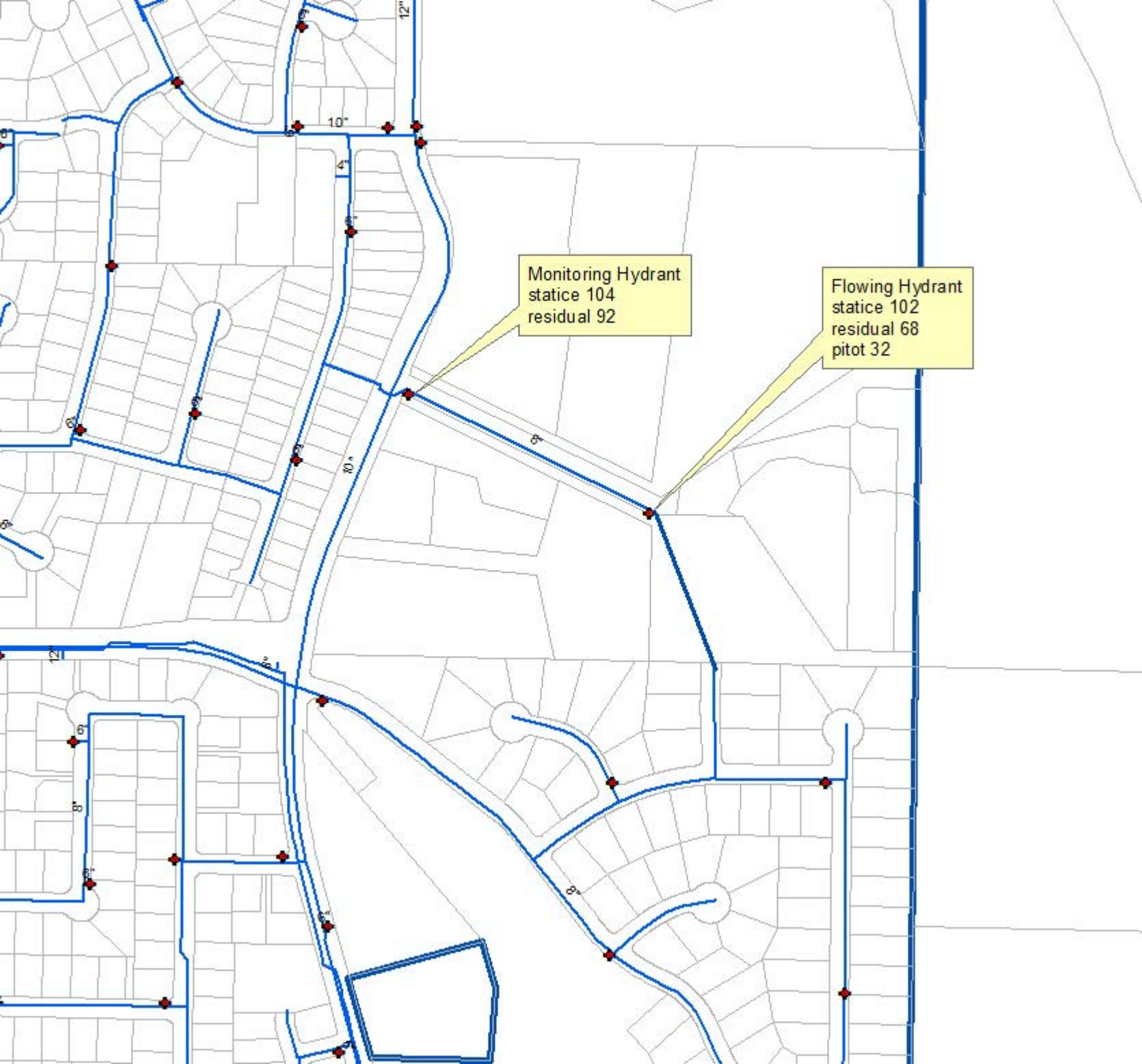
- Use the tab key to navigate.
- Tab between each box to update the calculation.
- Be sure to tab past your final entry for a correct calculation.

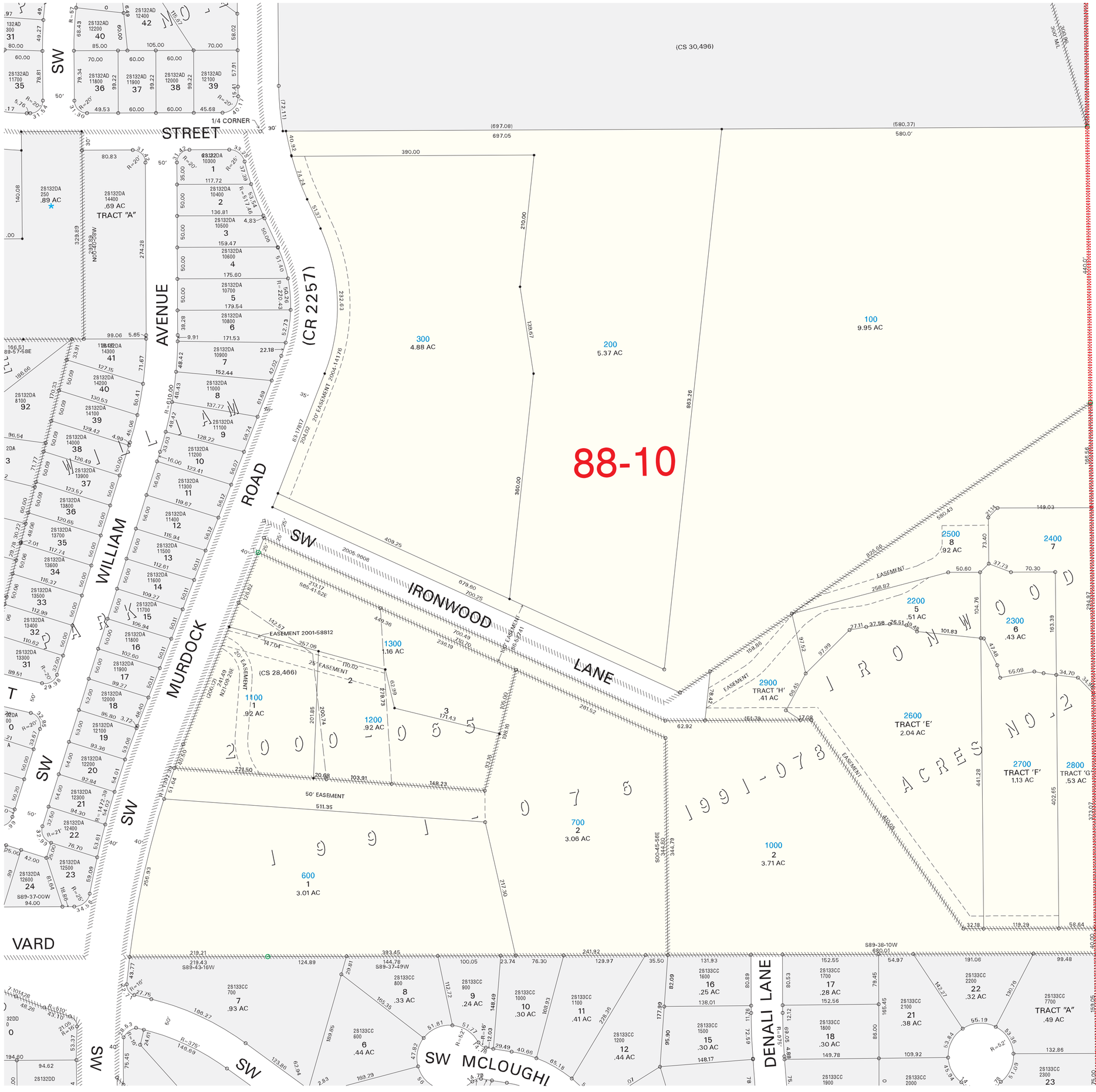
Static:	102	psi before flowing
Residual:	68	psi while flowing
Pitot:	32	pitot gage reading
Diameter:	4	size of opening tested
This hydrant is flowing:	2025	GPM from the test outlet
Projected available hydrant flow:	3257	GPM Note 1
2nd Static:	104	secondary psi before flowing
2nd Residual:	92	secondary psi while flowing
The main can be expected to flow about:	5791	GPM

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

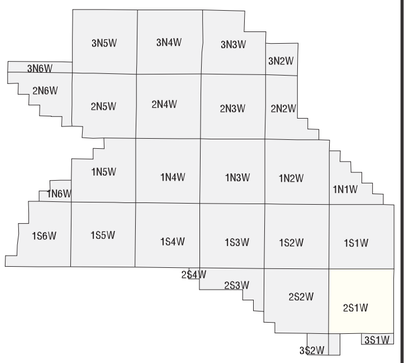
2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and FireHydrant.org express no warranty for its suitability for any particular purpose.


Monitoring Hydrant
statice 104
residual 92
Flowing Hydrant
statice 102
residual 68
pitot 32



dig2s1w33

2S 1 33CB



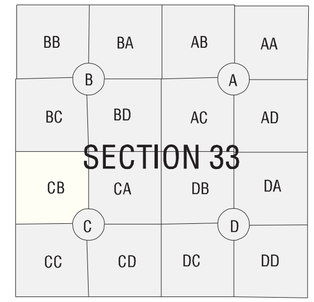
WASHINGTON COUNTY OREGON

NW1/4 SW1/4 SECTION 33 T2S R1W W.M.

SCALE 1" = 100'

36	31	32	33	34	35	36	31
1	6	5	4	3	2	1	6
12	7	8	9	10	11	12	7
13	18	17	16	15	14	13	18
24	19	20	21	22	23	24	19
25	30	29	28	27	26	25	30
36	31	32	33	34	35	36	31
1	6	5	4	3	2	1	6

FOR ADDITIONAL MAPS VISIT OUR WEBSITE AT www.co.washington.or.us



Cancelled Taxlots For: 2S133CB

400,500,800,900,1400,1500,1600,1700,1800, 1900,2000,2100,

SCALE 1" = 100'

0 50 100 200 300

Assessment CARTOGRAPHY Taxation

PLOT DATE: March 09, 2011

FOR ASSESSMENT PURPOSES ONLY - DO NOT RELY ON FOR OTHER USE

Map areas delineated by either gray shading or a cross-hatched pattern are for reference only and may not indicate the most current property boundaries. Please consult the appropriate map for the most current information.

SHERWOOD
2S 1 33CB