Land Use Review

FOR THE CONSTRUCTION OF THE
Memorial Park Pump Station

October 2019

murraysmith

MEMORIAL PARK PUMP STATION
LAND USE APPLICATION
FOR
CITY OF WILSONVILLE

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SECTION 1

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LAND USE REVIEW APPLICATION

WILSONVILLE
OREGON

29799 SW Town Center Loop E, Wilsonville, OR 97070
Phone: 503.682.4960 Fax: 503.682.7025
Web: www.ci.wilsonville.or.us

Planning Division
Development Permit Application

Final action on development application or zone change is required within 120 days in accordance with provisions of ORS 227.175

A pre application conference is normally required prior to submittal of an application. Please visit the City's website for submittal requirements

Pre-Application Meeting Date: 5/31/18

Incomplete applications will not be scheduled for public hearing until all of the required materials are submitted.

Applicant:
Name: Mike Nacrelli
Company: City of Wilsonville
Mailing Address: 29799 SW Town Center Loop E
City, State, Zip: Wilsonville, OR 97070
Phone: (503)682-1011 Fax:
E-mail: mnacrelli@ci.wilsonville.or.us

Authorized Representative:
Name: Eddie Kreipe
Company: Murraysmith
Mailing Address: 888 SW 5th Ave, Suite 1170
City, State, Zip: Portland, OR, 97204
Phone: (503)225-9010 Fax: (503)345-6865
E-mail: Eddie.Kreipe@murraysmith.us

Property Owner:
Name: Patty Nelson
Company: City of Wilsonville
Mailing Address: 29799 SW Town Center Loop E
City, State, Zip: Wilsonville, OR, 97070
Phone: (503)682-4960 Fax: (503)682-7025
E-mail: nelson@ci.wilsonville.or.us

Property Owner's Signature:
Printed Name: Patty Nelson Date: 10-28-19

Applicant's Signature: (If different from Property Owner)
Printed Name: MICHAEL NACRELLI Date: 10/28/19

Site Location and Description:
Project Address if Available: 8100 SW Wilsonville Road, Wilsonville, OR 97070 Suite/Unit
Project Location: Within Memorial Park, near the maintenance barn and the sports fields
Tax Map #(s): 3S1W24 Tax Lot #(s): 00691 County: ☐ Washington ■ Clackamas

Request:
Construction of a new sewage pump station to replace an existing station nearby.

Project Type: **Class I** ☐ **Class II** ☐ **Class III** ☐
☐ Residential ☐ Commercial ☐ Industrial ■ Other: Municipal

Application Type(s):

☐ Annexation	☐ Appeal	☐ Comp Plan Map Amend	☐ Parks Plan Review
☐ Final Plat	☐ Major Partition	☐ Minor Partition	☐ Request to Modify Conditions
☐ Plan Amendment	☐ Planned Development	☐ Preliminary Plat	
☐ Request for Special Meeting	☐ Request for Time Extension	☐ Signs	■ Site Design Review
☐ SROZ/SRIR Review	☐ Staff Interpretation	☐ Stage I Master Plan	☐ Stage II Final Plan
☐ Type C Tree Removal Plan	☐ Tree Permit (B or C)	☐ Temporary Use	☐ Variance
☐ Villebois SAP	☐ Villebois PDP	☐ Villebois FDP	☐ Other (describe)
☐ Zone Map Amendment	☐ Waiver(s)	☐ Conditional Use	

SECTION 2

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PROJECT NARRATIVE

SECTION 2

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Project Narrative and Background

Project Narrative

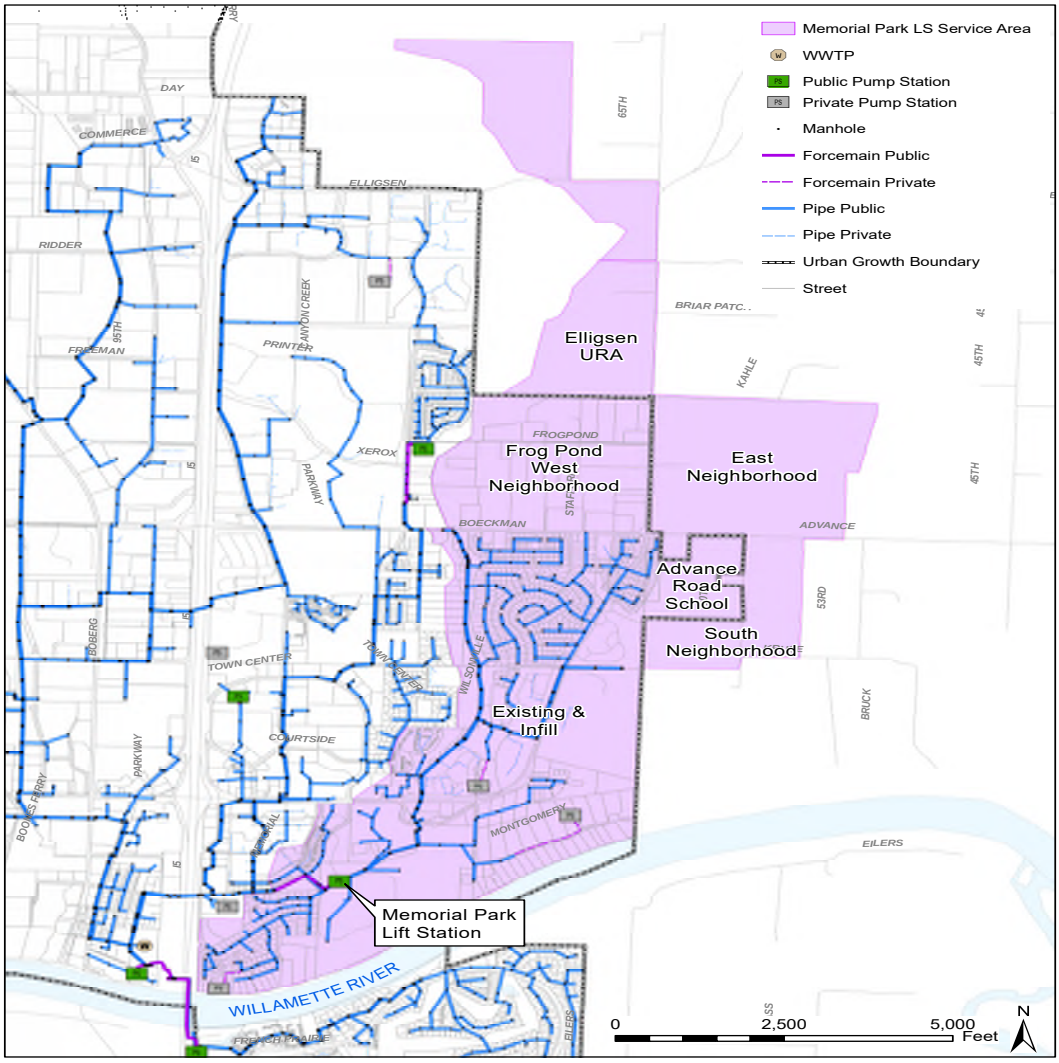
Date:	October 25, 2019
Project:	Memorial Park Pump Station
To:	City of Wilsonville, Planning Division
From:	Freeda Crow, EIT Eddie Kreipe, PE Murraysmith
Re:	Memorial Park Pump Station Land Use Application

I. Background Information

The City of Wilsonville currently owns and operates a sewage pump station in Memorial Park. Constructed in 1993, this pump station serves a developed area of Wilsonville that produces a peak flow of approximately 1,100 gpm. The City has identified that infill and new development in the Frog Pond West, East, and South neighborhoods will increase this flow to 3,200 gpm within the next 20 years. The total area of the existing pump station site is 1,300 SF, and the floor of the pump station control building is 3 feet below the 100-year floodplain elevation of 93.0'. Figure 1, below, shows the pump station service area and sub-basins.

Code requires that Site Design Review by the Planning Department be completed for this project. This application is intended to satisfy this requirement.

Figure 1: Service Area Plan



The existing pump station is a duplex self-priming type sewage pump station that currently has a capacity of approximately 1,700 gpm. The pumps and equipment are reaching the end of their expected design life and are in need of updating to current City standards. In addition, the pump station control building is located 3 feet below the Boeckman Creek floodplain elevation, posing a serious concern for reliability of the pump station's electrical and control equipment during a heavy storm event. The City has placed Jersey barriers around the pump station building to help reduce flood waters from the entering the building. The new pump station will comply with DEQ requirements to maintain a finish grade a minimum of two feet above the flood plain.

II. Summary of Proposal

The City has determined that the existing pump station should be abandoned and replaced with a new pump station that is above the flood plain, and that will have the capacity to handle the

expected increase in flow up to 3,200 gpm. A triplex pump configuration is recommended to obtain the required capacity. An onsite generator will provide emergency power.

The proposed location for the new pump station is approximately 550 feet to the Northeast of the existing pump station, along the same road that serves Memorial Park. This location was identified in the Memorial Park Master Plan (MPMP). The proposed pump station will have a total area of 4,700 SF, which will include a 800 SF utility building, an operations vehicle parking space, and a wet well and valve vault.

The proposed building will house the electrical and controls cabinets, emergency power generator, and odor control filter for the pump station. Building architecture will compliment other buildings within Memorial Park and has been coordinated with City Park Staff throughout the design process.

The proposed project will extend gravity and force main piping from the existing pump station site to the proposed location. Addition utilities for power, water, and communications will be extended to the new location along the existing park access road. The access road from the park entrance to the pump station location will be repaved to its original foot print.

The City's fiber network will be extended to the pump station site from the Murase Plaza area and routed along the lower walking path that connects Murase Plaza and Memorial Park . This will create a high speed connection for the City's SCADA system and allow the City to monitor the pump station through its network.

III. Key Issues/Discussion Items

The following Key Issues are discussed below:

Flood Plain Elevation

The existing pump station is located below the Boeckman Creek 100-year flood plain elevation of 93 feet. The new pump station is located on higher ground two feet above the flood plain (with a base elevation of 95 feet). This was required to meet Oregon Department of Environmental Quality standards for pump station construction. The building, proposed vault hatches, and the wet well are all above the flood plain and should remain accessible during a 100-year storm event. No net fill is proposed within the flood plain.

Seismic Resiliency

Geotechnical investigations identified soils in the project area to have high potential for liquefaction and permanent ground deformation with the expectation of 4-inches of settlement during a seismic event. To mitigate for this potential liability and ensure that the pump station continues to operate, a series of piles will be installed to support the building and adjacent underground structures that are supported by these liquefiable soils. The force main pipe will have restrained joints to prevent separation.

Previous Public Involvement

The City conducted public outreach in 2013 during the development of the Sanitary Sewer Master Plan that identified alternative locations within the park for the proposed pump station. These locations vetted through the City Commission and ultimately the preferred location was identified though the Memorial Park Master Plan completed by the City in 2015. Extensive public involvement was completed with this plan development through a schedule of open house events, online surveys and media, and stake holder engagement.

Park Access During Construction

It is anticipated that vehicle access along the access road will be restricted during construction of the underground utilities. This is necessary to ensure public safety. Use restrictions will be minimized to the extent possible. Pedestrian access around the work zone may be established during construction and use of the sports fields will remain.

IV. Response Findings to Code Criteria

Wilsonville Planning & Land Development Ordinance

Section 4.136 – Public Facility Zone

(.02) Uses Permitted Outright:

G. Public utilities and buildings

J. Parks

Response: Under section 4.136.02G, public utilities and buildings are permitted. This pump station is part of the public sewer utility system, and therefore is permitted outright.

(.04) Dimensional Standards:

A. Minimum Lot Size: One (l) Acre The minimum lot area may be reduced upon a finding that the resulting parcel is compatible with the adjoining property in that it does not impair the development of any adjoining property, does not adversely affect the value of adjoining property, and does not adversely affect the public health, safety, or welfare.

B. Minimum front and rear yard setbacks: Thirty (30) feet. Minimum sideyard setback: ten (10) feet.

C. Minimum street frontage: Seventy-five (75) feet.

D. Maximum height: thirty five (35) feet.

Response: The project site is fully within tax lot 691. This tax lot is 91.6 acres and is one of the tax lots that makes up Memorial Park. All structures are 30 feet or more from property lines. The pump station building will be less than 35 feet in height. Therefore, all dimensional standards are met.

(.05) Off-Street Parking Requirements: As provided in Section 4.155.

(.07) Corner Vision: As provided in Section 4.176

Response: The above requirements will be addressed as applicable in their respective sections, below.

(.08) Special Regulations:

A. All principal and conditional uses shall be subject to Section 4.400 through 4.450 (Site Design Review) of the Wilsonville Code.

B. As part of either a permitted or conditional use, the Planning Commission may review and approve a Master Plan for an entire development or area subject to Section 4.140 (Planned Development Regulations) of the Wilsonville Code. Approval of a Master Plan would allow all uses provided in the Master Plan without further review. Minor changes which do not have off-site impact or increase visitor capacity may be reviewed by the Planning Director. [Amended by Ordinance No. 538, 2/21/02.]

C. Prisons, other than minimum-security mental institutions, are hereby prohibited.

Response: Applicable Site Design Review code sections are addressed below. The 2015 Memorial Park Master Plan was approved through a legislative process rather than a quasi-judicial Planned Development. Therefore, B and C do not apply.

(.09) Block and access standards:

The PF zone shall be subject to the same block and access standards as the PDC zone, Section 4.131(.03).

Response: The project does not include any changes to existing road routes and will not affect any block lengths or vehicle, bicycle, or pedestrian access. Therefore, the standard does not apply.

Sections 4.139.00 through 4.139.11– Significant Resource Overlay Zone (SROZ)

Section 4.139.04 Uses and Activities Exempt from These Regulations

A request for exemption shall be consistent with the submittal requirements listed under Section 4.139.06(.01)(B – I), as applicable to the exempt use and activity. [Added by Ord. # 674 11/16/09]

(.20) The installation of public streets and utilities specifically mapped within a municipal utility master plan, the Transportation Systems Plan or a capital improvement plan.

Response: Since the project is a part of a municipal utility master plan, it is exempt from the SROZ development requirements. Therefore this standard is met.

Section 4.154 – On-site Pedestrian Access and Circulation.

(.01) On-site Pedestrian Access and Circulation

B. Standards. Development shall conform to all of the following standards:

1. Continuous Pathway System. A pedestrian pathway system shall extend throughout the development site and connect to adjacent sidewalks, and to all future phases of the development, as applicable.

Response: The pump station will have a pedestrian path through it. The parking area will be paved with asphalt concrete and there will be a cement walkway through the area to allow pedestrian access. There is an existing path to the Northwest of the site. The pedestrian path will connect to this pathway and extend through the site as shown in section 3, sheet C-1. Parks intends to extend the path beyond the pump station site to the East, but this portion of the path will likely be constructed after the pump station project is completed.

2. Safe, Direct, and Convenient. Pathways within developments shall provide safe, reasonably direct, and convenient connections between primary building entrances and all adjacent parking areas, recreational areas/playgrounds, and public rights-of-way and crosswalks based on all of the following criteria:

   a. Pedestrian pathways are designed primarily for pedestrian safety and convenience, meaning they are free from hazards and provide a reasonably smooth and consistent surface.

   b. The pathway is reasonably direct. A pathway is reasonably direct when it follows a route between destinations that does not involve a significant amount of unnecessary out-of-direction travel.

Response: The pathway will be separated from the roadway with bollards or boulders. The surface will be concrete which will ensure the pathway surface is smooth and consistent. The concrete will also clearly designate the pathway. The route through the site is as direct as possible, and since the site is small, the pathway is only approximately 250’ long.

   c. The pathway connects to all primary building entrances and is consistent with the Americans with Disabilities Act (ADA) requirements.

   d. All parking lots larger than three acres in size shall provide an internal bicycle and pedestrian pathway pursuant to Section 4.155(.03)(B.)(3.)(d.).

Response: The only building on the site is an electrical building that will only be accessed by authorized personnel. Stairs will be provided leading to the building. The pathway will be consistent with ADA requirements. There is not a parking lot larger than three acres, so an internal bicycle and pedestrian path is not required. Therefore, the standard does not apply.

3. Vehicle/Pathway Separation. Except as required for crosswalks, per subsection 4, below, where a pathway abuts a driveway or street it shall be vertically or horizontally separated from the vehicular lane. For example, a pathway may be vertically raised six inches above the abutting travel lane, or horizontally separated by a row of bollards.

Response: Bollards or boulders will provide separation between the pedestrian path and the road in the parking area. To the East of the parking area, a minimum of 1' of horizontal separation will be maintained between the path and the road. Therefore, the standard is met.

4. Crosswalks. Where a pathway crosses a parking area or driveway, it shall be clearly marked with contrasting paint or paving materials (e.g., pavers, light-color concrete inlay between asphalt, or similar contrast).

5. Pathway Width and Surface. Primary pathways shall be constructed of concrete, asphalt, brick/masonry pavers, or other durable surface, and not less than five (5) feet wide. Secondary pathways and pedestrian trails may have an alternative surface except as otherwise required by the ADA.

6. All pathways shall be clearly marked with appropriate standard signs.

Response: The pathway will be constructed with concrete and the parking area it runs through will be constructed with asphalt. These two materials are contrasting colors so the pathway will be clearly designated. The pathway will be 10' wide in most areas and a minimum of 6' wide in constricted areas. There will be no signs in the pump station area for the pathway, but there will be signs in other locations along the path to clearly mark it. Therefore, the standards are met.

Section 4.155 – General Regulations - Parking, Loading and Bicycle Parking.

(.03) Minimum and Maximum Off-Street Parking Requirements:

A. Parking and loading or delivery areas shall be designed with access and maneuvering area adequate to serve the functional needs of the site and shall:

1. Separate loading and delivery areas and circulation from customer and/or employee parking and pedestrian areas. Circulation patterns shall be clearly marked.
2. To the greatest extent possible, separate vehicle and pedestrian traffic.

Response: Since the site will only be accessed by the City's maintenance personnel, the parking area has been designed accordingly. The site has been designed with sufficient parking space for a vactor truck to enter from the West and exit to the East. This is a large vehicle (approximately the size of a school bus), so the parking area will also be suitable for a regular maintenance vehicle to access the site. There are no separate loading and delivery areas, and the parking area will be separated from the road with removable bollards and boulders. Therefore, the standard is met.

B. Parking and loading or delivery areas shall be landscaped to minimize the visual dominance of the parking or loading area, as follows:

1. Landscaping of at least ten percent (10%) of the parking area designed to be screened from view from the public right-of-ay and adjacent properties. This landscaping shall be considered to be part of the fifteen percent (15%) total landscaping required in Section 4.176.03 for the site development.

2. Landscape tree planting areas shall be a minimum of eight (8) feet in width and length and spaced every eight (8) parking spaces or an equivalent aggregated amount.

a. Trees shall be planted in a ratio of one (1) tree per eight (8) parking spaces or fraction thereof, except in parking areas of more than two hundred (200) spaces where a ratio of one (1) tree per six (six) spaces shall be applied as noted in subsection (.03)(B.)(3.). A landscape design that includes trees planted in areas based on an aggregated number of parking spaces must provide all area calculations.

b. Except for trees planted for screening, all deciduous interior parking lot trees must be suitably sized, located, and maintained to provide a branching minimum of seven (7) feet clearance at maturity.

Response: The area around the parking area will be landscaped, and there will be a landscaped planter on the North edge of the parking area. The parking area is not visible from the public right-of-way or adjacent properties since the site is located within Memorial Park. The parking area is designed for only 1-2 vehicles at a time, although it will not have delineated parking spaces. There are 10 trees proposed on the site. Therefore, the applicable standards are met.

G. Tables 5 shall be used to determine the minimum and maximum parking standards for various land uses. The minimum number of required parking spaces shown on Tables 5 shall be determined by rounding to the nearest whole parking space. For example, a use containing 500 square feet, in an area where the standard is one space for each 400 square feet of floor area, is required to provide one off-street parking space. If the same use contained more than 600 square feet, a second parking space would be required. Structured parking and on-street parking are exempted from the parking maximums in Table 5. [Amended by Ordinance No. 538, 2/21/02.]

Response: Table 5 does not include maximum and minimum vehicle parking for park or utility uses. The 2015 Memorial Park Master Plan shows 364 vehicle parking spaces across Memorial Park. The proposed pump station parking area will not be for use by the public and will only be used by City maintenance personnel. The existing number of parking spaces in the park will not change. Therefore, the applicable standards are met.

(.04) Bicycle Parking:

A. Required Bicycle Parking - General Provisions.

1. The required minimum number of bicycle parking spaces for each use category is shown in Table 5, Parking Standards.
2. Bicycle parking spaces are not required for accessory buildings. If a primary use is listed in Table 5, bicycle parking is not required for the accessory use.
3. When there are two or more primary uses on a site, the required bicycle parking for the site is the sum of the required bicycle parking for the individual primary uses.
4. Bicycle parking space requirements may be waived by the Development Review Board per Section 4.118(.03)(A.)(9.) and (10.).

Response: Table 5 does not include minimum bicycle parking for park or utility uses. Since there will be no public access to the building or site, there is no need for bicycle parking. Therefore, the applicable standards are met.

Section 4.176. Landscaping, Screening, and Buffering

(.03) Landscape Area. Not less than fifteen percent (15%) of the total lot area, shall be landscaped with vegetative plant materials. The ten percent (10%) parking area landscaping required by section 4.155.03(B)(1) is included in the fifteen percent (15%) total lot landscaping requirement. Landscaping shall be located in at least three separate and distinct areas of the lot, one of which must be in the contiguous frontage area. Planting areas shall be encouraged adjacent to structures. Landscaping shall be used to define, soften or screen the appearance of buildings and off-street parking areas. Materials to be installed shall achieve a balance between various plant forms, textures, and heights. The installation of native plant materials shall be used whenever practicable. (For recommendations refer to the Native Plant List maintained by the City of Wilsonville). [Amended by Ord. # 674 11/16/09]

Response: Approximately thirty percent (30%) of the site area is landscaped using various types of trees, shrubs, and groundcovers. There are plantings on the East and West of the site to screen it from view. See sheet L-4, section 3, for the planting plan. To the South is a road, and to the North is an existing stand of trees. Therefore, the applicable standards are met.

(.04) Buffering and Screening. Additional to the standards of this subsection, the requirements of the Section 4.137.5 (Screening and Buffering Overlay Zone) shall also be applied, where applicable.

A. All intensive or higher density developments shall be screened and buffered from less intense or lower density developments.

B. Activity areas on commercial and industrial sites shall be buffered and screened from adjacent residential areas. Multi-family developments shall be screened and buffered from single-family areas.

C. All exterior, roof and ground mounted, mechanical and utility equipment shall be screened from ground level off-site view from adjacent streets or properties.

D. All outdoor storage areas shall be screened from public view, unless visible storage has been approved for the site by the Development Review Board or Planning Director acting on a development permit.

E. In all cases other than for industrial uses in industrial zones, landscaping shall be designed to screen loading areas and docks, and truck parking.

F. In any zone any fence over six (6) feet high measured from soil surface at the outside of fenceline shall require Development Review Board approval.

Response: The site is not visible to adjacent properties or public rights-of-way. Landscaping on the East and West sides of the site and existing trees on the North side provide screening. The only location the site is not fully screened from is the park access road. The building will be partially screened from the road by a vegetated planter and will match the architectural style of other buildings in the park. Therefore, the applicable standards are met.

Section 4.199 OUTDOOR LIGHTING

Section 4.199.30. Lighting Overlay Zones.

(.01) The designated Lighting Zone as indicated on the Lighting Overlay Zone Map for a commercial, industrial, multi-family or public facility parcel or project shall determine the limitations for lighting systems and fixtures as specified in this Ordinance.

A. Property may contain more than one lighting zone depending on site conditions and natural resource characteristics.

(.02) The Lighting Zones shall be:

A. LZ 1. Developed areas in City and State parks, recreation areas, SROZ wetland and wildlife habitat areas; developed areas in natural settings; sensitive night environments; and rural areas. This zone is intended to be the default condition for rural areas within the City.

B. LZ 2. Low-density suburban neighborhoods and suburban commercial districts, industrial parks and districts. This zone is intended to be the default condition for the majority of the City.

C. LZ 3. Medium to high-density suburban neighborhoods and districts, major shopping and commercial districts as depicted on the Lighting Overlay Zone Map.

D. LZ 4. Reserved for limited applications with special lighting requirements. This zone is appropriate for users who have unique site or operating circumstances that warrant additional light. This zone shall not be applied to residential or agricultural areas.

[Section 4.199.30(.02) amended by Ord. 688, 11/15/10]

Response: The project site is located within Lighting Overlay Zone LZ 1. The pump station site will have exterior lighting that complies with the applicable standards, shown on sheets E-3, E-4, and E-5 of section 3. Therefore the standard is met.

Section 4.199.40. Lighting Systems Standards for Approval.

(.01) Non-Residential Uses and Common Residential Areas.

A. All outdoor lighting shall comply with either the Prescriptive Option or the Performance Option below.

B. Prescriptive Option. If the lighting is to comply with this Prescriptive Option, the installed lighting shall meet all of the following requirements according to the designated Lighting Zone.

1. The maximum luminaire lamp wattage and shielding shall comply with Table 7.

2. Except for those exemptions listed in Section 4.199.20(.02), the exterior lighting for the site shall comply with the *Oregon Energy Efficiency Specialty Code, Exterior Lighting.*

3. The maximum pole or mounting height shall be consistent with Table 8.

4. Each luminaire shall be set back from all property lines at least 3 times the mounting height of the luminaire:

a. Exception 1: If the subject property abuts a property with the same base and lighting zone, no setback from the common lot lines is required.

b. Exception 2: If the subject property abuts a property which is zoned (base and lighting) other than the subject parcel, the luminaire shall be setback three times the mounting height of the luminaire, measured from the abutting parcel's setback line. (Any variance or waiver to the abutting property's setback shall not be considered in the distance calculation).

c. Exception 3: If the luminaire is used for the purpose of street, parking lot or public utility easement illumination and is located less than 3 mounting heights from the property line, the luminaire shall include a house side shield to protect adjoining property.

d. Exception 4: If the subject property includes an exterior column, wall or abutment within 25 feet of the property line, a luminaire partly shielded or better and not exceeding 60 lamp watts may be mounted onto the exterior column, wall or abutment or under or within an overhang or canopy attached thereto.

e. Exception 5: Lighting adjacent to SROZ areas shall be set back 3 times the mounting height of the luminaire, or shall employ a house side shield to protect the natural resource area.

Response: The Prescriptive option requirements are met. The maximum lamp wattage allowed according to Table 7 is 50 watts. The maximum wattage of outdoor lights on the site is 33 watts per sheet E-5, section 3. The exterior lighting will comply with the Oregon Energy Efficiency Specialty Code, Exterior Lighting. The height for lights mounted onto buildings shall not exceed a mounting height greater than 4 feet higher than the tallest part of the building at the place where the lighting is installed, nor higher than 33.33 percent of the horizontal distance of the light from the nearest property line, whichever is less, according to Table 8. The exterior lights will be mounted to the wall of the building, so will not be higher than the building itself. The property line requirement is less restrictive in this case, so the building height will be the maximum height requirement. The lighting will either be shielded or set back from the SROZ 3 times the mounting height. Therefore, the applicable standards are met.

UNDERGROUND UTILITIES

Section 4.300. General.

(.01) The City Council deems it reasonable and necessary in order to accomplish the orderly and desirable development of land within the corporate limits of the City, to require the underground installation of utilities in all new developments.

(.02) After the effective date of this Code, the approval of any development of land within the City will be upon the express condition that all new utility lines, including but not limited to those required for power, communication, street lighting, gas, cable television services and related facilities, shall be placed underground.

(.03) The construction of underground utilities shall be subject to the City's Public Works Standards and shall meet applicable requirements for erosion control and other environmental protection.

Section 4.310 Exceptions.

Section 4.300 of this Code shall not apply to surface-mounted transformers, surface-mounted connection boxes, wireless communication facilities, and meter cabinets and other appurtenances which are reasonably necessary to be placed above ground, or to temporary utility service facilities during

construction, or to high capacity electric and communication feeder lines, or to utility transmission lines operating at 50,000 volts or more.

Response: All utility lines are to be installed underground as shown in section 3, sheet C-1. The City's Public Works Standards will be adhered to. A surface-mounted transformer will be installed on the pump station site, which will be exempt from this code section. Therefore, the standards are met.

Section 4.320. Requirements.

(.01) The developer or subdivider shall be responsible for and make all necessary arrangements with the serving utility to provide the underground services (including cost of rearranging any existing overhead facilities). All such underground facilities as described shall be constructed in compliance with the rules and regulations of the Public Utility Commission of the State of Oregon relating to the installation and safety of underground lines, plant, system, equipment and apparatus.

(.02) The location of the buried facilities shall conform to standards supplied to the subdivider by the City. The City also reserves the right to approve location of all surface-mounted transformers.

(.03) Interior easements (back lot lines) will only be used for storm or sanitary sewers, and front easements will be used for other utilities unless different locations are approved by the City Engineer. Easements satisfactory to the serving utilities shall be provided by the developer and shall be set forth on the plat.

Response: The new utilities to be installed associated with this project will all conform to the Public Utility Commission of the State of Oregon. All relevant City standards will be complied with. Easements are not required for this project since all utilities to be installed will be on property already owned by the City. Therefore, the applicable standards are met.

Section 4.171. General Regulations - Protection of Natural Features and Other Resources.

(.02) General Terrain Preparation:

A. All developments shall be planned, designed, constructed and maintained with maximum regard to natural terrain features and topography, especially hillside areas, floodplains, and other significant landforms.

B. All grading, filling and excavating done in connection with any development shall be in accordance with the Uniform Building Code

C. In addition to any permits required under the Uniform Building Code, all developments shall be planned, designed, constructed and maintained so as to:

l. Limit the extent of disturbance of soils and site by grading, excavation and other land alterations.

2. Avoid substantial probabilities of: (l) accelerated erosion; (2) pollution, contamination, or siltation of lakes, rivers, streams and wetlands; (3) damage to vegetation; (4) injury to wildlife and fish habitats.
3. Minimize the removal of trees and other native vegetation that stabilize hillsides, retain moisture, reduce erosion, siltation and nutrient runoff, and preserve the natural scenic character.

(.04) Trees and Wooded Areas.

A. All developments shall be planned, designed, constructed and maintained so that:
   l. Existing vegetation is not disturbed, injured, or removed prior to site development and prior to an approved plan for circulation, parking and structure location.
   2. Existing wooded areas, significant clumps/groves of trees and vegetation, and all trees with a diameter at breast height of six inches or greater shall be incorporated into the development plan and protected wherever feasible.
   3. Existing trees are preserved within any right-of-way when such trees are suitably located, healthy, and when approved grading allows.

B. Trees and woodland areas to be retained shall be protected during site preparation and construction according to City Public Works design specifications, by:
   l. Avoiding disturbance of the roots by grading and/or compacting activity.
   2. Providing for drainage and water and air filtration to the roots of trees which will be covered with impermeable surfaces.
   3. Requiring, if necessary, the advisory expertise of a registered arborist/horticulturist both during and after site preparation.
   4. Requiring, if necessary, a special maintenance, management program to insure survival of specific woodland areas of specimen trees or individual heritage status trees.

Response: The pump station design has been developed with maximum regard to the natural terrain and features in the existing area. All grading, filling, and excavating will be done in accordance with the Uniform Building Code. The Erosion and Sediment Control Plan has been developed to protect existing natural features during construction. Where possible, trees will be protected. See section 3 for erosion control and tree protection plans, and see section 4 for the arborist report. Therefore, all applicable standards have been met.

Section 4.175. Public Safety and Crime Prevention.

(.01) All developments shall be designed to deter crime and insure public safety.

(.02) Addressing and directional signing shall be designed to assure identification of all buildings and structures by emergency response personnel, as well as the general public.

(.03) Areas vulnerable to crime shall be designed to allow surveillance. Parking and loading areas shall be designed for access by police in the course of routine patrol duties.

(.04) Exterior lighting shall be designed and oriented to discourage crime.

Response: The above standards will be met. The building will be provided with exterior lighting and security features, as shown on sheet E-4 and E-5, section 3. The parking area is directly adjacent to the park access road and will be easily visible from the street. Therefore, the applicable standards are met.

Site Design Review (Detailed Review of Architecture, Landscaping, Signs and other Design Elements)

Section 4.421. Criteria and Application of Design Standards.

(.01) The following standards shall be utilized by the Board in reviewing the plans, drawings, sketches and other documents required for Site Design Review. These standards are intended to provide a frame of reference for the applicant in the development of site and building plans as well as a method of review for the Board. These standards shall not be regarded as inflexible requirements. They are not intended to discourage creativity, invention and innovation. The specifications of one or more particular architectural styles is not included in these standards. (Even in the Boones Ferry Overlay Zone, a range of architectural styles will be encouraged.)

A. Preservation of Landscape. The landscape shall be preserved in its natural state, insofar as practicable, by minimizing tree and soils removal, and any grade changes shall be in keeping with the general appearance of neighboring developed areas.

Response: The pump station design has been developed with maximum regard to the natural terrain and features in the existing area. All grading, filling, and excavating will be done in accordance with the grading and surfacing plan on sheet C-3, shown in section 3. The proposed landscaping around the pump station building has been designed to blend in with the natural environment. Therefore, the standard is met.

B. Relation of Proposed Buildings to Environment. Proposed structures shall be located and designed to assure harmony with the natural environment, including protection of steep slopes, vegetation and other naturally sensitive areas for wildlife habitat and shall provide proper buffering from less intensive uses in accordance with Sections 4.171 and 4.139 and 4.139.5. The achievement of such relationship may include the enclosure of space in conjunction with other existing buildings or other proposed buildings and the creation of focal points with respect to avenues of approach, street access or relationships to natural features such as vegetation or topography.

Response: The pump station building will be screened using landscaping to assure harmony with the natural environment. The building itself will match the architectural style of the other existing buildings in the park. The steeply sloped bank of Boeckman Creek is adjacent to the pump station, but a distance of 9 feet has been maintained from the top of slope to preserve that area. The other sides of the pump station do not border steep slopes, vegetation other than grass, or wildlife habitats. Therefore, the standard is met.

C. Drives, Parking and Circulation. With respect to vehicular and pedestrian circulation, including walkways, interior drives and parking, special attention shall be given to location

and number of access points, general interior circulation, separation of pedestrian and vehicular traffic, and arrangement of parking areas that are safe and convenient and, insofar as practicable, do not detract from the design of proposed buildings and structures and the neighboring properties.

Response: Since the pump station site will not be accessed by the general public, no public parking has been included in the design. The pump station does include a parking area for authorized personnel to access the site without affecting other traffic on the park access road. There is also a pathway that complies with all applicable standards in section 4.154 and 4.155, above. The path will be separate from the road. The pump station will not change existing parking, driveways, or circulation. Therefore, the standard does not apply.

D. Surface Water Drainage. Special attention shall be given to proper site surface drainage so that removal of surface waters will not adversely affect neighboring properties of the public storm drainage system.

Response: The site has been designed with a proposed storm drain so that all surface water generated by the increase in impervious area will drain into the City's existing storm sewer system. Water from the roof of the building will drain into a proposed vegetated planter. Since the impervious area of the site is under 5,000 square feet, no stormwater treatment is required. Therefore, the standard is met.

E. Utility Service. Any utility installations above ground shall be located so as to have a harmonious relation to neighboring properties and site. The proposed method of sanitary and storm sewage disposal from all buildings shall be indicated.

Response: All above ground installations are enclosed in the pump station building. The only aboveground utility features will be the pump station building and transformer. As noted above, both will be screened by landscaping and the building will match the architectural style of other Park buildings. Therefore, the standard is met.

F. Advertising Features. In addition to the requirements of the City's sign regulations, the following criteria should be included: the size, location, design, color, texture, lighting and materials of all exterior signs and outdoor advertising structures or features shall not detract from the design of proposed buildings and structures and the surrounding properties.

Response: No new signs or advertising features are planned. Therefore, the standard does not apply.

G. Special Features. Exposed storage areas, exposed machinery installations, surface areas, truck loading areas, utility buildings and structures and similar accessory areas and structures shall be subject to such setbacks, screen plantings or other screening methods as shall be required to prevent their being incongruous with the existing or contemplated environment and its surrounding properties. Standards for screening and buffering are contained in Section 4.176.

Response: The proposed building is a utility building. The criteria in Section 4.176 have been addressed, see response in the corresponding section of this document. Therefore, the standard is met.

Section 4.600.30. Tree Removal Permit Required

(.01) Requirement Established. No person shall remove any tree without first obtaining a Tree Removal Permit (TRP) as required by this subchapter.

(.02) Tree Removal Permits will be reviewed according to the standards provided for in this subchapter, in addition to all other applicable requirements of Chapter 4.

(.03) Although tree activities in the Willamette River Greenway are governed by WC 4.500 - 4.514, the application materials required to apply for a conditional use shall be the same as those required for a Type B or C permit under this subchapter, along with any additional materials that may be required by the Planning Department. An application for a Tree Removal Permit under this section shall be reviewed by the Development Review Board.

Response: A tree protection and removal plan has been developed and included with the application. This plan has been prepared by a Certified Arborist. The arborist's recommendations have been incorporated into the erosion control plan sheets, in section 3. The full report has also been included in section 4. A Tree Removal Permit will be obtained before any trees are removed. Therefore, this standard has been met. The project area is not located within the Willamette River Greenway. Therefore, this standard does not apply.

SECTION 3

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PLANS

SECTION 3

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Plan Set Submittal Checklist

General, Including Site Plan		WC	Sheet Reference
	1. On-site and immediately adjacent features:		
	a. Streets	4.035(.04)	C-1
	b. Private drives	4.035(.04)	N/A
	c. Sidewalks and pathways	4.035(.04)	C-1
	d. Off-street parking, including location and dimensions of each space	4.035(.04)	N/A
	e. Loading areas, including location and dimensions of each berth	4.035(.04)	N/A
	f. Direction of traffic flow into and out of off-street parking and loading areas	4.035(.04)	N/A
	g. Turning and maneuvering areas	4.035(.04)	C-1
	h. Utility services, including sanitary sewer, water, and storm drainage	4.035(.04)	C-1
	i. Location and dimension of all structures, primary and accessory	4.035(.04)	C-1
	j. Utilization of structures	4.035(.04)	C-1
	k. Tabulation of land area, in square feet, devoted to various uses such as building area (gross and net rentable), parking and paving coverage, landscaped area coverage.	4.035(.04)	C-1
	l. Major existing landscape features including trees to be saved	4.035(.04)	ESC-4 & ESC-5
	2. Grading Plan	4.035(.04)	
	a. Existing and proposed contours and other topographic information sufficient to determine direction and percentage of slopes and drainage patterns. Additional topographic information needed for environmentally sensitive areas (See WC 4.035 (.04) A. 6. f.)	4.035(.04)	C-3
	3. Flood Plain Permit Information (as applicable)		N/A
	a. A field survey in relation to mean sea level by a licensed surveyor or civil engineer of the actual location of the l00-year flood plain, fringe, floodway and the lowest habitable finished floor elevations, including basements, of all existing structures	4.172(.06)	
	b. A Site Plan map showing all existing and proposed contours and development and supplemented by a soils and hydrologic report sufficient to determine the net effect of the proposed development on the flood plain	4.172(.06)	

	elevations on the subject site and adjacent properties.		
	c. Clear indication of cut or fill areas	4.172(.06)	
	d. A soils stabilization plan for all cuts, fills and graded areas.	4.172(.06)	
Site Design Review			Sheet Reference
	1. Location and design of fences, walls	4.440(.01)	C-3
	2. Landscape Plan		
	a. Location and design of landscape areas	4.440(.01)	L-5
	b. Number and placement of trees and plant materials		L-5
	c. The variety of trees and plant materials listed by scientific and common name	4.440 (.01) 4.176 (.09)	L-5
	d. The size of trees and plant materials	4.440(.01)	L-5
	e. Information, including condition, size and variety, of trees or other plant material being retained on the site	4.440(.01) 4.176 (.09)	L-5
	f. Indication of water consumption categories (high, moderate, low, and interim or unique) See WC 4.176 (.09) A.-D.	4.440(.01) 4.176 (.09)	L-1
	3. Tree survey showing all trees 4” or greater in caliper. Large area of trees being undisturbed only need the perimeter of the area shown.	4.440(.01)	ESC-3 & ESC-4
	4. Architectural drawings and sketches of all building and structures		
	a. Floor plans	4.440(.01)	A-2
	b. All elevations of proposed structures and other improvements	4.440(.01)	A-3
	c. Details of outdoor site furnishings (benches, outdoor tables, garbage cans, lighting, etc.)	4.440(.01)	N/A
	5. Outdoor Lighting (as applicable):		
	a. All conformance methods:		
	i. Site lighting plan		E-5
	ii. Intended lighting by type and location		E-5
	iii. Aiming angles for adjustable luminaires		N/A
	1. Drawings of all building facades on which signs are proposed indicating the areas of the facades on which signs will be allowed;	4.156.02(.05)	N/A
Tree Plan			Sheet Reference
	1. Topographical information (same as provided on other sheets)	4.610.40(.02)	
	2. Shape and dimensions of the property	4.610.40(.02)	Tax Map

	3. Location of existing and proposed structures or improvements	4.610.40(.02)	C-3
	4. Location of each tree 6” or greater d.b.h. likely to be impacted	4.610.40(.02)	See Arborist Report (AR)
	5. Spread and canopy of each tree (may be by numerical reference to list in arborist report)	4.610.40(.02)	See Tree Layout and Data in Section 4.
	6. Common and botanical name of each tree	4.610.40(.02)	See AR
	7. Description of health and condition of each tree	4.610.40(.02)	See AR
	8. Approximate location and name of any other trees on property	4.610.40(.02)	See AR
	9. Where a stand of 20 or more contiguous trees exist on a site and the applicant does not propose to remove any of those trees, the required tree survey may be simplified to accurately show only the perimeter area of that stand of trees, including its drip line.	4.610.40(.02)	
	10. Show all Oregon white oak, native yews, and any species listed by either the state or federal government as rare or endangered.	4.610.40(.02)	N/A
	11. Location and dimension of existing and proposed easements	4.610.40(.02)	N/A
	12. Setbacks required by existing zoning requirements	4.610.40(.02)	N/A
	13. Grade changes proposed that may impact trees	4.610.40(.02)	C-3
	14. Tree Protection Plan	4.610.40(.02)	ESC

SECTION 3

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Plans

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

PROJECT NO. 2065

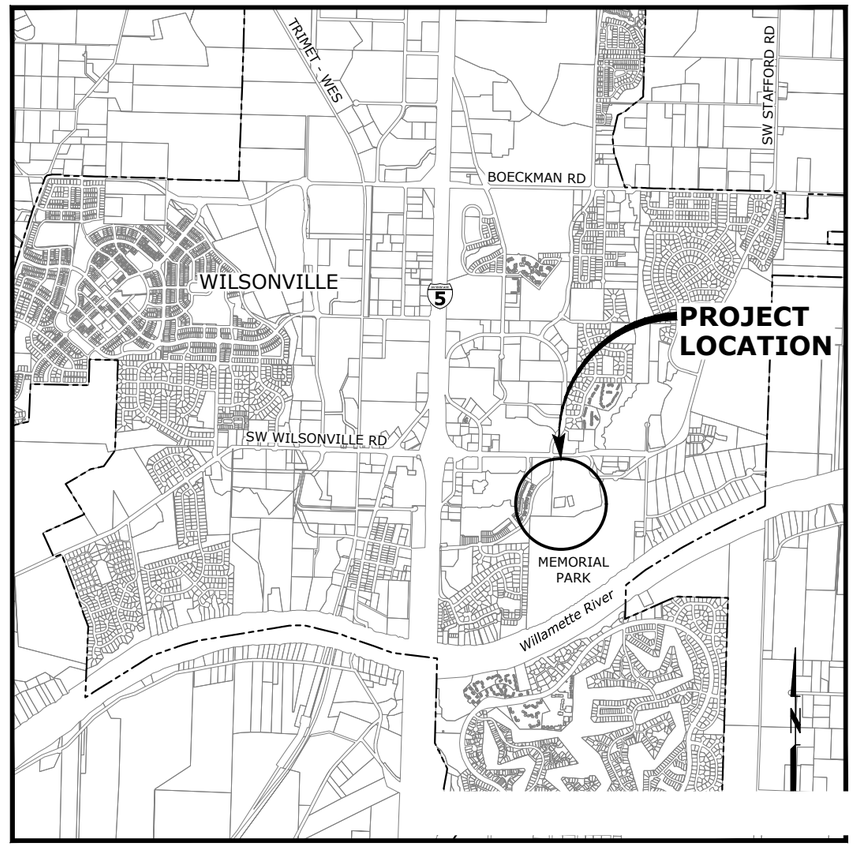
JULY 2019

LAND USE APPLICATION

NOTE: GREYED BACK INDEX ENTRIES ARE NOT PROVIDED IN THIS SUBMITTAL BUT WILL BE PROVIDED IN THE FINAL PLANS.

INDEX OF DRAWINGS

G-1	COVER
G-2	LEGEND
G-3	ABBREVIATIONS
ESC-1	TREE PROTECTION AND EROSION CONTROL NOTES
ESC-2	TREE PROTECTION AND EROSION CONTROL DETAILS
ESC-3	TREE PROTECTION AND EROSION CONTROL PLAN STA FM1+00 TO STA FM 5+60
ESC-4	TREE PROTECTION AND EROSION CONTROL PLAN STA FM5+60 TO STA FM 8+00
C-1	SITE PLAN
C-2	PUMP STATION UTILITY PLAN
C-3	PUMP STATION GRADING AND SURFACING PLAN
C-4	OFF SITE UTILITY PLAN STA FM1+00 TO STA FM4+20
C-5	OFF SITE UTILITY PLAN STA FM4+20 TO STA FM8+00
A-1	CODE SHEET
A-2	ROOF AND FLOOR PLANS
A-3	EXTERIOR ELEVATIONS
E-5	LIGHTING PLAN
L-1	IRRIGATION PLAN
L-2	IRRIGATION SCHEDULES, DETAILS AND NOTES
L-3	IRRIGATION DETAILS AND NOTES
L-4	IRRIGATION DETAILS AND NOTES
L-5	PLANTING PLAN
L-6	PLANTING DETAILS



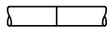
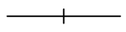
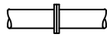
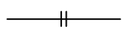
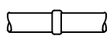
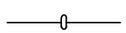
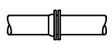
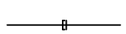
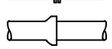
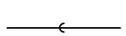
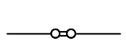
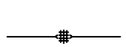
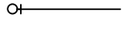
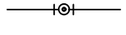
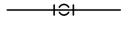
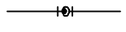
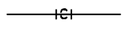
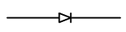
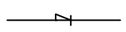
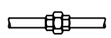
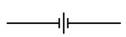
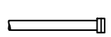
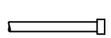
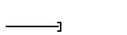
VICINITY MAP
SCALE: 1"=1500'

murraysmith
888 SW 5TH AVENUE, SUITE 1170
PORTLAND, OREGON 97204
P 503.225.9010

ATTENTION: OREGON LAW REQUIRES THE CONTRACTOR TO FOLLOW THE RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. THE CONTRACTOR MAY OBTAIN COPIES OF THE RULES BY CALLING THE UTILITY NOTIFICATION CENTER. (NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS 503-246-6699.)

17-2136.204

PIPE & FITTING SYMBOLS

PLANT	SCHEMATIC	
		WELDED JOINT
		FLANGED JOINT
		GROOVED END JOINT
		MECHANICAL JOINT
		PUSH-ON JOINT (RUBBER GASKET)
		FLANGED COUPLING ADAPTER
		DOUBLE BALL FLEXIBLE EXTENSION COUPLING
		FLEXIBLE COUPLING W/ THRUST RING
		90° BEND UP
		90° BEND DOWN
		TEE UP
		TEE DOWN
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		BLIND FLANGE
		CAP
		LONG SLEEVE
		FLEXIBLE COUPLING
		FITTING (45°)

VALVE SYMBOLS

PLANT	SCHEMATIC	
		BUTTERFLY VALVE
		GATE VALVE
		GLOBE VALVE
		BALL VALVE
		BALANCING VALVE
		PLUG VALVE (TOP)
		PLUG VALVE (SIDE)
		3-WAY PLUG VALVE
		CHECK VALVE
		SWING CHECK VALVE
		DOUBLE CHECK ASSEMBLY
		BALL SWING CHECK
		SILENT CHECK VALVE
		PRESSURE REDUCING VALVE
		ALTITUDE CONTROL VALVE
		SOLENOID VALVE
		RELIEF VALVE
		NEEDLE VALVE
		HOSE BIBB (SIDE)
		REDUCED PRESSURE BACKFLOW PREVENTER W/ GATE VALVES
		HOSE BIBB (TOP)

SECTION AND DETAIL DESIGNATIONS

SECTION DESIGNATIONS

DETAIL DESIGNATIONS

* NOTE: IF PLAN AND SECTION FOR DETAIL CALL-OUT AND DETAIL ARE SHOWN ON THE SAME DRAWING, DRAWING NUMBER IS REPLACED WITH A DASH.

MISCELLANEOUS PIPING SYMBOLS

	STRAINER
	SIGHT GLASS
	PRESSURE GAUGE W/ COCK
	PRESSURE SWITCH W/ COCK
	METER
	SLIP-ON JOINT PIPE
	RESTRAINED JOINT PIPE

TOPOGRAPHIC LEGEND

	EXISTING	PROPOSED
WATERLINE	10"W	12"DI W
ELECTRICITY	E	E
GAS	4"G	4"G
FIBER OPTIC	FO	2"FO
TELEPHONE/TELEMETRY	T	T
CABLE TELEVISION	CATV	CATV
SANITARY SEWER LINE	8"SS	8"SS
SANITARY SEWER FORCE MAIN	6"FM	6"FM
STORM DRAIN	8"SD	8"SD
CULVERT		18"D
ABANDON PIPE		
DRAINAGE DITCH		
CREEK CENTERLINE		
BARBWIRE FENCE		
CHAIN LINK FENCE		
TEMPORARY SILT FENCE		
STRAW WATTLES		
TREE/BUSH LINE		
CENTERLINE		
EASEMENT/PROPERTY LINE		
RIGHT-OF-WAY		
EDGE OF PAVEMENT/AC		
EDGE OF GRAVEL		
CURB		
SIDEWALK	S/W	
STRUCTURE OR FACILITY		
CONTOUR MINOR		
CONTOUR MAJOR	200	200
MANHOLE		
CLEAN-OUT		
CATCH BASIN/FIELD INLET		
THRUST BLOCK		
VALVE		
AIR INJECTION ASSEMBLY		
BLOW-OFF ASSEMBLY		
AIR RELEASE ASSEMBLY		
FIRE HYDRANT ASSEMBLY		
WATER METER		
BOLLARD		
PULL BOX/JUNCTION BOX		
UTILITY POLE		
GUY WIRE		
LIGHT POST		
MAILBOX		
SIGN		
BENCHMARK		
TREE DECIDUOUS		
TREE CONIFEROUS		
TREE TO BE REMOVED		
SURFACE ELEVATION	+ 176.63	+ 176.63

LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

LEGEND

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
G-2
2 of XX

G:\PDX_Projects\17\2136 - Wilsonville Memorial Park PS\CAD\Sheets\17-2136-OR-GEN.dwg G-2 7/25/2019 4:03 PM DAK 23.0s (LMS Tech)

@	AT
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS
AB	ANCHOR BOLT
ABAN(D)	ABANDON(ED)
ABS	ACRYLONITRILE BUTADIENE STYRENE
ABV	ABOVE / ALCOHOL BY VOLUME
AC	ASPHALTIC CONCRETE
ACP	ASPHALTIC CONCRETE PAVING
ADJ	ADJUSTABLE
ADJC	ADJACENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHR	ANCHOR
AL	ALUMINUM
ALT	ALTERNATE
AMP	AMPERE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
APPVD	APPROVED
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
ARCH	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASSN	ASSOCIATION
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING & MATERIALS
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWWA	AMERICAN WATER WORKS ASSOCIATION
B&S	BELL & SPIGOT
BC	BOLT CIRCLE
BD	BOARD
BETW	BETWEEN
BF	BOTH FACE
BFD	BACKFLOW PREVENTION DEVICE
BFILL	BACKFILL
BFV	BUTTERFLY VALVE
BHP	BRAKE HORSEPOWER
BKGD	BACKGROUND
BLDG	BUILDING
BLK	BLOCK
BLVD	BOULEVARD
BM	BENCHMARK / BEAM
BMP	BEST MANAGEMENT PRACTICES
BO	BLOW-OFF
BOC	BACK OF CURB
BS	BOTH SIDES
BSMT	BASEMENT
BTF	BOTTOM FACE
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BW	BOTH WAYS
C	CELSIUS
C TO C	CENTER TO CENTER
CARV	COMBINATION AIR RELEASE VALVE
CATV	CABLE TELEVISION
CB	CATCH BASIN
CCP	CONCRETE CYLINDER PIPE
CCW	COUNTER CLOCKWISE
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHAN	CHANNEL
CHEM	CHEMICAL
CHFR	CHAMFER
CHKV	CHECK VALVE
CI	CAST IRON
CIP	CAST IRON PIPE
CIPC	CAST IN PLACE CONCRETE
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT
CL OR C/L	CENTER LINE
CL2	CHLORINE
CLG	CEILING
CLJ	CONTROL JOINT
CLR	CLEAR
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CND	CONDUIT
CO	CLEANOUT
COL	COLUMN
COMB	COMBINATION
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS / CONTINUATION
CONTR	CONTRACT(OR)
COORD	COORDINATE
COP	COPPER
CORP	CORPORATION
CORR	CORRUGATED
CP	CONTROL POINT
CPLG	COUPLING
CPVC	CHLORINATED POLYVINYL CHLORIDE
CR	CRUSHED ROCK
CS	COMBINED SEWER
CSP	CONCRETE SEWER PIPE
CT	COURT
CTR	CENTER
CU	CUBIC
CULV	CULVERT
CV	CONTROL VALVE
CW	CLOCKWISE / COLD WATER
CY	CUBIC YARDS
CYL	CYLINDER LOCK
D	DRAIN
DC	DIRECT CURRENT
DEFL	DEFLECTION
DET	DETAIL
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DIR	DIRECTION
DIST	DISTANCE
DN	DOWN
DR	DRIVE
DS	DOWNSPOUT
DWG	DRAWING
DWL	DOWEL
DWV	DRAIN WASTE AND VENT
DWY	DRIVEWAY
E OR ELEC	ELECTRICAL
EA	EACH
ECC	ECCENTRIC
EF	EACH FACE
EL	ELEVATION
ELB	ELBOW
ENCL	ENCLOSURE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQL SP	EQUALLY SPACED
EQUIP	EQUIPMENT
ESC	EROSION AND SEDIMENT CONTROL
ESMT	EASEMENT
EW	EACH WAY
EXC	EXCAVATE
EXIST	EXISTING
EXP	EXPANSION
EXP BT	EXPANSION BOLT
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F	FAHRENHEIT
F TO F	FACE TO FACE
FA	FORCED AIR
FAB	FABRICATE
FB	FLAT BAR
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDN	FOUNDATION
FEXT	FIRE EXTINGUISHER
FF	FAR FACE
FGL	FIBERGLASS
FH	FIRE HYDRANT
FIN	FINISH(ED)
FIPT	FEMALE IRON PIPE THREAD
FITG	FITTING
FL	FLOOR LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLL	FLOW LINE
FLR	FLOOR
FM	FORCE MAIN
FO	FIBER OPTIC
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FEET / FOOT
FTG	FOOTING
FUT	FUTURE
FXTR	FIXTURE
G	GAS
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GROOVED COUPLING
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GIP	GALVANIZED IRON PIPE
GJ	GRIP JOINT
GL	GLASS
GLV	GLOBE VALVE
GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPS	GALLONS PER SECOND
GR	GRADE
GR LN	GRADE LINE
GRTG	GRATING
GV	GATE VALVE
GRVL	GRAVEL
GYP	GYPSUM
HB	HOSE BIBB
HC	HOLLOW CORE
HDPE	HIGH DENSITY POLYETHYLENE
HDR	HEADER
HDWE	HARDWARE
HGR	HANGER
HGT	HEIGHT
HH	HANDHOLD
HM	HOLLOW METAL
HMAC	HOT MIX ASPHALT CONCRETE
HNDRL	HANDRAIL
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
HORIZ	HORIZONTAL
HP	HIGH PRESSURE / HORSEPOWER
HPG	HIGH PRESSURE GAS
HPT	HIGH POINT
HR	HOUR
HSB	HIGH STRENGTH BOLT
HV	HOSE VALVE
HVAC	HEATING, VENTILATION, AIR CONDITIONING
HWL	HIGH WATER LINE
HWY	HIGHWAY
HYD	HYDRANT
HYDR	HYDRAULIC
HZ	HERTZ
I&C	INSTRUMENTATION & CONTROL
IAW	IN ACCORDANCE WITH
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IF	INSIDE FACE
IMPVT	IMPROVEMENT
IN	INCH
INCC	INCLUDE(D)(ING)
INFL	INFLUENT
INJ	INJECTION
INSTL	INSTALLATION / INSTALL
INSUL	INSULATION
INTER	INTERCEPTOR
INTR	INTERIOR
INV	INVERT
IP	IRON PIPE
IPT	IRON PIPE THREAD
IR	IRON ROD
IRRIG	IRRIGATION
JT	JOINT
JUNC	JUNCTION
KPL	KICK PLATE
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWY	KEYWAY
L	LENGTH
LAB	LABORATORY
LAV	LAVATORY
LB	POUND
LF	LINEAR FOOT
LIN	LINEAL
LN	LANE
LOC	LOCATION
LONG	LONGITUDINAL
LP	LOW PRESSURE
LPT	LOW POINT
LRG	LARGE
LS	LONG SLEEVE / LUMP SUM
LT	LEFT
LVL	LEVEL
LWL	LOW WATER LINE
MAN	MANUAL
MAT	MATERIAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCP	MASTER CONTROL PANEL
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MIPT	MALE IRON PIPE THREAD
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MON	MONUMENT / MONOLITHIC
MOT	MOTOR
MP	MILEPOST
MSL	MEAN SEAL LEVEL
MTD	MOUNTED
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO / NO.	NORMALLY OPEN / NUMBER
NOM	NOMINAL
NORM	NORMAL
NRS	NON-RISING STEM
NTS	NOT TO SCALE
O TO O	OUT TO OUT
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OF	OVERFLOW / OUTSIDE FACE
OPNG	OPENING
OPP	OPPOSITE
ORIG	ORIGINAL
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OVHD	OVERHEAD
P&ID	PROCESS & INSTRUMENTATION DIAGRAM
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PCVC	POINT OF CURVATURE ON VERTICAL CURVE
PE	PLAIN END
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PG	PRESSURE GAUGE
PH	PIPE HANGER
PI	POINT OF INTERSECTION
PIVC	POINT OF INTERSECTION ON VERTICAL CURVE
PL OR P/L	PROPERTY LINE / PLATE / PLASTIC
PLBG	PLUMBING
PNL	PANEL
POC	POINT OF CURVATURE
POLY	POLYETHYLENE
PP	POWER POLE
PRC	POINT OF REVERSE CURVATURE
PRCST	PRECAST
PREP	PREPARATION
PRESS	PRESSURE
PRKG	PARKING
PROP	PROPERTY
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
PSIG	POUNDS PER SQUARE INCH GAUGE
PSL	PIPE SLEEVE
PSPT	PIPE SUPPORT
PT	POINT OF TANGENCY
PTVC	POINT OF TANGENCY ON VERTICAL CURVE
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PWR	POWER
QTY	QUANTITY
RAD	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD / ROOF DRAIN
RDCR	REDUCER
REF	REFERENCE
REINF	REINFORCE(D)(ING)(MENT)
REQ'D	REQUIRED
RESTR	RESTRAINED
RFCA	RESTRAINED FLANGE COUPLING ADAPTER
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
R/W	RIGHT-OF-WAY
RPBP	REDUCED PRESSURE BACKFLOW PREVENTION
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RST	REINFORCED STEEL
RT	RIGHT
SALV	SALVAGE
SAN	SANITARY
SC	SOLID CORE
SCHED	SCHEDULE
SD	STORM DRAIN
SDL	SADDLE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHLDR	SHOULDER
SHT	SHEET
SIM	SIMILAR
SLP	SLOPE
SLV	SLEEVE
SOLN	SOLUTION
SP	SOIL PIPE / SEWER PIPE
SPCL	SPECIAL
SPEC(S)	SPECIFICATION(S)
SPG	SPACING
SPL	SPOOL
SPRT	SUPPORT
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SQ YD	SQUARE YARD
SS	SANITARY SEWER
SSMH	SANITARY SEWER MANHOLE
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STOR	STORAGE
STR	STRAIGHT
STRUCT	STRUCTURE / STRUCTURAL
SUBMG	SUBMERGED
SUCT	SUCTION
SV	SOLENOID VALVE
S/W	SIDEWALK
SWD	SIDEWATER DEPTH
SWGR	SWITCH GEAR
SYMM	SYMMETRICAL
SYS	SYSTEM
T OR TEL	TELEPHONE
T&B	TOP & BOTTOM
TAN	TANGENCY
TB	THRUST BLOCK
TBM	TEMPORARY BENCHMARK
TC	TOP OF CONCRETE / TOP OF CURB
TCE	TEMPORARY CONSTRUCTION EASEMENT
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPERATURE / TEMPORARY
T&G	TONGUE & GROOVE
THK	THICK / THICKNESS
THRD	THREAD (ED)
THRU	THROUGH
TP	TEST PIT / TOP OF PAVEMENT / TURNING POINT
TRANS	TRANSITION
TSP	TRI-SODIUM PHOSPHATE
TST	TOP OF STEEL
TW	TOP OF WALL
TYP	TYPICAL
UG	UNDERGROUND
UH	UNIT HEATER
UN	UNION
UON	UNLESS OTHERWISE NOTED
USGS	UNITED STATES GEOLOGIC SURVEY
V	VENT / VOLT
VAC	VACUUM
VB	VACUUM BREAKER
VBOX	VALVE BOX
VC	VERTICAL CURVE
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VCP	VITRIFIED CLAY PIPE
VTR	VENT THROUGH ROOF
W	WATER
W/	WITH
W/IN	WITHIN
W/O	WITHOUT
W/W	WALL TO WALL
WD	WOOD
WF	WIDE FLANGE
WH	WATER HEATER
WI	WROUGHT IRON
WM	WATER METER
WP	WORKING POINT / WATERPROOFING
WS	WATER SERVICE
WSDOT	WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
WT	WEIGHT
WTP	WATER TREATMENT PLANT
WTRT	WATERTIGHT
WWF	WELDED WIRE FABRIC
WWTF	WASTEWATER TREATMENT FACILITY
WWTP	WASTEWATER TREATMENT PLANT
X SECT	CROSS SECTION
XFMR	TRANSFORMER
YD	YARD DRAIN / YARD
YH	YARD HYDRANT
YR	YEAR
ZN	ZINC

G:\PDX_Projects\17\2136 - Wilsonville Memorial Park PS\CAD\Sheets\17-2136-OR-GEN.dwg G-3 7/25/2019 4:03 PM DAK 23.0s (LMS Tech)

LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

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FC DESIGNED

NEM DRAWN

FC CHECKED

PRELIMINARY ONLY
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JULY 2019

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

ABBREVIATIONS

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET G-3

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CITY OF WILSONVILLE EROSION AND SEDIMENT CONTROL NOTES

1. EROSION AND SEDIMENT CONTROL MEASURES. EFFECTIVE EROSION AND SEDIMENT CONTROL MEASURES ARE REQUIRED AT ALL TIMES. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED TO PREVENT EROSION, FILTER RUNOFF AND KEEP SEDIMENT FROM LEAVING THE SITE. DURING THE DRY SEASON, DUST CONTROL MEASURES SHALL BE IMPLEMENTED TO PREVENT DUST FROM LEAVING THE SITE. THE CITY'S BUILDING DIVISION, ENGINEERING DIVISION, AND NATURAL RESOURCES PROGRAM REQUIRE AN APPROVED EROSION CONTROL PLAN FOR ALL SITES THAT MEASURE 500 SQUARE FEET OR GREATER IN AREA. FOR SITES LESS THAN 500 SQUARE FEET IT MAY STILL BE NECESSARY TO INSTALL AND MAINTAIN ADEQUATE EROSION AND SEDIMENT CONTROL MEASURES

2. RESPONSIBLE PARTY. THE PROPERTY OWNER OR DESIGNEE SHALL BE RESPONSIBLE FOR PROPER INSTALLATION, MAINTENANCE AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL (ESC) MEASURES, IN ACCORDANCE WITH THE CITY OF WILSONVILLE, STATE, AND FEDERAL REGULATIONS.

3. INSTALLATION OF ESC MEASURES PRIOR TO CLEARING & GRADING. THE ESC MEASURES SHOWN IN THESE PLANS SHALL BE CONSTRUCTED AND APPROVED BY THE CITY'S AUTHORIZED REPRESENTATIVE PRIOR TO CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DOES NOT ENTER THE DRAINAGE SYSTEM, ROADWAYS, OR VIOLATE APPLICABLE STORMWATER DISCHARGE STANDARDS.

4.INSPECTIONS. INITIAL AND FINAL ESC INSPECTIONS ARE REQUIRED. THE CITY'S 24 HOUR BUILDING/ESC INSPECTION NUMBER IS (503) 682-4159. ALL CALLS REQUESTING INSPECTIONS THAT ARE RECEIVED BY 7:00 A.M. SHALL BE INSPECTED BY THE END OF THE DAY THE CALL WAS RECEIVED (NO INSPECTIONS SATURDAY, SUNDAY, OR HOLIDAYS). TREE PROTECTION SHALL BE INSTALLED, INSPECTED AND APPROVED BY A PLANNING DEPARTMENT REPRESENTATIVE BEFORE ANY ESC MEASURES ARE PLACED. THE INITIAL ESC INSPECTION SHALL NOT OCCUR UNTIL TREE PROTECTION MEASURED ARE INSPECTED AND APPROVED. THE PROPERTY OWNER OR DESIGNEE SHALL REMOVE ESC MEASURES, ESTABLISH PERMANENT GROUNDCOVER ON ALL EXPOSED SOILS; CLEAN AND REMOVE TRASH, CONSTRUCTION WASTE AND SEDIMENT DEPOSITS BEFORE RECEIVING A FINAL ESC INSPECTION APPROVAL. (SOLELY STRAW OR PLASTIC SHEETING IS NOT PERMANENT GROUND COVER.)

5. DAILY INSPECTION. THE ESC MEASURES SHALL BE INSPECTED DAILY BY THE PROPERTY OWNER OR DESIGNEE AND MAINTAINED AS NECESSARY TO ENSURE PROPER FUNCTIONING. ALL ESC MEASURES REQUIRING MAINTENANCE OR REPAIR SHALL BE COMPLETED IMMEDIATELY.

6. STATE 1200-C (DEQ) AND 1200-CN (CITY) PERMITS. IF A SITE REQUIRES AN OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ) 1200-C PERMIT FOR DISTURBING FIVE ACRES OR MORE, A COPY OF THE APPROVED 1200-C SHALL BE SUBMITTED TO THE CITY'S AUTHORIZED REPRESENTATIVE BEFORE ANY CLEARING OR GRADING SHALL BE ALLOWED TO PROCEED. CONSTRUCTION ACTIVITIES INCLUDING CLEARING, GRADING, EXCAVATION, AND STOCKPILING THAT WILL DISTURB FIVE (5) OR MORE ACRES AND THAT MAY DISCHARGE TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS OF THE STATE, REQUIRE A DEQ 1200-C PERMIT. FOR CONSTRUCTION ACTIVITIES THAT DISTURB FIVE (5) OR MORE ACRES, A PUBLIC REVIEW PROCESS IS REQUIRED. THE PROPERTY OWNER OR DESIGNEE IS REQUIRED TO FOLLOW ALL 1200-C REQUIREMENTS AND MAKE THE 1200-C PERMIT AVAILABLE FOR REVIEW IF REQUESTED BY THE CITY'S AUTHORIZED REPRESENTATIVE. THE DEQ 1200-C PERMITS ARE OBTAINED DIRECTLY FROM DEQ. A 1200-CN PERMIT, FOR DISTURBING ONE TO LESS THAN FIVE ACRES, FOR AUTOMATICALLY COVERED CONSTRUCTION ACTIVITIES IS ISSUED BY THE CITY OF WILSONVILLE FOR SITES MEETING APPLICABLE ORDINANCE AND CODE REQUIREMENTS.

7. CODE CONFORMANCE. THE PROPERTY OWNER OR DESIGNEE SHALL INSTALL, OPERATE, AND MAINTAIN ADEQUATE ESC MEASURES IN CONFORMANCE WITH THE STANDARDS ADOPTED BY THE CITY OF WILSONVILLE EROSION CONTROL ORDINANCE DURING THE CONSTRUCTION OF ANY PUBLIC UTILITIES AND PRIVATE IMPROVEMENTS, UNTIL SUCH TIME AS APPROVED PERMANENT VEGETATIVE MATERIALS HAVE BEEN INSTALLED. THE CONTRACTOR SHALL READ AND BE FAMILIAR WITH THE CITY'S EROSION CONTROL STANDARDS AND ODOT CONSTRUCTION EROSION CONTROL STANDARDS. THE CONTRACTOR SHALL ADHERE TO THE MORE RESTRICTIVE OF THE TWO STANDARD REQUIREMENTS WHEN PERFORMING PUBLIC WORKS PROJECTS. THE CITY'S EROSION CONTROL ORDINANCE NO. 482 IS AVAILABLE AT: HTTP://WWW.CI.WILSONVILLE.OR.US/DOCUMENTCENTER/VIEW/613. ODOT'S CONSTRUCTION EROSION CONTROL STANDARDS ARE AVAILABLE AT: HTTP://WWW.OREGON.GOV/ODOT/HWY/SPECS/DOCS/15BOOK/15_00200.PDF (SECTION 00280 - EROSION AND SEDIMENT CONTROL).

8. SCOPE OF RESPONSIBILITY. THE IMPLEMENTATION OF THE APPROVED ESC PLAN, INCLUDING THE INSTALLATION, CONSTRUCTION, MAINTENANCE, REPLACEMENT, UPGRADING AND REMOVAL OF THE ESC MEASURES ARE THE RESPONSIBILITY OF THE PROPERTY OWNER OR DESIGNEE UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED, AND ALL VEGETATION/LANDSCAPING IS ESTABLISHED. THE PROPERTY OWNER OR DESIGNEE SHALL BE RESPONSIBLE FOR MAINTENANCE OF THE ESC MEASURES UNTIL THE PERMIT IS TRANSFERRED OR THE PERMIT COVERAGE IS TERMINATED.

9. EROSION CONTROL. NO PERSON SHALL CREATE PHYSICAL EROSION BY DRAGGING, DROPPING, TRACKING, OR OTHERWISE PLACING OR DEPOSITING, OR PERMITTING TO BE DEPOSITED, MUD, DIRT, ROCK, OR OTHER SUCH DEBRIS ON A PUBLIC STREET, OR INTO ANY PART OF THE PUBLIC STORMWATER AND SURFACE WATER SYSTEM, OR INTO ANY PART OF A PRIVATE STORMWATER AND SURFACE WATER SYSTEM THAT DRAINS OR CONNECTS TO THE PUBLIC STORMWATER AND SURFACE WATER SYSTEM. ANY SUCH DEPOSITED MATERIAL SHALL BE IMMEDIATELY REMOVED BY HAND LABOR OR MECHANICAL MEANS. NO MATERIAL SHALL BE WASHED OR FLUSHED INTO ANY PART OF THE STORMWATER AND SURFACE WATER SYSTEM UNTIL ALL MECHANICAL MEANS TO REMOVE THE DEBRIS ARE EXHAUSTED AND PREVENTIVE SEDIMENT FILTRATION IS IN PLACE. NO DISCHARGE CONTAINING VISIBLE SOLIDS IS ALLOWED. ALL ABOVE GROUND TREATMENT FACILITIES (SWALES, PONDS, ETC.) SHALL BE COMPLETED, INSPECTED, AND APPROVED PRIOR TO ANY STORMWATER BEING ALLOWED TO ENTER FACILITY OR ANY PAVING TO OCCUR.

10. MINIMUM REQUIREMENTS – UPGRADES & RETROFITS EXPECTED. THE ESC MEASURES DEPICTED IN THESE PLANS ARE CONSIDERED MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC MEASURES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND CHANGES IN CONSTRUCTION ACTIVITIES. AT ALL TIMES, ESC MEASURES SHALL ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DOES NOT LEAVE THE CONSTRUCTION SITE.

11. CLEARING LIMITS. THE BOUNDARIES OF THE CLEARING LIMITS DEPICTED ON THE ESC PLAN SHALL BE CLEARLY MARKED IN THE FIELD PRIOR TO CLEARING. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE CLEARING LIMITS SHALL BE PERMITTED. THE CLEARING LIMIT MARKINGS SHALL BE MAINTAINED BY THE PROPERTY OWNER OR DESIGNEE FOR THE DURATION OF CONSTRUCTION.

12. TOXIC & HAZARDOUS MATERIALS. ANY USE OF TOXIC OR HAZARDOUS MATERIALS SHALL INCLUDE PROPER STORAGE, APPLICATION, AND DISPOSAL. THE PROPERTY OWNER OR DESIGNEE SHALL PROPERLY MANAGE HAZARDOUS WASTES, USED OILS, CONTAMINATED SOILS, CONCRETE WASTE, SANITARY WASTE, LIQUID WASTE, OR OTHER TOXIC SUBSTANCES DISCOVERED OR GENERATED DURING CONSTRUCTION.

13. ON-SITE CONCRETE TRUCK WASH AREA. THE ESC PLAN SHALL DESIGNATE SPECIFIC AREAS FOR ON-SITE WASHING OF CONCRETE TRUCKS AND THE DISPOSAL OF ACCUMULATED CONCRETE WASTE. NO TRACKING OF CONCRETE IS ALLOWED AND MUST BE IMMEDIATELY CLEANED FROM ROAD OR ALLEY.

14. SECURING OF PORTABLE TOILETS. IF REQUIRED, THE PROPERTY OWNER OR DESIGNEE SHALL SECURE PORTABLE TOILETS, BY CABLE OR CHAIN, TO POSTS OR STABLE ANCHOR TO PREVENT THEM FROM OVER- TURNING AND SPILLING.

15. RESOURCES FOR ESC FACILITY DESIGN & DEVELOPMENT. THE PROPERTY OWNER OR DESIGNEE SHALL REFER TO THE CLACKAMAS COUNTY WATER ENVIRONMENT SERVICES MOST CURRENT VERSION OF THE "EROSION PREVENTION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL," AVAILABLE ON LINE AT HTTP://WWW.CLACKAMAS.US/WES/DESIGN MANUAL.HTML AND THE CITY OF WILSONVILLE'S "EROSION CONTROL ORDINANCE".

16. CONSTRUCTION ENTRANCES. STABILIZED GRAVEL ENTRANCES, WITH SUBGRADE REINFORCEMENT GEOTEXTILE FABRIC, SHALL BE INSTALLED AND MAINTAINED FOR THE DURATION OF THE PROJECT IN CONFORMANCE WITH DETAIL S-2240. ADDITIONAL MEASURES SUCH AS A WHEEL WASH, IN CONFORMANCE WITH DETAIL S-2235, MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT. THE CONSTRUCTION ENTRANCE SHALL NOT BLOCK EXISTING PUBLIC ACCESSIBLE ROUTES UNLESS PROPER CLOSURES ARE APPROVED BY THE CITY OF WILSONVILLE ENGINEERING AUTHORIZED REPRESENTATIVE.

17. PROTECTION OF STORMWATER FACILITIES, DRAINS & INLETS. STORM DRAIN INLETS, BASINS, AND AREA DRAINS SHALL BE PROTECTED UNTIL COMPLETION OF PROJECT. ALTHOUGH THERE ARE A NUMBER OF APPROVED MEASURES FOR INLET PROTECTION, LOW FLOW SILT SACK INSERTS (NO OVERFLOW), IN CONFORMANCE WITH DETAIL S-2127, WITH BIOBAGS, IN CONFORMANCE WITH DETAIL S-2126, AROUND CURB INLETS ARE THE PREFERRED MEASURES FOR INLET PROTECTION, WHERE APPLICABLE. PER DEQ REQUIREMENTS OVERFLOW SILT SACK INSERTS ARE NOT ALLOWED. LOW FLOW SILT SACK INSERTS (NO OVERFLOW) SHALL BE USED FOR STREET INLETS (UNLESS INLET IN CURB). INLETS WILL BE PROTECTED WITH APPROPRIATE MEASURES UPON BASIN INSTALLATION. ALL STORM DRAIN INLET PROTECTION MEASURES LOCATED IN PUBLIC STREETS SHALL NOT CREATE A HAZARD TO VEHICULAR TRAFFIC, BIKE OR PEDESTRIAN TRAFFIC. IF REQUIRED BY THE CITY'S AUTHORIZED REPRESENTATIVE, A MINIMUM OF SIX (6) EXTRA BIOBAGS SHALL BE KEPT ON SITE AT ALL TIMES FOR UPGRADING AND REPAIRS.

18. DETAIL DRAWINGS. USE ONLY CITY OF WILSONVILLE DETAIL DRAWINGS HTTP://WWW.CI.WILSONVILLE.OR.US/153/DETAIL-DRAWINGS-INDEX (IF AVAILABLE).

19. CLEANING SEDIMENT BARRIERS. AT NO TIME SHALL SEDIMENT BE ALLOWED TO ACCUMULATE MORE THAN ONE THIRD OF BARRIER HEIGHT. CLEANING OPERATIONS SHALL NOT ALLOW SEDIMENT-LADEN WATER TO BE INTENTIONALLY WASHED INTO STORM SEWERS, DRAINAGE WAYS OR WATER BODIES. DRY SWEEPING SHALL BE USED TO CLEAN UP RELEASED SEDIMENTS USING APPROPRIATE DUST CONTROL MEASURES.

20. PERMANENT GROUND COVER. PAVEMENT SURFACES AND PERMANENT VEGETATION ARE TO BE INSTALLED AS SOON AS POSSIBLE. IMPERVIOUS SURFACES SHALL NOT BE INSTALLED UNTIL STORMWATER DETENTION AND WATER QUALITY FACILITIES HAVE BEEN CONSTRUCTED AND APPROVED BY THE CITY'S AUTHORIZED REPRESENTATIVE.

21. SEEDING. SEEDING SHALL BE ESTABLISHED ONLY BETWEEN MARCH 1 THROUGH MAY 15 AND SEPTEMBER 1 THROUGH OCTOBER 15 FOR EACH PHASE OF CONSTRUCTION. IF AN IRRIGATION SYSTEM IS INSTALLED, SEEDING MAY BE ESTABLISHED FROM MARCH 1 THROUGH NOVEMBER 15.

22. WET WEATHER REQUIREMENTS. EXPOSED SOILS AND UN-VEGETATED SURFACES NOT FULLY ESTABLISHED BY OCTOBER 15, SHALL BE SUBJECT TO WET WEATHER EROSION PREVENTION MEASURES IN EFFECT THROUGH APRIL 30. FOR REQUIREMENTS, SEE CLACKAMAS COUNTY WATER ENVIRONMENT SERVICES' MOST CURRENT VERSION OF "EROSION PREVENTION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL," AND THE CITY OF WILSONVILLE EROSION CONTROL ORDINANCE. ANY OPEN GROUND (REGARDLESS OF SLOPE) IS TO BE COVERED DURING THE WET WEATHER SEASON IF NOT UNDER ACTIVE CONSTRUCTION (ACTIVE CONSTRUCTION TO BE DETERMINED BY THE CITY'S AUTHORIZED REPRESENTATIVE).

23. DUST CONTROL. DURING ALL PHASES OF WORK THE CONTRACTOR SHALL TAKE PRECAUTIONS TO ABATE ANY DUST NUISANCE. DUST SHALL BE MINIMIZED TO THE EXTENT PRACTICABLE AND PREVENTION MEASURES SHALL BE CONTINUOUS UNTIL FINAL INSPECTION BY THE CITY'S AUTHORIZED REPRESENTATIVE. ADDITIONAL MEASURES FOR DUST CONTROL, IF REQUIRED BY THE CITY'S AUTHORIZED REPRESENTATIVE, SHALL INCLUDE AT LEAST ONE (1) WATER TRUCK ON SITE AT ALL TIMES FROM JUNE 1 TO OCTOBER 31. IN AREAS SUBJECT TO WIND EROSION, APPROPRIATE BMP'S MUST BE USED WHICH MAY INCLUDE THE APPLICATION OF FINE WATER SPRAYING, PLASTIC SHEETING, MULCHING, OR OTHER APPROVED MEASURES.

24. USE OF STRAW. SOLID STRAW BALES ARE NOT TO BE USED FOR ANY ESC MEASURES. STRAW SHOULD ONLY BE USED LOOSE, TO SPREAD AS TEMPORARY GROUND COVER. A MINIMUM OF TWO INCHES IS TO BE APPLIED, COVERING ALL EXPOSED SOILS (NO VISIBLE SOILS). WHEN SINGLE AND MULTIFAMILY RESIDENCES FOUNDATIONS HAVE BEEN POURED AND APPROVED, AND FOUNDATION FORM HAS BEEN REMOVED, ALL EXPOSED SOILS SHALL BE COVERED WITH 2 TO 4 INCHES OF LOOSE STRAW, WHICH COVERS ALL EXPOSED AREAS.

25. PLANS. ALL ESC PLANS SHALL INCLUDE THESE CITY OF WILSONVILLE EROSION AND SEDIMENT CONTROL NOTES, AN APPROPRIATE EROSION CONTROL LEGEND AND EROSION CONTROL DETAILS, WHICH ARE CONSISTENT WITH THE CITY OF WILSONVILLE'S EROSION AND SEDIMENT CONTROL NOTES. LEGEND SYMBOLS ARE FOUND IN THE CLACKAMAS COUNTY WATER ENVIRONMENT SERVICES "EROSION PREVENTION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL," IN APPENDIX A.

26. WATERTIGHT TRUCKS. WATERTIGHT TRUCKS SHALL BE USED TO TRANSPORT SATURATED SOILS FROM THE CONSTRUCTION SITE.

27. PUMPING OF SEDIMENT-LADEN WATER. ALL PUMPING OF SEDIMENT-LADEN WATER MUST BE DISCHARGED OVER AN UNDISTURBED VEGETATED AREA, AND THROUGH A SEDIMENT CONTROL BMP (I.E. FILTER BAG). ALL DISCHARGES SHALL BE AUTHORIZED BY THE CITY OF WILSONVILLE.

28. ESC LOGS. WRITTEN ESC LOGS ARE TO BE MAINTAINED ONSITE AND AVAILABLE TO THE CITY INSPECTORS.

29. SEDIMENT FENCE. FILTER FABRIC SEDIMENT FENCES SHALL BE INSTALLED IN CONFORMANCE WITH DETAIL S-2245.

30. STITCHED POST LOOPS. STANDARD OR HEAVY DUTY FILTER FENCE SHALL HAVE MANUFACTURED STITCHED POST LOOPS WITH 2"X 2" X 4' POSTS FOR INSTALLATION. STITCHED POST LOOPS SHALL BE INSTALLED ON THE UPHILL SIDE OF THE SLOPED AREA.

31. CONTINUOUS RUN / CONSTRUCTION OF JOINTS. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL, AND CUT TO LENGTH IN THE FIELD TO AVOID THE USE OF JOINTS. WHEN JOINTS ARE NECESSARY, CONNECT SILT FENCE ENDS BY SPINNING 2"X 2" X 4' POSTS TOGETHER TWO TO THREE TIMES AND BURY AS ONE POST.

32. INSTALLATION ON CONTOUR / FINISH AT TERMINATION POINTS. THE FILTER FENCE SHALL BE INSTALLED TO FOLLOW THE CONTOURS. THE POSTS SHALL BE SPACED A MAXIMUM OF SIX FEET APART AND DRIVEN SECURELY INTO THE GROUND. WHEN SEDIMENT FENCE APPROACHES ITS TERMINATION POINT, TURN FENCE UPHILL AND EXTEND ONE (1) FULL PANEL (6 FEET).

33. BURIAL OF FABRIC. THE FILTER FABRIC SHALL HAVE A MINIMUM VERTICAL BURIAL OF SIX INCHES. ALL EXCAVATED MATERIAL FROM FILTER FABRIC FENCE INSTALLATION SHALL BE BACKFILLED AND COMPACTED ON BOTH SIDES OF FENCE ALONG THE ENTIRE DISTURBED AREA.
34. INSPECTION. FILTER FABRIC FENCES SHALL BE INSPECTED BY PROPERTY OWNER OR DESIGNEE IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS, MAINTENANCE OR NEEDED UPGRADES SHALL BE MADE IMMEDIATELY. IF REQUIRED BY THE CITY'S AUTHORIZED REPRESENTATIVE, A MINIMUM OF ONE (1) FULL ROLL OF EXTRA FILTER FABRIC FENCING SHALL BE ON SITE AT ALL TIMES FOR UPGRADING AND REPAIRS.

35. REMOVAL. FILTER FABRIC FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY PROTECTED AND STABILIZED.

36. ESC PROTECTION BEHIND CURBS. INSTALLATION OF A ¾" – 0 CRUSHED AGGREGATE IS THE PREFERRED ESC APPLICATION WHERE GROUND IS EXPOSED ALONG EXISTING CURBING. THIS IS DEPENDENT UPON THE SLOPES INVOLVED AND MAY BE INSUFFICIENT.

37. REQUIRED ESC MEASURES. FAILURE TO ABIDE BY THESE ESC MEASURES MAY RESULT IN A STOP WORK ORDER BEING ISSUED BY THE CITY ENGINEER OR CITY ENGINEERING MANAGER UNTIL CORRECTIVE MEASURES HAVE BEEN UNDERTAKEN AND APPROVED.

GENERAL EROSION AND SEDIMENT CONTROL NOTES

1. WHEN RAINFALL AND RUNOFF OCCURS DAILY INSPECTIONS OF THE EROSION AND SEDIMENT CONTROLS AND DISCHARGE OUTFALLS MUST BE PROVIDED BY SOME ONE KNOWLEDGEABLE AND EXPERIENCED IN THE PRINCIPLES, PRACTICES, INSTALLATION, AND MAINTENANCE OF EROSION AND SEDIMENT CONTROLS WHO WORKS FOR THE PERMITTEE.

2. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND CREATION OF BARE GROUND FROM OCTOBER 1 THROUGH MAY 31 EACH YEAR.

3. CLEANING OF ALL STRUCTURES WITH SUMPS MUST OCCUR WHEN THE SEDIMENT RETENTION CAPACITY HAS BEEN REDUCED BY 50% AND AT COMPLETION OF PROJECT.

4. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS. NUTRIENT RELEASES FROM FERTILIZERS TO SURFACE WATERS MUST BE MINIMIZED. TIME RELEASE FERTILIZERS SHOULD BE USED AND CARE SHOULD BE MADE IN APPLICATION OF FERTILIZERS WITHIN ANY WATER WAY RIPARIAN ZONE.

5. THE ESC PLAN MUST BE KEPT ONSITE. ALL MEASURES SHOWN ON THE PLAN MUST BE INSTALLED PROPERLY TO ENSURE THAT SEDIMENT LADEN WATER DOES NOT ENTER A SURFACE WATER SYSTEM, ROADWAY, OR OTHER PROPERTIES.

6. IN AREAS SUBJECT TO WIND EROSION, APPROPRIATE BMP'S MUST BE USED WHICH MAY INCLUDE THE APPLICATION OF FINE WATER SPRAYING, PLASTIC SHEETING, MULCHING, OR OTHER APPROVED MEASURES.

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LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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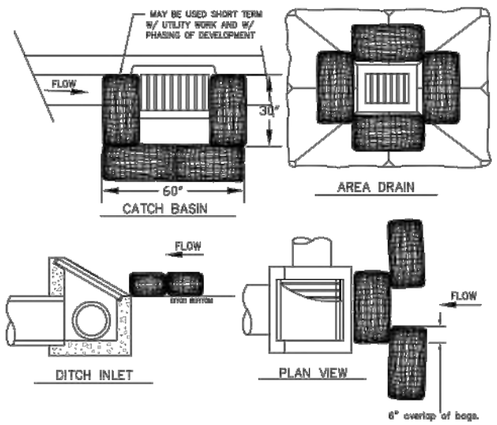
WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

TREE PROTECTION AND EROSION CONTROL NOTES

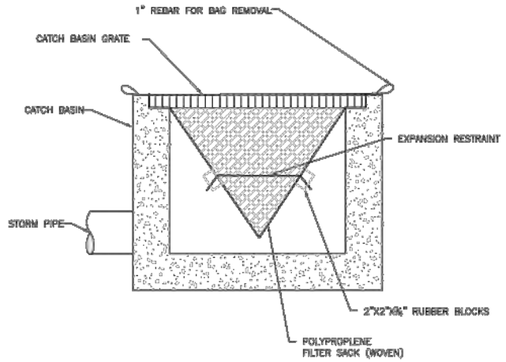
PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
ESC-1
6 of XX



Notes:
1. ADDITIONAL MEASURES MUST BE CONSIDERED DEPENDING ON SOIL TYPES.
2. BIO-FILTER BAGS SHOULD BE STAKED WHERE APPLICABLE USING (2) 1" X 2" WOODEN STAKES OR APPROVED EQUAL PER BAG OR AREA DRAIN.
3. WHEN USING 30" BIO-BAGS TO PROTECT A CATCH BASIN YOU MUST HAVE AT LEAST 4 BAGS AND THEY SHALL BE OVERLAPPED BY A MINIMUM OF 6".

Inlet Protection Type 4			CITY OF WILSONVILLE PUBLIC WORKS STANDARDS
DRAWING NUMBER: S-2126	DRAWN BY: SR	SCALE: N.T.S.	
FILE NAME: S-2126.dwg	APPROVED BY: NK	DATE: 9/17/14	



WOVEN POLYPROPLENE SACK

NOTE:
1. RECESSED CURB INLET CATCH BASINS MUST BE BLOCKED WHEN USING FILTER FABRIC INLET SACKS. SIZE OF FILTER FABRIC INLET SACKS TO BE DETERMINED BY MANUFACTURER.
2. SHALL BE LOW FLOW, NO OVERFLOW STYLE BAGS

Inlet Protection Type 5			CITY OF WILSONVILLE PUBLIC WORKS STANDARDS
DRAWING NUMBER: S-2127	DRAWN BY: SR	SCALE: N.T.S.	
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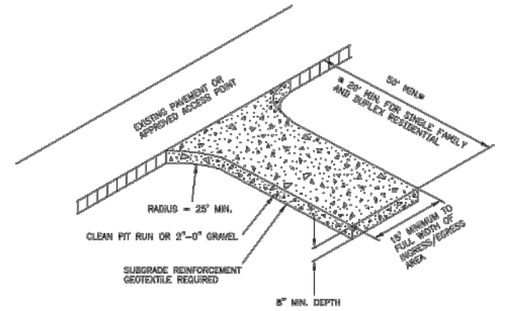
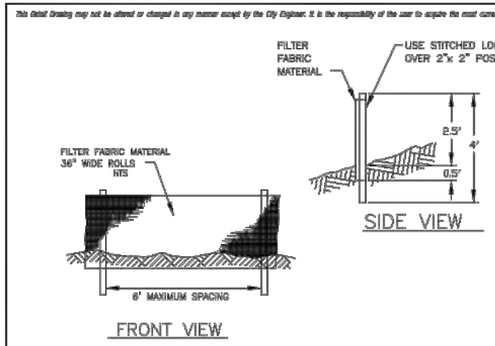
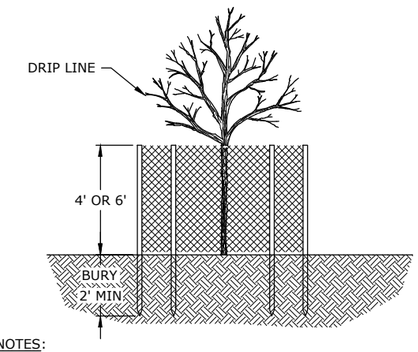


Gravel Construction Entrance			CITY OF WILSONVILLE PUBLIC WORKS STANDARDS
DRAWING NUMBER: S-2240	DRAWN BY: SR	SCALE: N.T.S.	
FILE NAME: S-2240.DWG	APPROVED BY: NK	DATE: 9/17/14	



NOTE:
1. SEDIMENT FENCING SHALL BE INSTALLED AS PER MANUFACTURER RECOMMENDATIONS.
2. BURY BOTTOM OF FILTER FABRIC 6" MIN. VERTICALLY BELOW GRADE.
3. 2" X 2" FIR, PINE, OR STEEL FENCE POSTS.
4. STITCHED LOOPS TO BE INSTALLED UPHILL SIDE OF SLOPE.
5. COMPACT NATIVE FILL IN ALL AREAS OF FILTER FABRIC TRENCH.

Sediment Fence			CITY OF WILSONVILLE PUBLIC WORKS STANDARDS
DRAWING NUMBER: S-2245	DRAWN BY: SR	SCALE: N.T.S.	
FILE NAME: S-2245.DWG	APPROVED BY: NK	DATE: 9/17/14	



NOTES:

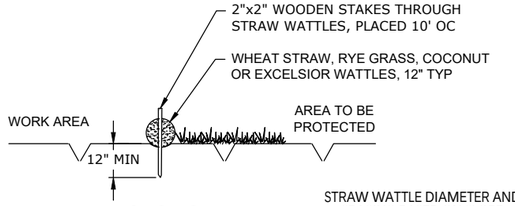
1. ORANGE FENCING SHALL BE 4' IN HEIGHT, MESH CHAIN LINK FENCE SHALL BE 6' IN HEIGHT. FENCE SHALL BE SET AS SHOWN ON THE PLANS.

2. FENCE MATERIALS SHALL CONSIST OF ORANGE CONSTRUCTION FENCING OR MESH CHAIN LINK AS SHOWN ON THE PLANS, SECURED TO A MINIMUM 1 ½" DIAMETER STEEL OR ALUMINUM LINE POSTS.

3. POSTS SHALL BE SET TO A DEPTH OF NO LESS THAN 2 FEET IN NATIVE SOIL.

4. FENCE SHALL REMIAN IN PLACE UNTIL CONSTRUCTION ACTIVITIES, MOVEMENT OR REMOVAL OF FENCE REQUIRES APPROVAL BY CITY'S AUTHORIZED REPRESENTATIVE.

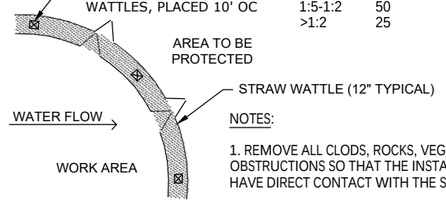
TREE PROTECTION FENCING DETAIL 1
SCALE: NTS



SECTION
NTS

STRAW WATTLE DIAMETER AND SPACING BASED ON SLOPE

SLOPE	SPACING (FT)	DIAMETER (IN)
<1:50	250	8
1:50-1:10	125	12
1:10-1:5	100	12
1:5-1:2	50	18
>1:2	25	18



PLAN
NTS

NOTES:

1. REMOVE ALL CLODS, ROCKS, VEGETATION, OR OTHER OBSTRUCTIONS SO THAT THE INSTALLED WATTLES WILL HAVE DIRECT CONTACT WITH THE SOIL.

2. INSTALL THE WATTLES IN A 2" DEEP TRENCH, ENSURING THAT NO GAPS EXIST BETWEEN THE SOIL AND THE BOTTOM OF THE WATTLE. THE ENDS OF ADJACENT WATTLES SHALL BE OVERLAPPED 1 FT MINIMUM TO PREVENT SEDIMENT PASSING THROUGH THE END JOINT.

STRAW WATTLE 2
SCALE: NTS

TREE PROTECTION NOTES

1. PRECONSTRUCTION CONFERENCE. THE CONTRACTOR SHALL COORDINATE WITH THE PROJECT ARBORIST IN A TIMELY MANNER TO REVIEW TREE PROTECTION MEASURES AND ADDRESS QUESTIONS ON-SITE PRIOR TO THE START OF CONSTRUCTION ACTIVITY.

2. PROTECTION FENCING. TREES TO REMAIN ON SITE SHALL BE PROTECTED BY INSTALLATION OF TREE PROTECTION FENCING AS DEPICTED ON THE TREE PRESERVATION PLAN IN ORDER TO PREVENT INJURY TO TREE TRUNKS OR ROOTS, OR SOIL COMPACTION WITHIN THE ROOT PROTECTION ZONE. FENCES SHALL BE A MINIMUM 6-FOOT HIGH 2-INCH CHAIN LINK MESH SECURED TO A MINIMUM 1.5-INCH STEEL OR ALUMINUM POSTS STEEL ON CONCRETE BLOCKS OR DRIVEN INTO THE GROUND EXCEPT WHERE MINIMUM 4-FOOT HIGH ORANGE PLASTIC MESH FENCING ON METAL STAKES IS SPECIFIED ON THE PLAN. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH THE PROJECT ARBORIST PRIOR TO OPENING, ADJUSTING OR REMOVING TREE PROTECTION FENCING.

3. TREE PROTECTION ZONE. WITHOUT AUTHORIZATION FROM THE PROJECT ARBORIST, NONE OF THE FOLLOWING SHALL OCCUR BENEATH THE DRIPLINE OF ANY PROTECTED TREE:
   A. GRADE CHANGE OR CUT AND FILL;
   B. NEW IMPERVIOUS SURFACES;
   C. UTILITY OR DRAINAGE FIELD PLACEMENT;
   D. STAGING OR STORAGE OF MATERIALS AND EQUIPMENT; OR
   E. VEHICLE MANEUVERING.

ROOT PROTECTION ZONES MAY BE ENTERED FOR TASKS LIKE SURVEYING, MEASURING, AND, SAMPLING. FENCES MUST BE CLOSED UPON COMPLETION OF THESE TASKS.

4. EROSION CONTROL. SILT FENCING REQUIRED TO BE INSTALLED BENEATH THE DRIPLINE OF PROTECTED TREES SHALL NOT BE TRENCHED IN PER MANUFACTURER SPECIFICATIONS TO AVOID ROOT DAMAGE. INSTEAD, USE A STRAW WATTLE OR ROLL THE BASE OF THE SILT FENCE AROUND A STRAW WATTLE AND STAKE THE WATTLE SECURELY INTO THE GROUND.

5. TREE AND STUMP REMOVAL. TREES TO BE REMOVED SHALL BE CLEARLY IDENTIFIED WITH TREE-MARKING PAINT OR OTHER METHODS APPROVED IN ADVANCED BY THE PROJECT ARBORIST. STUMPS FROM REMOVED TREES LOCATED WITHIN TREE PROTECTION ZONES SHALL REMAIN IN THE GROUND WHERE FEASIBLE. OTHERWISE, STUMPS MAY BE REMOVED BY STUMP GRINDING OR EXTRACTED FROM THE GROUND UNDER ARBORIST SUPERVISION.

6. PRUNING. PRUNING WILL BE NEEDED TO PROVIDE FOR OVERHEAD CLEARANCE AND TO REMOVE DEAD AND DEFECTIVE BRANCHES FOR SAFETY. THE CITY'S PARKS MAINTENANCE CREW SHALL BE RESPONSIBLE FOR ALL PRUNING. THE CITY'S PROJECT MANAGER SHALL COORDINATOR WITH THE PARK'S DEPARTMENT IN A TIMELY MANNER TO ARRANGE THE NECESSARY PRUNING PRIOR TO CONSTRUCTION.

7. EXCAVATION. THE PROJECT ARBORIST SHALL PROVIDE ON-SITE CONSULTATION DURING ALL EXCAVATION ACTIVITIES BENEATH THE DRIPLINE OF PROTECTED TREES. EXCAVATION IMMEDIATELY ADJACENT TO ROOTS LARGER THAN 2-INCHES IN DIAMETER WITHIN THE ROOT PROTECTION ZONE OF RETAINED TREES SHALL BE BY HAND OR OTHER NON-INVASIVE TECHNIQUES TO ENSURE THAT ROOTS ARE NOT DAMAGED. WHERE FEASIBLE, MAJOR ROOTS SHALL BE PROTECTED BY TUNNELING OR OTHER MEANS TO AVOID DESTRUCTION OR DAMAGE. EXCEPTIONS CAN BE MADE IF, IN THE OPINION OF THE PROJECT ARBORIST, UNACCEPTABLE DAMAGE WILL NOT OCCUR TO THE TREE.

8. LANDSCAPING. FOLLOWING CONSTRUCTION AND WHERE LANDSCAPING IS DESIRED, APPLY APPROXIMATELY 3-INCHES OF MULCH BENEATH THE DRIPLINE OF PROTECTED TREES, BUT NOT DIRECTLY AGAINST TREE TRUNKS. SHRUBS AND GROUND COVERS MAY BE PLANTED WITHIN TREE PROTECTION AREAS. IF IRRIGATION IS USED, USE DRIP IRRIGATION OR LOW FLOW EMITTERS INSTALLED AT NATIVE GRADE (NO TRENCHING) ONLY BENEATH THE DRIPLINES OF PROTECTED TREES. LANDSCAPING SHALL BE PERFORMED BY HAND AND WITH HAND TOOLS ONLY BENEATH PROTECTED TREE DRIPLINES; ADJUST THE LOCATION OF PLANTS TO AVOID TREE ROOT IMPACTS.

9. QUALITY ASSURANCE. THE PROJECT ARBORIST SHOULD SUPERVISE PROPER EXECUTION OF THIS PLAN DURING CONSTRUCTION ACTIVITIES THAT COULD ENCROACH ON RETAINED TREES. TREE PROTECTION SITE INSPECTION MONITORING REPORTS SHOULD BE PROVIDED TO THE CLIENT AND CITY ON A REGULAR BASIS THROUGHOUT CONSTRUCTION.

10. ARBORIST REPORT. THE ARBORIST REPORT SHALL BE USED IN CONJUNCTION WITH THE PLANS. ALL RECOMMENDATIONS IN THE ARBORIST REPORT SHALL BE FOLLOWED. ANY PROPOSED DEVIATIONS FROM THE PLANS OR REPORT SHALL BE DISCUSSED WITH THE ENGINEER & ARBORIST.

LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

TREE PROTECTION AND EROSION CONTROL NOTES AND DETAILS

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
ESC-2
7 of XX

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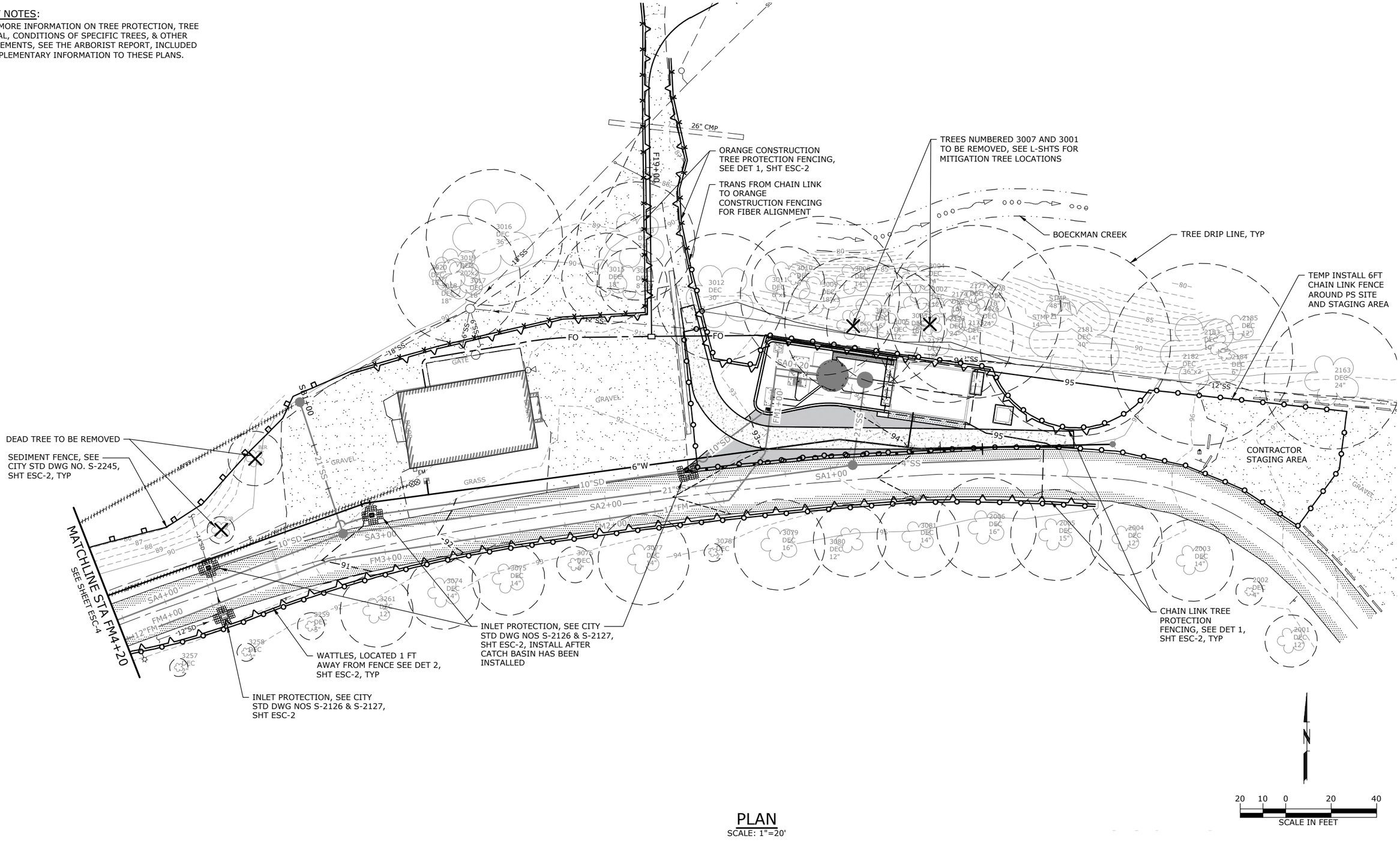
SHEET NOTES:

1. FOR MORE INFORMATION ON TREE PROTECTION, TREE REMOVAL, CONDITIONS OF SPECIFIC TREES, & OTHER REQUIREMENTS, SEE THE ARBORIST REPORT, INCLUDED AS SUPPLEMENTARY INFORMATION TO THESE PLANS.



PLAN
SCALE: 1"=20'

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LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE
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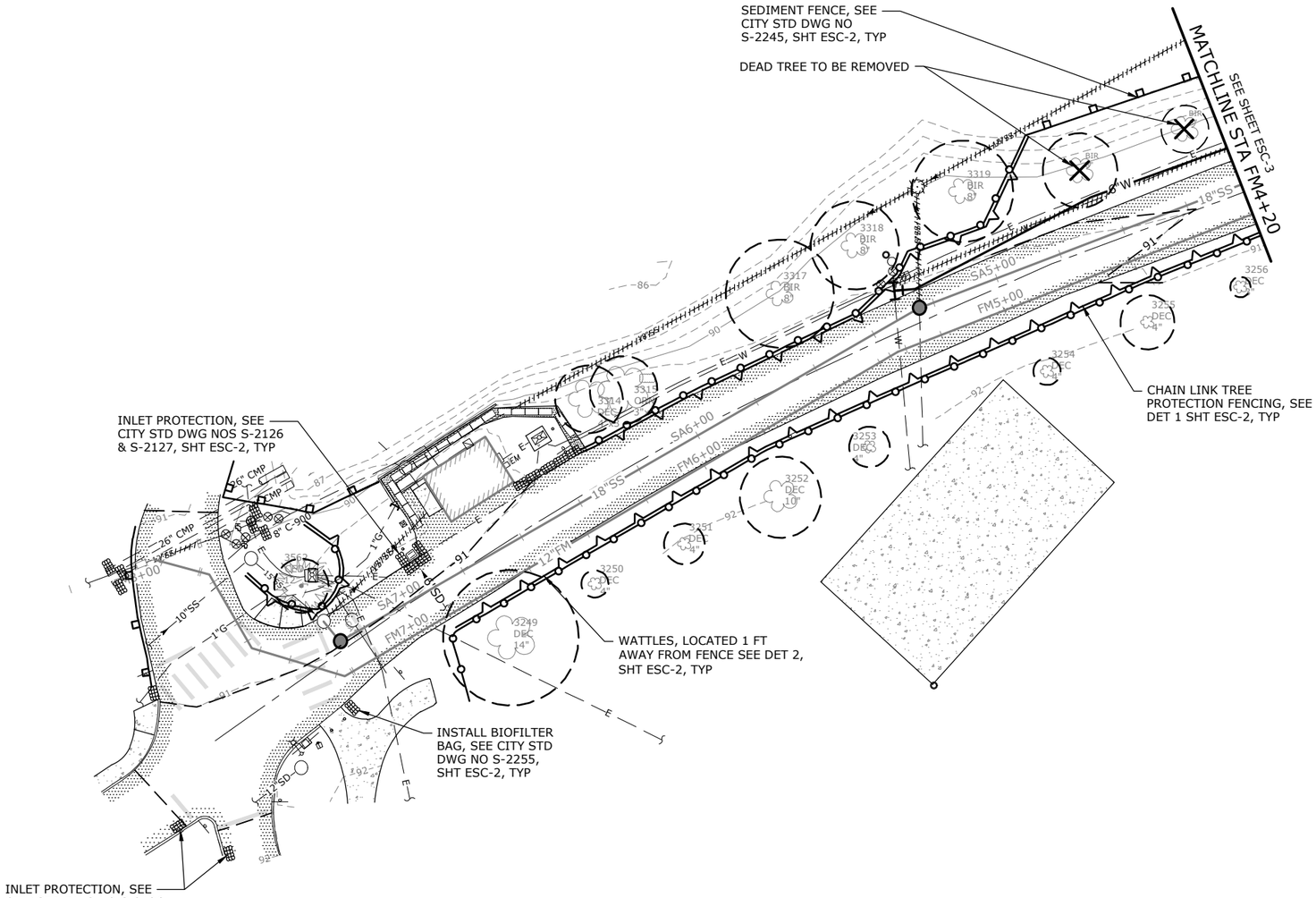
WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

TREE PROTECTION AND EROSION CONTROL PLAN
STA FM1+00 TO STA FM5+60

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
ESC-3
8 of XX



PLAN
SCALE: 1"=20'

LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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FC DESIGNED
NEM DRAWN
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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

TREE PROTECTION AND EROSION CONTROL PLAN STA FM5+60 TO STA FM8+00

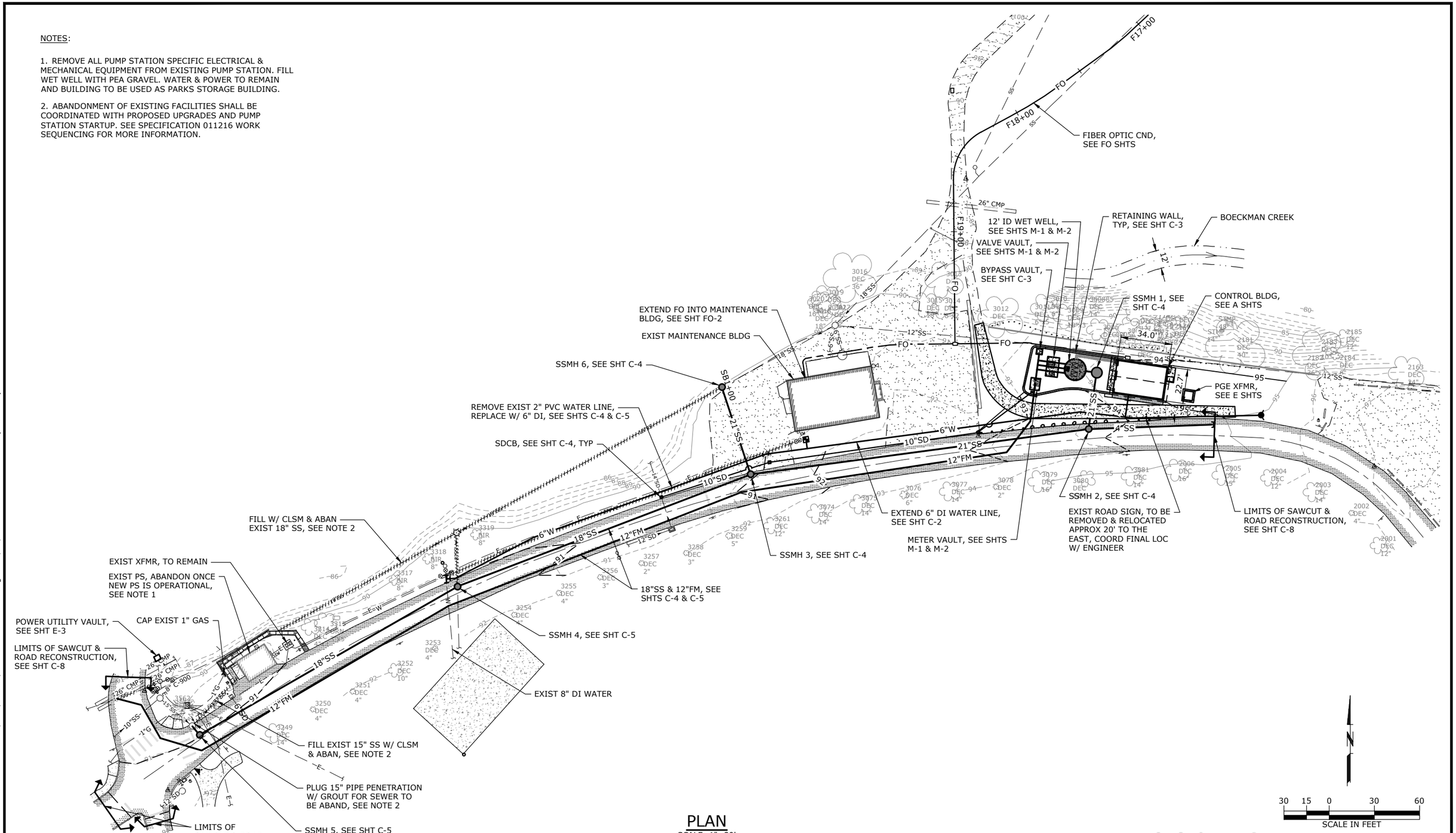
PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
ESC-4
9 of XX

NOTES:

1. REMOVE ALL PUMP STATION SPECIFIC ELECTRICAL & MECHANICAL EQUIPMENT FROM EXISTING PUMP STATION. FILL WET WELL WITH PEA GRAVEL. WATER & POWER TO REMAIN AND BUILDING TO BE USED AS PARKS STORAGE BUILDING.

2. ABANDONMENT OF EXISTING FACILITIES SHALL BE COORDINATED WITH PROPOSED UPGRADES AND PUMP STATION STARTUP. SEE SPECIFICATION 011216 WORK SEQUENCING FOR MORE INFORMATION.



PLAN
SCALE: 1"=30'

LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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NEM DRAWN
FC CHECKED

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

SITE PLAN

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
C-1
10 of XX

G:\PDX_Projects\17\2136 - Wilsonville Memorial Park PS\CAD\Sheets\17-2136-OR-C SITE.dwg C-1 7/25/2019 1:17 PM DAK 23.0s (LMS Tech)

KEY NOTES

FORCE MAIN

1. BYPASS VAULT, SEE DET 2, SHT C-10
2. STA FM1+00, BEGIN 12'' DI FM ALIGNMENT AT OUTSIDE FACE OF VALVE VAULT, SEE SHT C-4
3. SEE SHT M-1 FOR PS PIPING

WATER

1. 6" DI WATER AT 36" DEPTH W/ JOINT RESTRAINTS, SEE SHTS C-4 & C-5 FOR CONTINUATION
2. FIRE HYDRANT, SEE DET X, SHT C-X
3. 6" SERVICE SADDLE W/ 1" SERVICE CONNECTION
4. 1" COP WATER SERVICE INTO BUILDING, SEE SHT M-5

SANITARY SEWER

1. 21" GRAVITY SS, SEE SHTS C-4 & C-5
2. SSMH 2, SEE SHT C-4
3. SSMH 1, SEE SHT C-4
4. 4" DI FLOOR DRAIN FROM BUILDING

FIBER

1. FIBER OPTIC CONDUIT VAULT, SEE DET, SHT FO-1
2. FIBER OPTIC CONDUIT, SEE SHT FO-2 FOR FIBER OPTIC PLAN

ODOR CONTROL

1. 8" PVC PIPE, ROUTED FROM ODOR CONTROL UNIT TO WET WELL

STORM SEWER

1. STORM SEWER AREA DRAIN, SEE CITY STD DWG NO. S-2110, SHT C-11
2. 10" STORM SEWER, SEE SHT C-4

BOECKMAN CREEK C/L

HOUSEKEEPING PAD FOR HVAC UNIT AND POWER SERVICE PANEL, 6" THK

CONC PAD AND PGE XFMR

PLAN
SCALE: 1"=10'

SCALE IN FEET: 10 5 0 10 20

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LAND USE APPLICATION

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

PUMP STATION UTILITY PLAN

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
C-2
11 of XX

NOTES:

1. DEWATERING WELLS AND OBSERVATION WELL LOCATIONS AND SPACING ARE APPROXIMATE AND ARE FOR CONTRACTOR BIDDING PURPOSES ONLY, FINAL DESIGN OF DEWATERING SYSTEM SHALL BE BY CONTRACTOR AS SPECIFIED IN SECTION 312319.

2. DEEP WATERING WELLS, LOCATED NORTH AND SOUTH OF THE VALVE VAULT, MAY NOT BE NECESSARY IF THE PUMP STATION EXCAVATION IS PERFORMED WITH INTERLOCKING SHEET PILE SHORING EMBEDDED TO APPROXIMATE ELEVATION OF 51 FEET (IE APPROXIMATELY 10 FEET INTO STIFF CLAY LAYER). COORDINATE WITH ENGINEER PRIOR TO DEWATERING CONTRACTORS MOBILIZATION TO THE SITE.

3. DEEP DEWATERING WELLS PLACED NEAR SSMH-1 AND SSMH-2 ARE RECOMMENDED TO HAVE THE BOTTOM OF THE SCREENED INTERVAL INSTALLED TO APPROXIMATE ELEVATION 61.5 FEET (IE TOP OF THE STIFF CLAY LAYER) AND PUMPED FOR A MINIMUM OF 5 DAYS PRIOR TO BEGINNING EXCAVATIONS.

4. INTERNAL SUMPING WILL BE NECESSARY FOR BOTH THE PUMP STATION AND PIPELINE/ MANHOLE EXCAVATIONS. INTERNAL SUMPING SHOULD ALSO BE USED TO SUPPLEMENT EXTERNAL DEWATERING SYSTEMS (IE DEEP WELLS OR VACUUM WELLPOINTS) WHEN USED.

5. AN OBSERVATION WELL IS PROPOSED TO CONFIRM DEWATERING IS OCCURRING NEAR THE PUMP STATION CONNECTIONS AND ALONG THE PIPELINE. PROPOSED LOCATIONS OF OBSERVATION WELLS FOR SUPPORT OF THE VACUUM WELLPOINT DEWATERING, NOT SHOWN. OBSERVATION WELLS ARE RECOMMENDED TO HAVE THE BOTTOM OF THE SCREENED INTERVALS PLACED TO APPROXIMATE ELEVATION OF THE TOP OF THE STIFF CLAY LAYER.

GRADING COORDINATES				
PT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	N603312.90	E7621044.72	95.30	TOP OF WALL
2	N603289.15	E7620988.47	94.45	EDGE OF CONC
3	N603315.07	E7621026.65	95.10	EDGE OF CONC
5	N603263.97	E7620953.48	92.75	CATCH BASIN RIM
6	N603294.77	E7620990.22	94.60	TOP OF METER VAULT
7	N603306.46	E7621002.78	94.70	TOP OF VALVE VAULT
8	N603317.32	E7620993.91	94.70	TOP OF BYPASS VAULT
9	N603289.41	E7621042.34	95.30	TOP OF WALL
10	N603305.30	E7621017.47	95.00	RIM OF WET WELL
11	N603303.25	E7621031.81	95.00	RIM OF SSMH 1
12	N603272.11	E7621074.22	94.50	EDGE OF ASPH
13	N603268.88	E7621014.64	93.90	EDGE OF ASPH
14	N603262.63	E7620952.83	92.80	EDGE OF ASPH
15	N603288.14	E7621092.74	95.25	TOP OF XFMR PAD
16	N603265.99	E7621026.48	94.05	TOP OF SSMH 2
18	N603318.26	E7621004.87	94.90	EDGE OF CONC
19	N603320.10	E7620990.56	94.75	EDGE OF CONC
20	N603290.65	E7620988.31	94.40	EDGE OF CONC
21	N603291.82	E7621004.58	94.70	EDGE OF CONC
22	N603292.88	E7621021.74	94.90	EDGE OF CONC
23	N603265.77	E7620982.66	93.20	EDGE OF CURB
24	N603270.39	E7621044.27	94.25	EDGE OF CURB
25	N603281.94	E7621075.71	94.70	EDGE OF ASPH

BOECKMAN CREEK C/L

DAVIT CRANE MOUNTED ON CONC PAD, PAD SHALL BE INTEGRATED INTO THE WET WELL LID DESIGN, DESIGNED BY CONTR, DAVIT CRANE TO HAVE 1-TON CAPACITY

OPTIONAL DEEP DEWATERING WELL, SEE NOTE 2, TYP

DEEP DEWATERING WELL, SEE NOTE 3, TYP

PUMP DISCONNECT PANEL & TRENCH, SEE DET X, SHT X-X

TOP OF SLP

6" THK CONC SURFACING, SEE DET 2, SHT C-9

SMALL BLOCK RETAINING WALL, SEE DET 1, SHT C-10

BUILDING FIN FLR=95.4

1.00% MIN, 5.00% MAX SLP

2.00% MAX SLP

2.00% MIN SLP

CONC PEDESTRIAN PATHWAY, SEE DET 1, SHT C-9

EXIST ROAD SIGN, RELOCATED

REMOVABLE BOLLARDS ACROSS ENTRANCE, SEE DET 3, SHT C-9, TYP OF 9

BOULDERS, CITY TO PROVIDE & CONTR TO INSTALL, SPACED AT APPROX 6' TO 7' OC TO PREVENT VEHICLES FROM PARKING AT THE PS

OBSERVATION WELL, SEE NOTE 5

VEGETATED PLANTER BOX, SEE L SHTS & CITY STD DWG NO. 4010, SHT C-11

N

10 5 0 10 20
SCALE IN FEET

PLAN
SCALE: 1"=10'

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LAND USE APPLICATION

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

PUMP STATION GRADING AND SURFACING PLAN

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
C-3
12 of XX

SHEET NOTES:

1. VACUUM WELLPOINTS ARE SPACED EVERY 5 FEET AND ARE TO BE CONNECTED IN 100-FOOT SEGMENTS. VACUUM WELLPOINTS, WHEN INSTALLED, SHOULD BE PUMPED FOR A MINIMUM OF 5 DAYS PRIOR TO PERFORMING EXCAVATIONS.

2. SEE SHEET C-3 FOR PUMP STATION SITE DEWATERING LAYOUT.

3. FOR PIPE BACKFILL, SEE CITY STANDARD DRAWING NO. S-2145 ON SHEET C-11; FOR SANITARY SEWER CROSSING AND ACCESS LOCATION, SEE CITY STANDARD DRAWINGS NOS. 2065 AND 2150 ON SHEET C-12.

4. ALL DUCTILE IRON PIPE SHALL BE RESTRAINED.

SDCB 2
FURNISH & INSTALL:
1-CB, SEE CITY STD DWG NO. 2100 ON SHT C-11 AND DWG NO. 2095 & 2096, SHT C-12
RIM=92.80
10" IE IN (NE)=89.45
10" IE OUT (W)=89.45

SDCB 1
FURNISH & INSTALL:
1-CB, SEE CITY STD DWG NO. 2100 ON SHT C-11 AND DWG NO. 2095 & 2096, SHT C-12
RIM=94.4
10" IE OUT (SW)=89.9

SSMH
48" PRECAST
RIM=90.08
6" PVC IN (SW)=82.2
6" PVC IN (S)=82.2
12" PVC IN (E)=81.4
18" CONC IN (NE)=81.4
18" CONC OUT (SW)=81.3

STA SB1+00
SSMH 6
FURNISH & INSTALL:
1-48" SSMH,
SEE CITY STD DWGS. 2005 & 2080,
SHT C-11 AND DWG NO. 2055, SHT C-12,
CONNECT TO EXIST 18" SS

FURNISH & INSTALL:
1-6" 11.25° BEND

SDCB 4
FURNISH & INSTALL:
1-CB, SEE CITY STD DWG NO. 2100 ON SHT C-11 AND DWG NO. 2095 & 2096, SHT C-12
RIM=90.20
10" IE IN (E)=87.25
14" IE IN (N)=87.25 (EXIST)
14" IE OUT (S)=87.25 (EXIST)
CONNECT TO EXIST SD

STA FM3+25
FURNISH & INSTALL:
1-12" 11.25° BEND, MJ

SDCB 3
FURNISH & INSTALL:
1-CB, SEE CITY STD DWG NO. 2100 ON SHT C-11 AND DWG NO. 2095 & 2096, SHT C-12
RIM=91.30
10" IE IN (E)=88.10
10" IE OUT (SW)=88.10

STA SA3+16=STA SB1+61
SSMH 3
FURNISH & INSTALL:
1-48" SSMH,
SEE CITY STD DWGS. 2005 & 2080,
SHT C-11 AND DWG NO. 2055, SHT C-12,

STA FM1+47
FURNISH & INSTALL:
1-12" 45° BEND, MJ

STA FM1+21
FURNISH & INSTALL:
1-12" 22.5° BEND, MJ

VACUUM WELLPOINTS, SEE NOTE 1

12' ID WET WELL, SEE M SHEETS

STA SA0+90
SSMH 2
FURNISH & INSTALL:
1-48" SSMH,
SEE CITY STD DWGS. 2005 & 2080,
SHT C-11 AND DWG NO. 2055, SHT C-12,

FURNISH & INSTALL:
1-6" 11.25° BEND

STA SA0+52
SSMH 1
FURNISH & INSTALL:
1-72" SSMH,
SEE CITY STD DWGS. 2005 & 2080,
SHT C-11 AND DWG NO. 2055, SHT C-12,

FURNISH & INSTALL:
1-6" 11.25° BEND

4"SS LATERAL STUBBED 49' TO THE EAST, CAP END

SS CO
RIM=86.65
LID SLANTED TO SOUTH

26" CMP IE=79.49
26" CMP
26" CMP IE=75.89

BOECKMAN CREEK

EXIST MAINTENANCE BLDG

SD CB
CIP (1.9x2.7)
RIM=90.32
12" PVC IN (W)=87.7
14" PVC OUT (N)=87.5
BOTT=87.0

MATCHLINE STA FM4+20
SEE SHEET C-5

PLAN
SCALE: 1"=20'

SCALE IN FEET
20 10 0 20 40

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LAND USE APPLICATION

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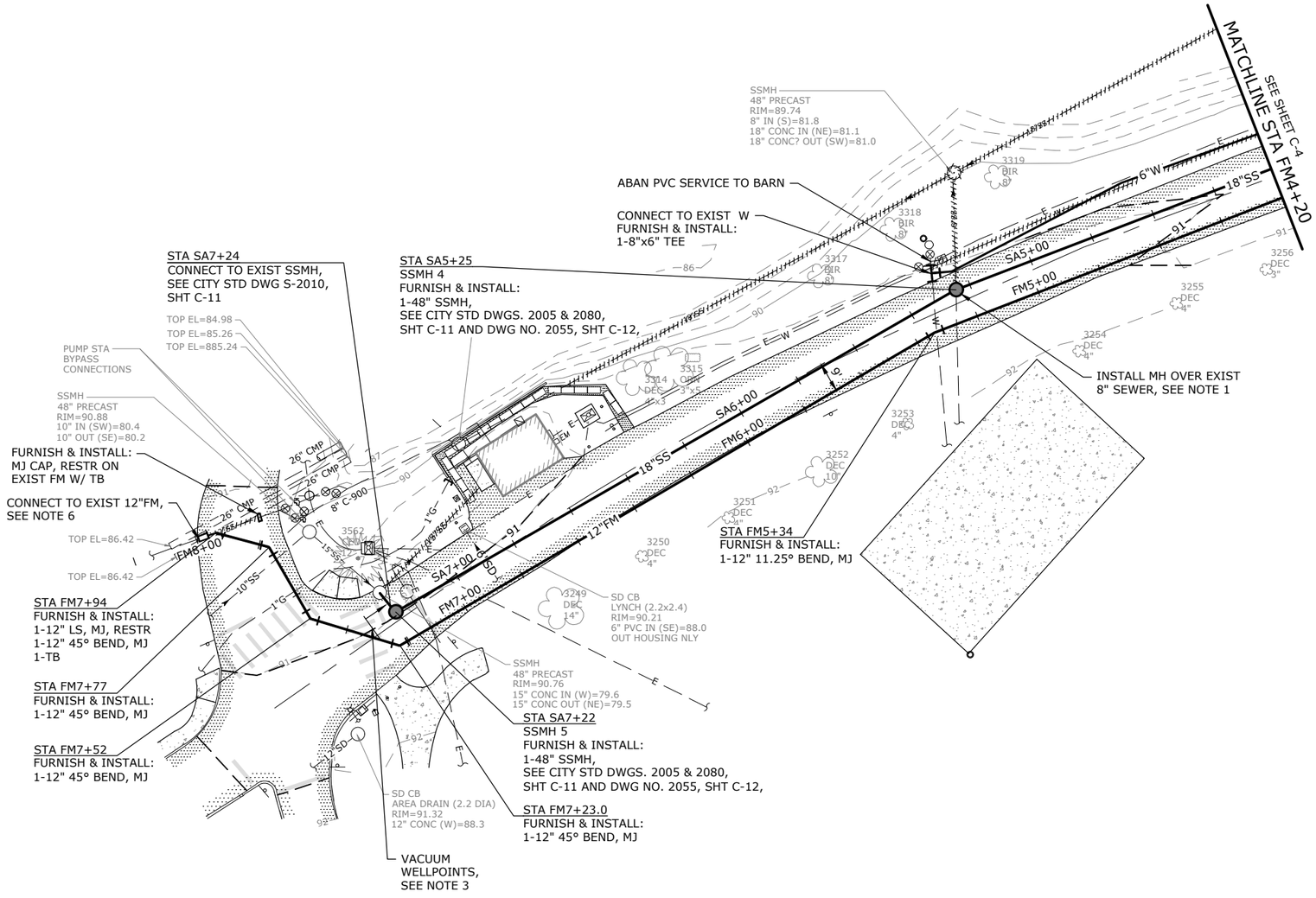
WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

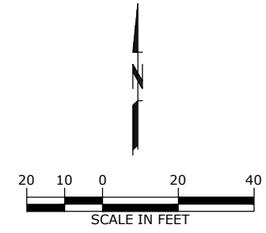
OFF SITE UTILITY PLAN
STA FM1+00 TO STA FM4+20

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
C-4
13 of XX



PLAN
SCALE: 1"=20'



SHEET NOTES:

1. PRIOR TO INSTALLING MANHOLE, CAP EXISTING 8" SEWER. COORDINATE WITH CITY, POTHOLE TO LOCATE SEWER FOR EXACT LOCATION OF MANHOLE. FIELD CORE 8" PENETRATION INTO MANHOLE.

2. INSTALL JOINT RESTRAINTS ON ALL FORCE MAIN JOINTS.

3. VACUUM WELL POINTS TO BE INSTALLED PER NOTE 1, SHEET C-4.

4. SEE SHEET NOTE 3 ON SHEET C-4.

5. ALL DUCTILE IRON PIPE SHALL BE RESTRAINED.

6. COORDINATE ALL WORK WITH THE REQUIREMENTS IN SPECIFICATION SECTION 011216 WORK SEQUENCING.

LAND USE APPLICATION

NO.	DATE	BY	REVISION

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

OFF SITE UTILITY PLAN
STA FM4+20 TO STA FM8+00

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
C-5
14 of XX

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GENERAL NOTES

A. VERIFY ALL DIMENSIONS AND CONDITIONS ON SITE. NOTIFY OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES BEFORE START OF WORK.

B. ALL WORK TO COMPLY WITH THE STATE OF OREGON BUILDING CODE, 2014 EDITION, AND WITH ALL OTHER APPLICABLE MUNICIPAL, COUNTY, STATE AND FEDERAL CODES AND REGULATIONS.

C. DO NOT SCALE THE DRAWINGS. UNLESS NOTED OTHERWISE, DIMENSIONS ARE FROM FACE OF STUD, MASONRY, AND CONCRETE, OR TO CENTERLINE OF POSTS AND WALLS. DIMENSIONS MARKED 'CLR' ARE TO BE HELD FROM FACE OF FINISH TO FACE OF FINISH. DO NOT SCALE THE DRAWINGS TO OBTAIN DIMENSIONS OR LOCATIONS. WHERE PLANS INDICATE 'ALIGN' MATCH FINISH TO FINISH.

D. THE CONTRACT DOCUMENTS ARE COMPLEMENTARY, AND WHAT IS REQUIRED BY ONE SHALL BE AS BINDING AS IF REQUIRED BY ALL; COORDINATE ALL PORTIONS OF THE WORK AS DESCRIBED IN THE CONTRACT DOCUMENTS. REQUEST CLARIFICATION FROM THE OWNER'S REPRESENTATIVE FOR ALL DISCREPANCIES PRIOR TO CONSTRUCTION.

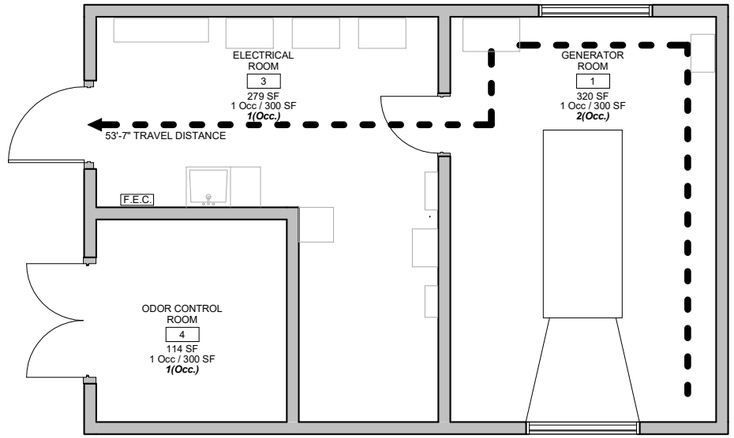
E. CONDITIONS AND DETAILS MARKED 'TYPICAL' SHALL APPLY IN ALL CASES, UNLESS SPECIFICALLY INDICATED OTHERWISE. TYPICAL DETAILS NOT REFERENCED ON DRAWINGS APPLY UNLESS NOTED OTHERWISE BY SPECIFIC NOTES AND DETAILS. WHERE NO SPECIFIC DETAIL IS SHOWN, THE CONSTRUCTION SHALL BE IDENTICAL OR SIMILAR TO THAT INDICATED FOR THE TYPICAL CONSTRUCTION ON THE PROJECT.

F. CONTRACTOR TO COORDINATE ANY REQUIRED WORK IN ADJACENT AREAS AND MAINTAIN A CLEAN AND ORGANIZED JOB SITE WITH RESPECT FOR NEIGHBORHOOD SURROUNDINGS .

G. PROVIDE SHORING, BRACING, SUPPORT AND PROTECTION AS REQUIRED TO MAINTAIN STRUCTURAL INTEGRITY OF THE PROJECT.

H. THE CONTRACTOR SHALL VERIFY ALL FIGURES, DIMENSIONS, MATERIALS, ETC., ON THE DRAWINGS WITH ALL OTHER DRAWINGS AND WITH THE VARIOUS MANUFACTURER'S INSTALLATION REQUIREMENTS BEFORE COMMENCING ANY OF THE WORK HEREIN SHOWN.

I. ANY WORK DEVIATING FROM THE DRAWINGS WILL BE REJECTED UNLESS THE CHANGE IS DULY AUTHORIZED.



1 CODE PLAN
SCALE: 1/4" = 1'-0"

ARCHITECTURAL ABBREVIATIONS

AB	ANCHOR BOLT	FEC	FIRE EXTINGUISHER CABINET	OC	ON CENTER
ABV	ABOVE	FD	FLOOR DRAIN	OH	OPPOSITE HAND
ADJ	ADJACENT	FDC	FIRE DEPARTMENT CONNECTION	OPP	OPPOSITE
ADJUST	ADJUSTABLE	FFE	FINISH FLOOR ELEVATION	OSOI	OWNER SUPPLIED & OWNER INSTALLED
AFF	ABOVE FINISH FLOOR	FG	FIBER GLASS		
ALUM	ALUMINUM	FIN	FINISH	OSCI	OWNER SUPPLIED & CONTRACTOR INSTALLED
ANOD	ANODIZED	FLR	FLOOR		
ARCH	ARCHITECT(URAL)	FND	FOUNDATION		
		FO	FACE OF	PL	PLATE
BLDG	BUILDING	FOC	FACE OF CONCRETE	P-LAM	PLASTIC LAMINATE
BO	BOTTOM OF	FOF	FACE OF FINISH	PNL	PANEL
BOM	BOTTOM OF MASONRY	FOM	FACE OF MASONRY	PT	PRESSURE TREATED
		FOS	FACE OF STRUCTURE	PTD	PAINTED
CG	CORNER GUARD	FP	FIRE PANEL	PTN	PARTITION
CIP	CAST IN PLACE	FRP	FIBERGLASS REINFORCED PLASTIC		
CJ	CONTROL JOINT			RO	ROUGH OPENING
CLG	CEILING	FRT	FIRE RETARDANT TREATED		
CLR	CLEAR	FT	FEET	SCHED	SCHEDULE
CMU	CONCRETE MASONRY UNIT	FTG	FOOTING	SD	SMOKE DETECTOR
COL	COLUMN			SF	SQUARE FEET
CONC	CONCRETE	GA	GAUGE	SHT	SHEET
CONT	CONTINUOUS	GALV	GALVANIZED	SHTG	SHEATHING
CONST	CONSTRUCTION	GB	GYPSUM BOARD	SIM	SIMILAR
CSCI	CONTRACTOR SUPPLIED & CONTRACTOR INSTALLED	GC	GENERAL CONTRACTOR	SI	SQUARE INCHES
		GL	GLASS	SM	SHEET METAL
		GWB	GYPSUM BOARD	SOG	SLAB ON GRADE
CS	COUNTERSINK			SPECS	SPECIFICATIONS
		HM	HOLLOW METAL	SS	STAINLESS STEEL
DBL	DOUBLE	HOR	HORIZONTAL	STD	STANDARD
DIA	DIAMETER	HT	HEIGHT	STL	STEEL
DIM	DIMENSION			STRUCT	STRUCTURAL
DN	DOWN	INT	INTERIOR		
DS	DOWNSPOUT	INSUL	INSULATION	T	TEMPERED GLASS
DR	DOOR			TO	TOP OF
DTL	DETAIL	JT	JOINT	TOC	TOP OF CONCRETE
DWG	DRAWING			TOJ	TOP OF JOIST
		MAX	MAXIMUM	TOM	TOP OF MASONRY
EX	EXISTING	MECH	MECHANICAL	TOW	TOP OF WALL
EA	EACH	MANUF	MANUFACTURER	TS	TUBE STEEL
EF	EACH FACE	MIN	MINIMUM	TYP	TYPICAL
EJ	EXPANSION JOINT	MC	MASONSRY COURSES		
ELEC	ELECTRICAL	MO	MASONRY OPENING	UNO	UNLESS NOTED OTHERWISE
ENCL	ENCLOSED	MTL	METAL		
EQ	EQUAL			VIF	VERIFY IN FIELD
EQUIP	EQUIPMENT	NIC	NOT IN CONTRACT	VERT	VERTICAL
EL./ELEV	ELEVATION	NOM	NOMINAL		
EW	EACH WAY	NTS	NOT TO SCALE	W/	WITH
EXP	EXPANSION				
EXT	EXTERIOR				

ARCHITECTURAL SYMBOLS

1 VIEW NAME
SCALE: 1/8" = 1'-0"
DRAWING TITLE

1 / AX.XX — DETAIL NO. / SHEET NO.
EXTERIOR ELEVATION

1 / 1 AX.XX 1 / 1 — SHEET NO. / DETAIL NO.
INTERIOR ELEVATION

1 / AX.XX — DETAIL NO. / SHEET NO.
BUILDING SECTION

1 / AX.XX — DETAIL NO. / SHEET NO.
WALL SECTION

1 / AX.XX — DETAIL NO. / SHEET NO.
DETAIL KEY

ROOM NAME
101
150 SF
101
ROOM NAME/NUMBER
DOOR MARK

X
LOUVER MARK

KEYNOTE

ALIGN — FINISH TO BE FLUSH

SLOPE TO DRAIN

℄ CENTERLINE

FD AREA/FLOOR DRAIN

F.E.C. FIRE EXTINGUISHER CABINET

NORTH ARROW

1 GRID BUBBLE

T.O. WALL 9'-0" ELEVATION HEIGHT

WORK POINT, CONTROL POINT, OR DATUM POINT

1 REVISION MARK AND CLOUD

APPLICABLE CODES

- 2014 OREGON STRUCTURAL SPECIALTY CODE (OSSC)
- 2014 OREGON ENERGY EFFICIENCY SPECIALTY CODE (OEESC)
- 2014 OREGON FIRE CODE (OFC)
-OSHA REGULATIONS

STRUCTURE OCCUPANCY

(PER OSSC TABLE 3-A)

ROOM NAME	GROUP TYPE
GENERATOR ROOM	F-1
ELECTRICAL ROOM	F-1
ODOR CONTROL ROOM	F-1

BUILDING CONSTRUCTION ALLOWABLE HEIGHTS & AREAS

CONSTRUCTION TYPE(S) USED IN BUILDING: V-B

	ALLOWED	PROPOSED
# OF STORIES: (PER TABLE 503)	1	1
BUILDING ALLOWED AREA	8500 SF	
BUILDING PROPOSED AREA	766 SF	

OCCUPANCY LOAD

ROOM NAME	SF	SF/OCC	OCCUPANTS
GENERATOR ROOM	320 SF	300 SF	2
ELECTRICAL ROOM	279 SF	300 SF	1
ODOR CONTROL ROOM	114 SF	300 SF	1
			4

BUILDING EXITING

ROOM NAME	PROVIDED	REQUIRED
ELECTRICAL ROOM	1	1

COMMON PATH OF EGRESS TRAVEL

MARK	ACTUAL DISTANCE	Max.DISTANCE	Occ.	COMMENTS	OK
ETD	53' - 7"	75' - 0"	1	≤ 75' MAX - COMMON PATH OF EGRESS TRAVEL - PER TABLE 1014.3	Yes

STRUCTURE FIRE DETECTION AND SUPPRESSION

OCCUPANCY GROUP:	F-1		COMMENTS
	REQ'D	PER	TYPE/CLASS/AREAS OF COVERAGE
FIRE ALARM SYSTEM:	NO	-	-
SMOKE DETECTION SYSTEM:	NO	-	-
SPRINKLER SYSTEM:	NO	-	-
STANDPIPE SYSTEM:	NO	-	-

CODE PLAN SYMBOLS LEGEND

EGRESS PATH AND OCCUPANT LOAD

F.E. FIRE EXTINGUISHER

ETD ##' EXIT TRAVEL DISTANCE

mwa architects

LAND USE APPLICATION

NO.	DATE	BY

NOTICE
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED
DRAWN
CHECKED

REGISTERED ARCHITECT JEFFREY J. MURRAY PORTLAND, OR STATE OF OREGON

murraysmith

WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

CODE SHEET

PROJECT NO.: 201812.00 | SCALE: As indicated | DATE: 10/30/2018

SHEET A-1 OF xxx

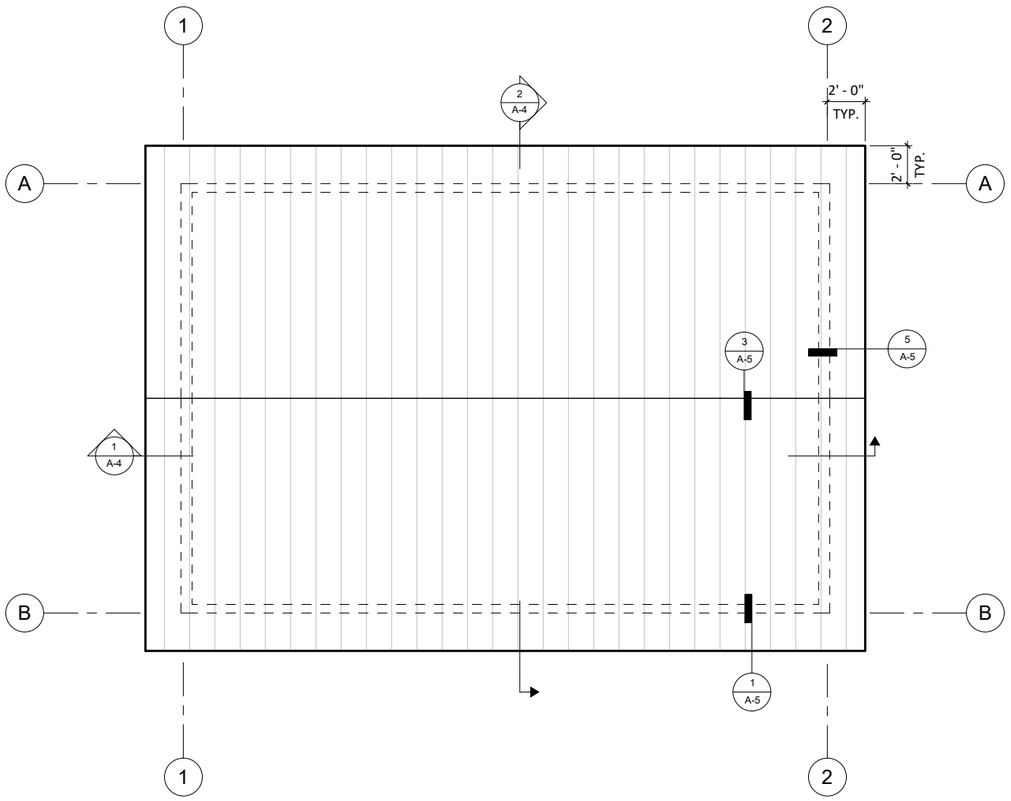
C:\Users\ncarden\Documents\201812.00_Memorial PS Wilsonville_ncarden.rvt

KEYNOTES

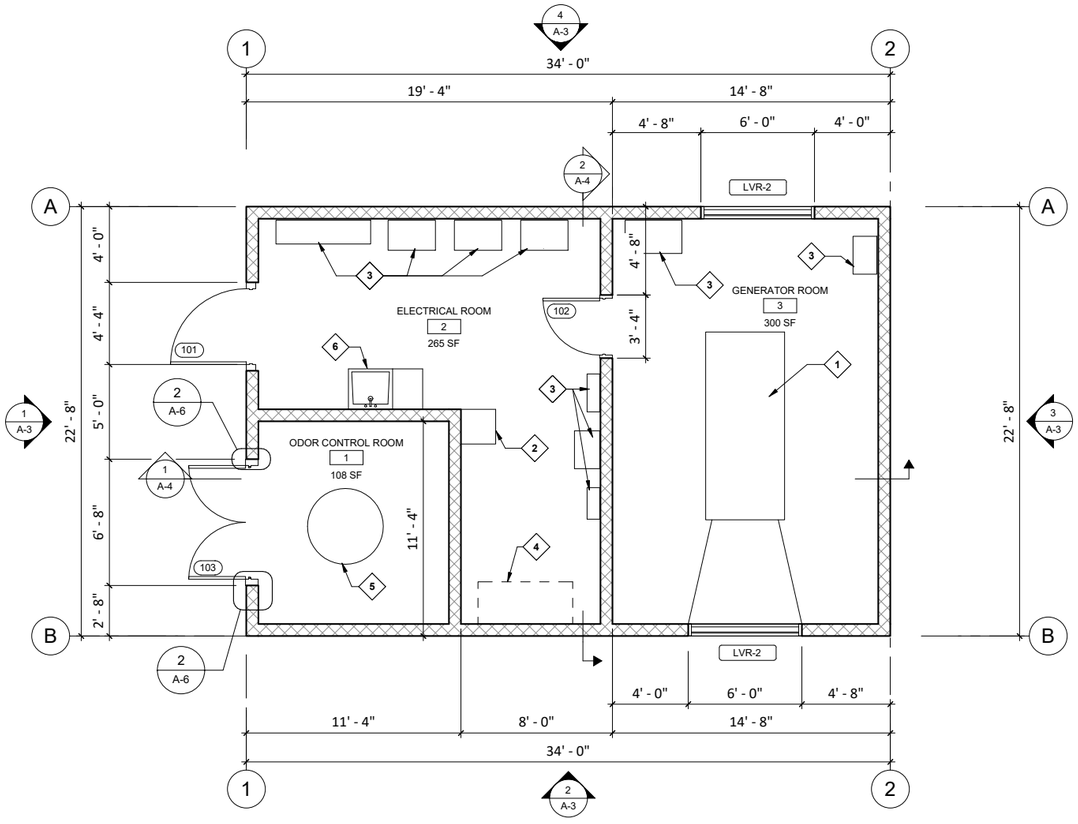
1 GENERATOR. SEE ELECTRICAL SHEETS
2 AIR HANDLING UNIT, SEE H SHEETS
3 SEE ELECTRICAL SHEETS FOR ELECTRICAL EQUIPMENT LAYOUT
4 DESK, OWNER FURNISHED
5 BIOAIR DRUM SCRUBBER, SEE MECHANICAL SHEETS
6 SINK WITH DRAIN BOARD, SEE SPECS

GENERAL NOTES

1. CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE.
2. DIMENSIONS INDICATED ARE TO GRIDLINE, FACE OF CONCRETE OR FACE OF MASONRY U.N.O.
3. SEE ELEVATIONS FOR LOUVER SILL HEIGHTS.
4. SEE MECHANICAL FOR ADDITIONAL LOUVER INFORMATION.



1 ROOF PLAN
SCALE: 1/4" = 1'-0"



2 FLOOR PLAN
SCALE: 1/4" = 1'-0"

NORTH

mwa architects

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LAND USE APPLICATION

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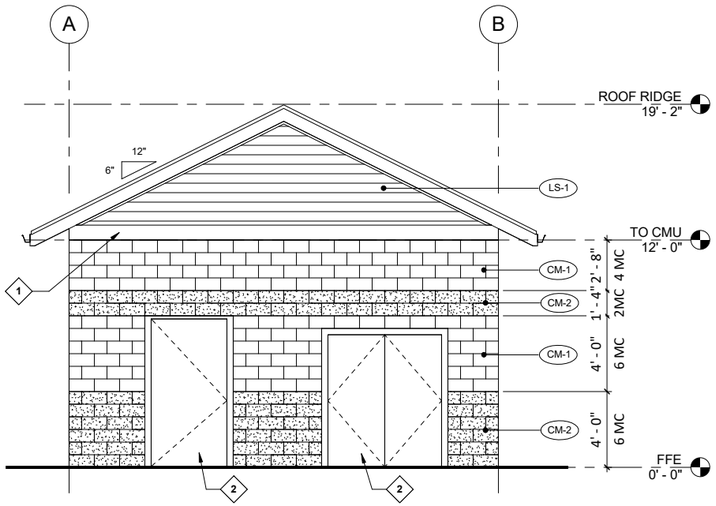
WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

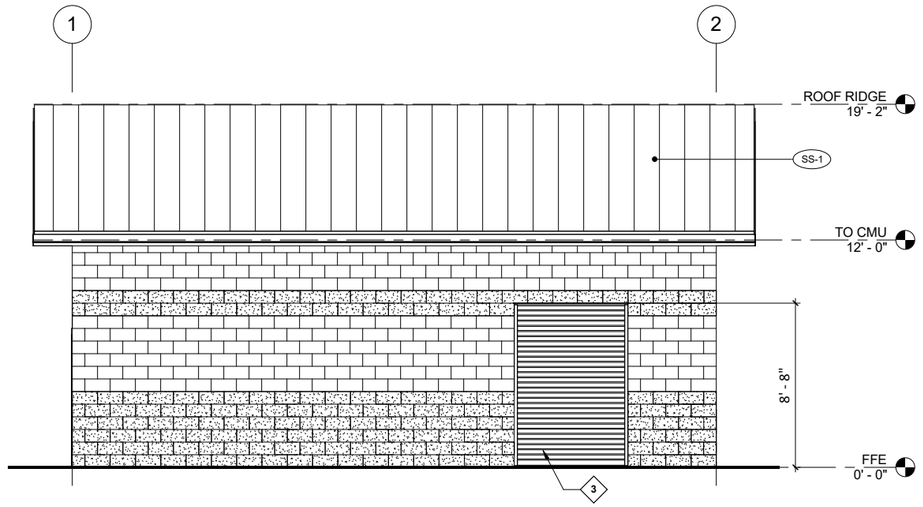
FLOOR AND ROOF PLANS

SHEET **A-2**

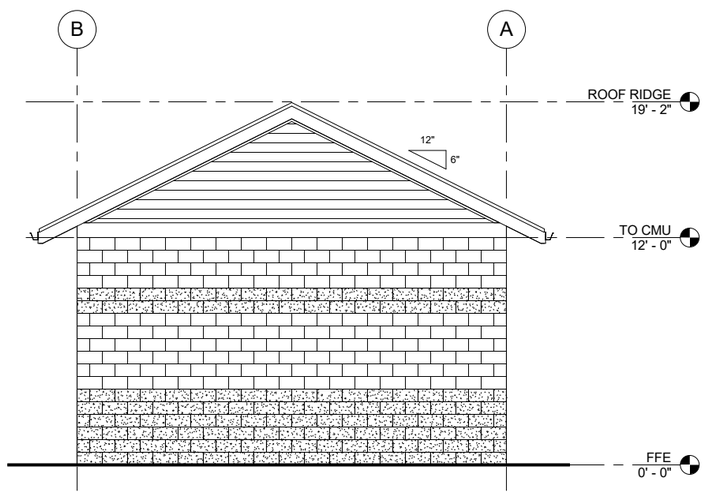
PROJECT NO.: 201812.00 | SCALE: As indicated | DATE: DECEMBER 2018 | xx OF xxx



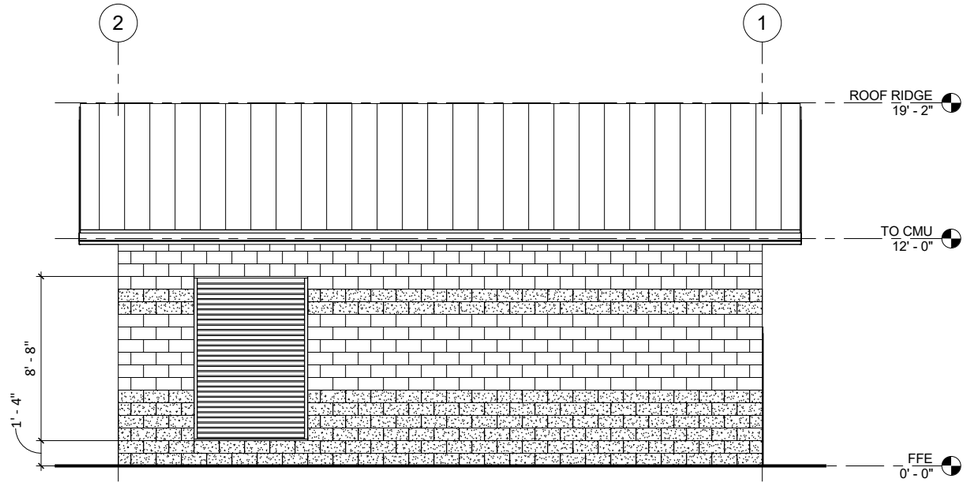
1 WEST ELEVATION
SCALE: 1/4" = 1'-0"



2 SOUTH ELEVATION
SCALE: 1/4" = 1'-0"



3 EAST ELEVATION
SCALE: 1/4" = 1'-0"



4 NORTH ELEVATION
SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. SEE MECHANICAL FOR ADDITIONAL LOUVER INFORMATION.
2. SEE CIVIL FOR FINISH FLOOR ELEVATION.
3. DIMENSIONS INDICATED ARE TO GRIDLINE, FACE OF CONCRETE OR FACE OF MASONRY U.N.O.

KEYNOTES

1 FIBER CEMENT TRIM BOARD
2 HOLLOW METAL DOOR
3 METAL LOUVER - SEE MECHANICAL

COLOR & MATERIAL LEGEND

LS-1 LAP SIDING (SEE SPECS) - SW 6037 TEMPERATE TAUPE
SS-1 STANDING SEAM METAL ROOF - WEATHERED COPPER
CM-1 CMU - SMOOTH FACE - DRIFTWOOD
CM-2 CMU - SPLIT FACED - DRIFTWOOD

mwa architects

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LAND USE APPLICATION

NO.	DATE	BY

NOTICE
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CHECKED

REGISTERED ARCHITECT
JEFFREY E. MURRAY
OREGON
STATE OF OREGON

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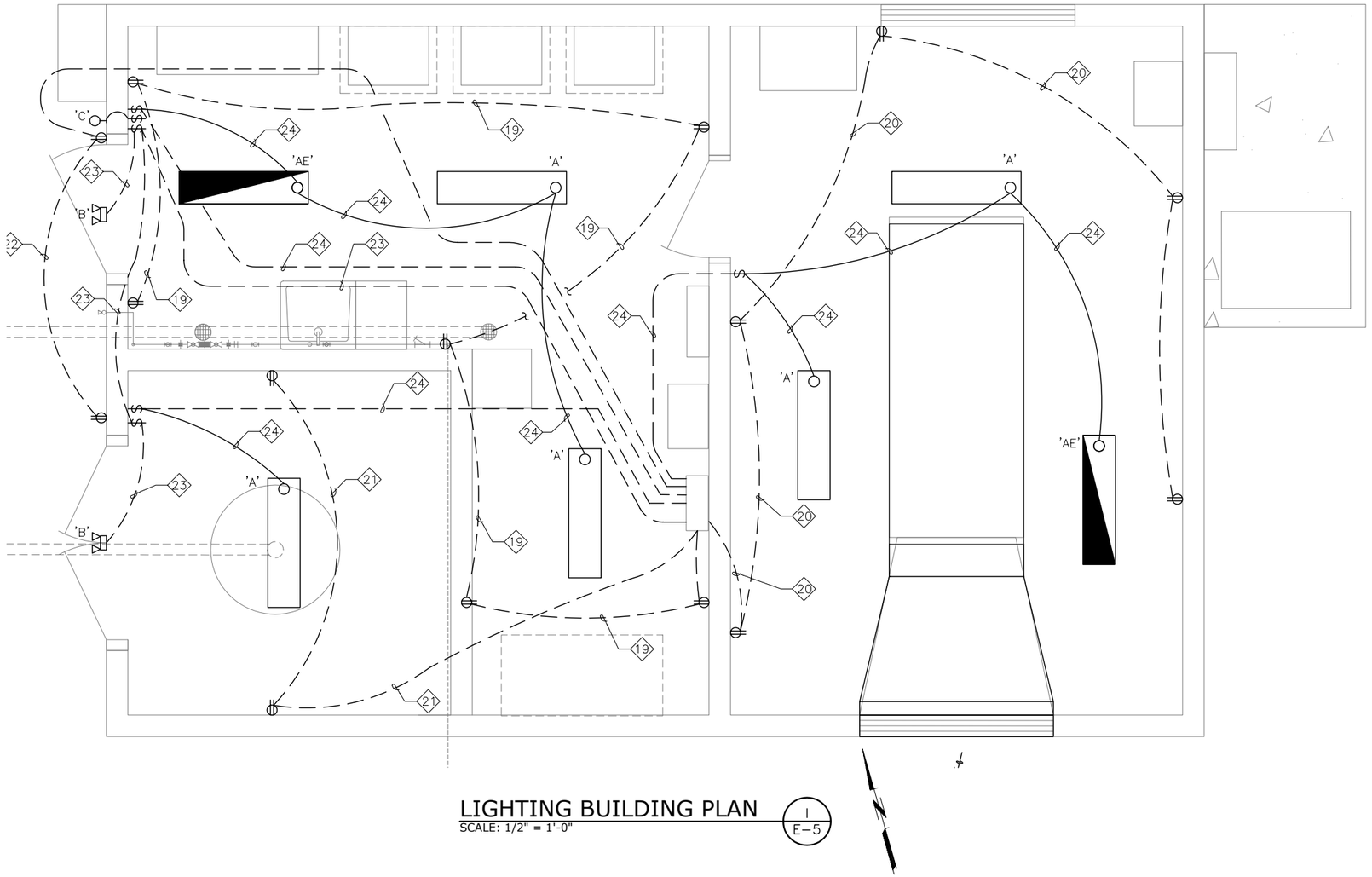
WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

EXTERIOR ELEVATIONS

PROJECT NO.: 201812.00 | SCALE: As indicated | DATE: 10/30/2018

SHEET
A-3
xx OF xxx



LIGHTING BUILDING PLAN

SCALE: 1/2" = 1'-0"

1 / E-5

LUMINAIRE SCHEDULE

LUMINAIRE TYPE	DESCRIPTION	WATTS	MANUFACTURER AND MODEL SERIES
A	LITHONIA #VAP-4000LM-FST-WD-MVOLT-GZ10-40K-90CRI	44	LED 4-FOOT SURFACE MOUNT LUMINAIRE IN INJECTION MOLDED, IMPACT-RESISTANT, FROSTED POLYCARB HOUSING W/ CONTINUOUS POURED-IN-PLACE CLOSED CELL GASKET. 4000K COLOR TEMPERATURE, 4000 LUMENS, WIDE DISTRIBUTION W/RIBBED FROSTED POLYCARB LENS.
AE	LITHONIA #VAP-4000LM-FST-WD-MVOLT-GZ10-40K-90CRI-BSL722	44	LED 4-FOOT SURFACE MOUNT LUMINAIRE IN INJECTION MOLDED, IMPACT-RESISTANT, IMPACT-RESISTANT, FROSTED POLYCARB HOUSING W/ CONTINUOUS POURED-IN-PLACE CLOSED CELL GASKET. 4000K COLOR TEMPERATURE, 4000 LUMENS, WIDE DISTRIBUTION W/RIBBED FROSTED POLYCARB LENS. EMERGENCY BATTERY BACKUP.
B	LITHONIA **#OLF - 3RH - 40K - 120 - BZ**	36	LED HIGH PERFORMANCE TRIPLE HEAD FLOOD LIGHT LUMINAIRE. 50,000 HOUR SERVICE LIFE. 4000K COLOR TEMPERATURE, 3100 LUMENS. CORROSION RESISTANT AND ALUMINUM HOUSING W/ BRONZE FINISH AND CLEAR ACRYLIC FULLY GASKETED LENS.
C	LITHONIA #OLWX1-LED-13W-40K-M4	14	LED WALL PACK WITH PHOTOCELL AND MOTION SENSOR. 13 WATT LED, 4000K COLOR TEMPERATURE, CAST ALUMINUM HOUSING, IP65 RATED, 1271 LUMENS.

R&W ENGINEERING, INC.
"Engineering Integrated Solutions"
9615 S.W. Allen Boulevard
Suite 107
Beaverton, Oregon 97005
Phone: (503) 726-3349
Fax: (503) 726-3326
E-mail: rweng@rweng.com
Project No.: 483.133.001 Contact: KENNETH RYNONE

LAND USE APPLICATION

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R&W DRAWN
GHS CHECKED

JULY 2019

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WILSONVILLE OREGON

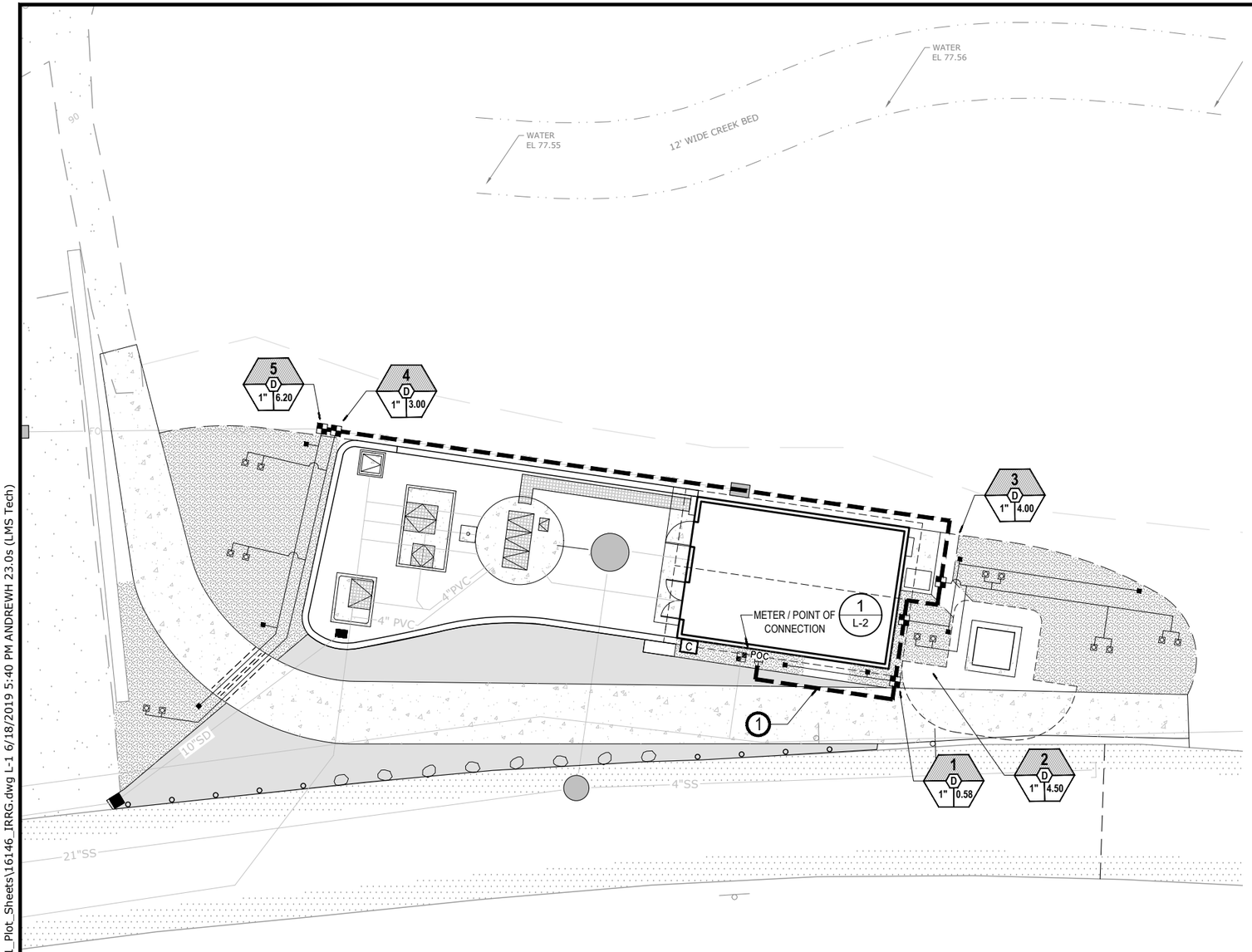
CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

LIGHTING PLAN

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JULY 2019

SHEET
E-5
X of XX

W:\WF\483_Murray Smith Assoc\133_Wilsonville Memorial Park Pump Station\001_Preliminary Design\DWG\E-5.dwg E-5 7/22/2019 7:32 AM MARKP 19.1s (LMS Tech)



IRRIGATION LEGEND

IRRIGATION HEADS — 2 L-3 — 3 L-3

SYMBOL	DESCRIPTION / MANUFACTURER / MODEL	ARC	PSI	GPM	RADIUS
⊠	TREE BUBBLER - RAIN BIRD RWS-B-C 1402	360	30	0.50	3'
	AREA TO RECEIVE LANDSCAPE DRIPLINE - RAIN BIRD XFCV-09-18 (2)				

IRRIGATION EQUIPMENT — 1 L-2 — 5 L-2 — 6 L-2 — 1 L-3

SYMBOL	DESCRIPTION
POC 1"	POINT OF CONNECTION
	DRIP CONTROL ZONE KIT - RAIN BIRD XCZ-100-PRB-COM
C	IRRIGATION CONTROLLER - HUNTER PHC-600 W/ FLOW SENSOR AND RAIN-CLICK - INCLUDE HUNTER HYDRAWISE CONTRACTOR PROFESSIONAL PLAN - "STARTER"
	IRRIGATION LATERAL LINE - PVC 200 - 1" MIN.
	DRIP ZONE LATERAL HEADER LINE / CONNECTION - 1" MIN.
	IRRIGATION MAIN LINE - 1.5" SCH 40
	IRRIGATION SLEEVE - TWICE LINE SIZE

CONTROL VALVE TARGET

1 D 1" 14 *

- STATION NUMBER
- AREA DESIGNATION: D = DRIP
- FLOW IN GPM
- VALVE SIZE

KEYNOTES

1. SEE IRRIGATION NOTE 8 BELOW

IRRIGATION NOTES

1. CALL UTILITIES TO LOCATE EXISTING SERVICES PRIOR TO EXCAVATION.
2. SYSTEM OPERATION AND DESIGN IS BASED ON A MINIMUM OF REQUIREMENT OF 40 PSI OF PRESSURE AND 7 GPM AT THE SHUTOFF VALVE. THE CONTRACTOR SHALL VERIFY THE DESIGN PRESSURE AND VOLUME BEFORE INSTALLATION AND NOTIFY OWNER IF THERE IS A DISCREPANCY.
3. CONTRACTOR SHALL REFERENCE PLANTING PLAN(S) PRIOR TO INSTALLATION OF VALVES. LOCATE VALVES IN PLANTING BEDS WHEREVER POSSIBLE. ADJUST VALVE LOCATIONS TO ELIMINATE CONFLICT WITH PROPOSED PLANTINGS AND PLANTING PATTERNS.
4. VALVE LOCATIONS SHALL BE STAKED BY THE CONTRACTOR AND APPROVED BY THE OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION OF NEW IRRIGATION SYSTEM.
5. THE CONTRACTOR SHALL VERIFY THE DIMENSIONS AND LAYOUT OF ALL NEW PLANTING AND LAWN AREAS ON SITE BEFORE STARTING WORK AND IMMEDIATELY NOTIFY OWNER OF ANY DEVIATIONS FROM PLAN.
6. NEW TREE LOCATIONS SHALL BE STAKED BY THE CONTRACTOR AND APPROVED BY THE OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION OF NEW IRRIGATION SYSTEM.
7. THE CONTRACTOR SHALL INSTALL THE IRRIGATION CONTROLLER(S) AT THE LOCATION(S) SHOWN ON THE DRAWINGS, PER THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL VERIFY THE LOCATION WITH THE OWNER PRIOR TO INSTALLATION.
8. MAIN AND LATERAL LINES MAY BE SHOWN DIAGRAMMATICALLY FOR CLARITY. MAIN AND LATERAL LINES SHOWN IN PAVED AREAS SHALL BE PLACED IN ADJACENT PLANTING BEDS UNLESS SPECIFICALLY SHOWN AS PASSING UNDER PAVING IN SLEEVING (SEE LEGEND FOR SLEEVE SYMBOL). THE CONTRACTOR MUST OBTAIN APPROVAL OF OWNER'S REPRESENTATIVE BEFORE MAKING CHANGES IN ROUTING OF PIPE OR LOCATION OF VALVES.

N

SCALE: 1" = 10'-0"

0' 5' 10' 20'

GREENWORKS

LAND USE APPLICATION

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

IRRIGATION PLAN

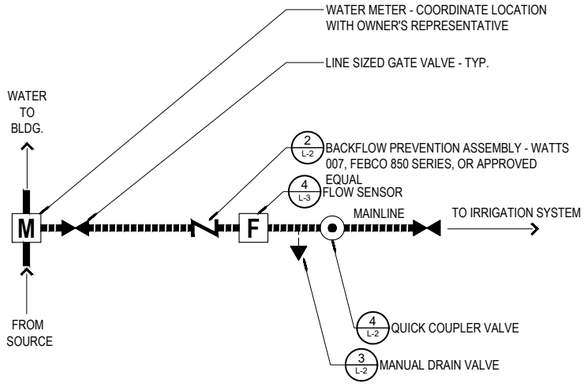
PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JUNE 2019

SHEET

L-1

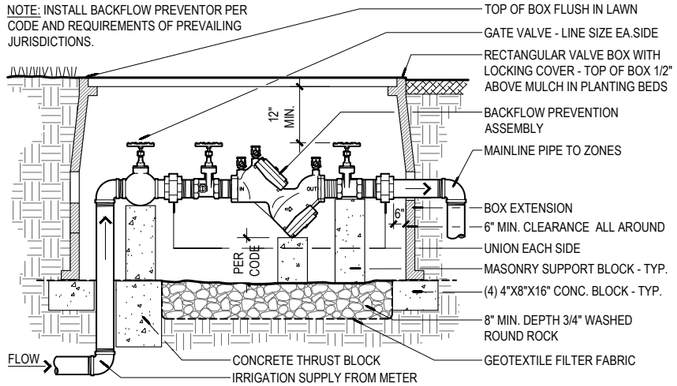
X of X

G:\Projects\116146.1_Memorial_Park_PS\02_Production\01_CAD\01_Plot_Sheets\16146_IRRG.dwg L-1 6/18/2019 5:40 PM ANDREWH 23.0s (LMS Tech)



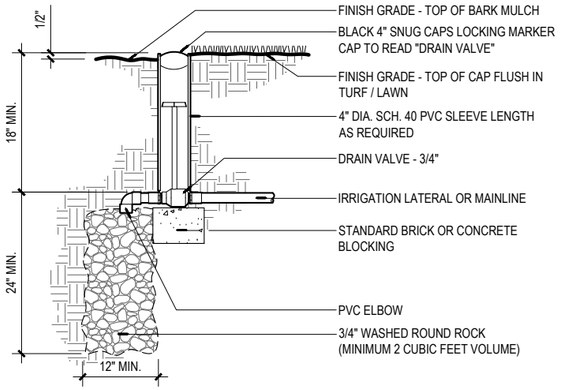
1 POINT OF CONNECTION DIAGRAM

PLAN — NOT TO SCALE



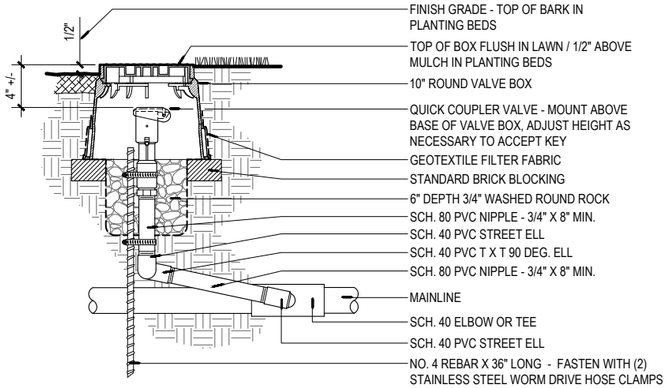
2 BACKFLOW PREVENTION ASSEMBLY

SECTION — NOT TO SCALE



3 MANUAL DRAIN VALVE

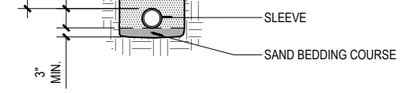
SECTION — NOT TO SCALE



4 QUICK COUPLER VALVE

SECTION — NOT TO SCALE

NOTES:
1. EXTEND IRRIGATION SLEEVES 24" BEYOND EACH SIDE OF PAVING.
2. SLEEVE PIPE DIAMETER TO BE A MINIMUM OF TWO TIMES PIPE DIAMETER(S) IT CONTAINS.
3. 24" MINIMUM DEPTH UNDER PEDESTRIAN WALKS; 36" MINIMUM DEPTH UNDER VEHICULAR PAVING.



5 IRRIGATION SLEEVE UNDER PAVEMENT

SECTION — NOT TO SCALE

6 WALL MOUNT IRRIGATION CONTROLLER

SECTION — NOT TO SCALE

GREENWORKS

LAND USE APPLICATION

NO.	DATE	BY	REVISION

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

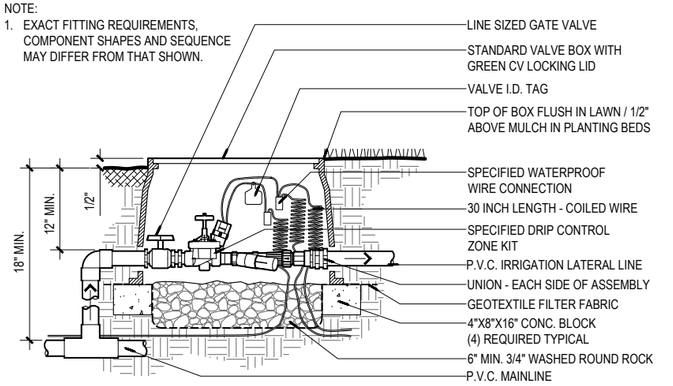
IRRIGATION SCHEDULES, DETAILS AND NOTES

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JUNE 2019

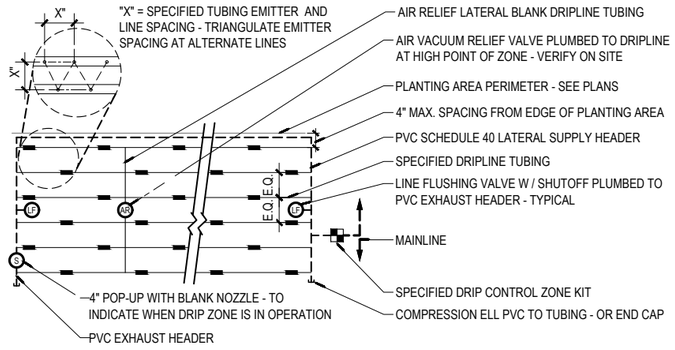
SHEET
L-2
X of X

G:\Projects\116146.1_Memorial_Park_PS\02_Production\01_CAD\01_Plot_Sheets\16146_IRRG.dwg L-2 6/18/2019 5:40 PM ANDREWH 23.0s (LMS Tech)

NOTE:
1. EXACT FITTING REQUIREMENTS, COMPONENT SHAPES AND SEQUENCE MAY DIFFER FROM THAT SHOWN.

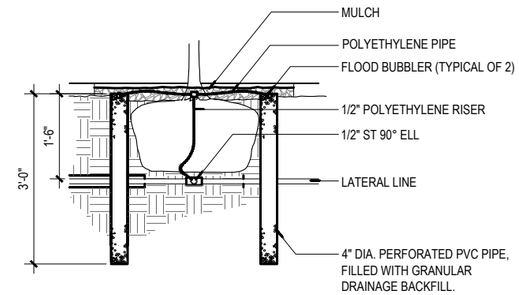


1 DRIP CONTROL ZONE KIT
SECTION — NOT TO SCALE



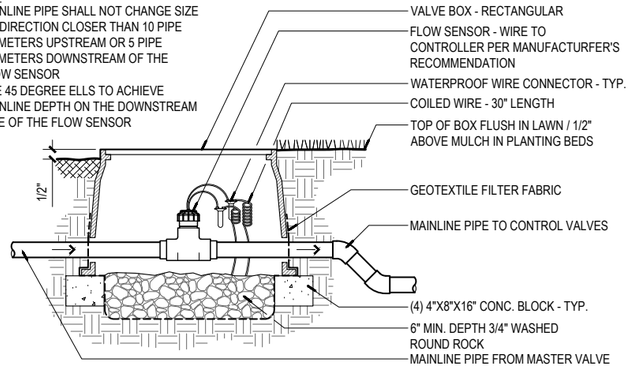
NOTE:
1. DRIPLINE LENGTHS SHALL NOT EXCEED MANUFACTURER'S RECOMMENDED MAXIMUM
2. MINIMUM OF (1) LINE FLUSHING VALVE PER 15 GPM - REFER TO MANUFACTURER'S RECOMMENDATION

2 LANDSCAPE DRIPLINE INSTALLATION
PLAN — NOT TO SCALE

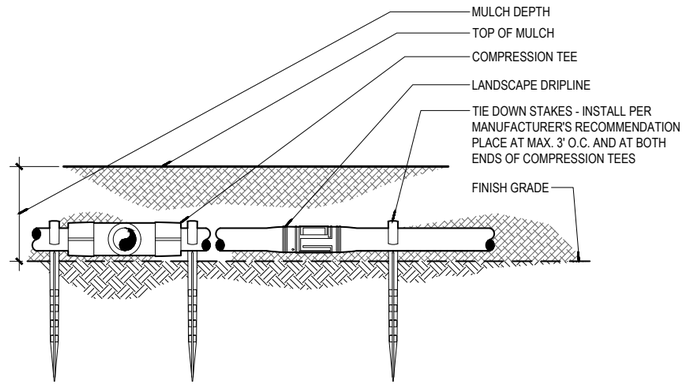


3 TREE BUBBLER
Section — NOT TO SCALE

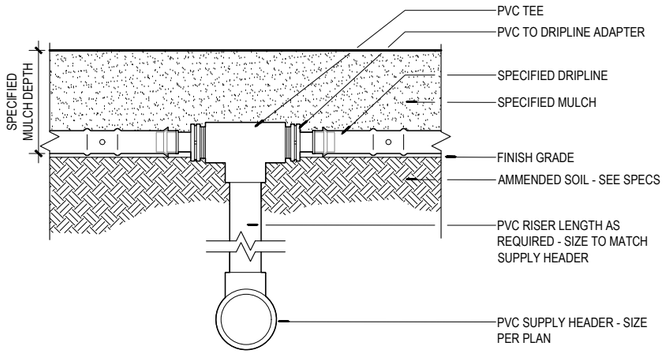
NOTES:
1. MAINLINE PIPE SHALL NOT CHANGE SIZE OR DIRECTION CLOSER THAN 10 PIPE DIAMETERS UPSTREAM OR 5 PIPE DIAMETERS DOWNSTREAM OF THE FLOW SENSOR
2. USE 45 DEGREE ELLS TO ACHIEVE MAINLINE DEPTH ON THE DOWNSTREAM SIDE OF THE FLOW SENSOR



4 FLOW SENSOR
SECTION — NOT TO SCALE



5 LANDSCAPE DRIPLINE ON GRADE
SECTION — NOT TO SCALE



6 ON-GRADE DRIPLINE CONNECTION - PVC RISER AND TEE
SECTION — NOT TO SCALE

GREENWORKS

LAND USE APPLICATION

NO.	DATE	BY	REVISION

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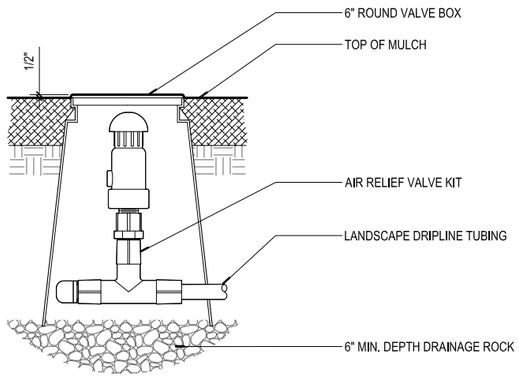
WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

IRRIGATION DETAILS AND NOTES

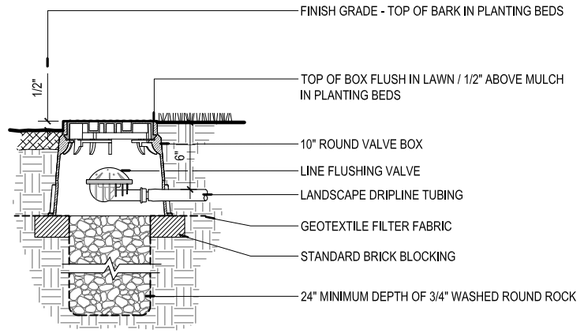
PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JUNE 2019

SHEET
L-3
X of X



1 AIR VACUUM RELIEF VALVE

SECTION — NOT TO SCALE



2 LANDSCAPE DRIPLINE - FLUSH VALVE

SECTION — NOT TO SCALE

GREENWORKS

LAND USE APPLICATION

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NOTICE

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CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

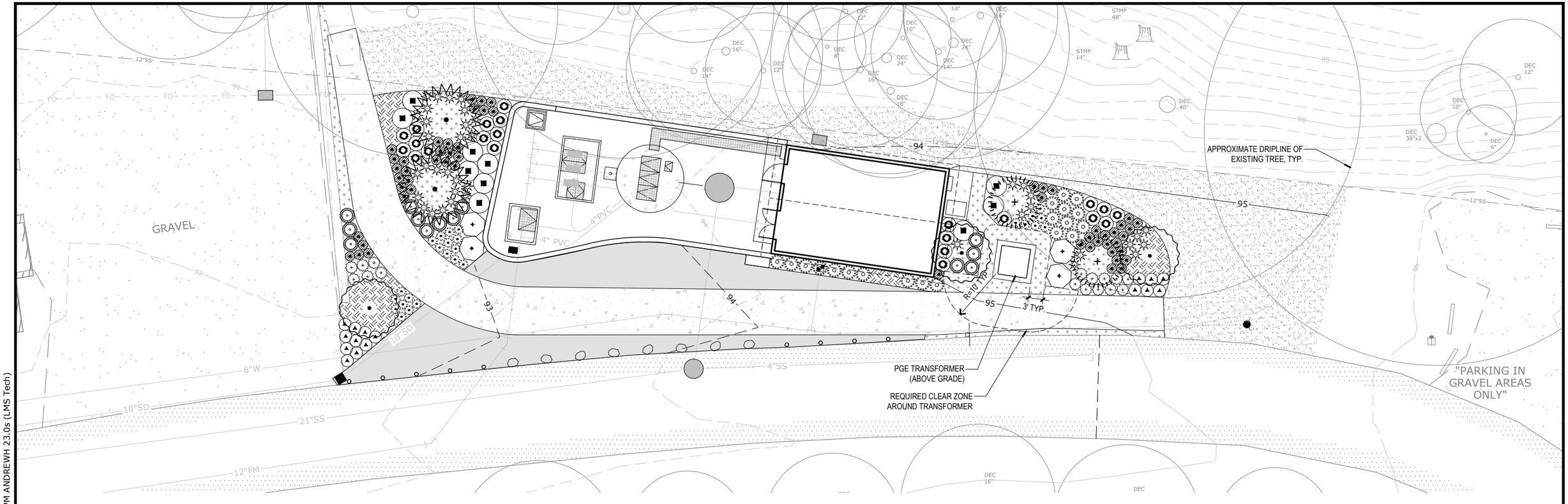
IRRIGATION DETAILS AND NOTES

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JUNE 2019

SHEET

L-4

X of X



SCALE: 1" = 10'-0"

N 0' 5' 10' 20'

PLANTING LEGEND

TREES (2 L-6, 3 L-6)

EXISTING TREES TO REMAIN

BOTANICAL NAME	COMMON NAME	SIZE & TYPE	SPACING	QTY.
AMELENCHIER LAEVIS 'SNOWCLOUD'	SNOWCLOUD SERVICEBERRY	2" CAL., B&B	AS SHOWN	3
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	4'-6' HT., B&B	AS SHOWN	2
THUJA PLICATA 'HOGAN'	HOGAN'S CEDAR	4'-6' HT., B&B	AS SHOWN	2

SHRUBS AND GROUNDCOVERS (1 L-6, 4 L-6, 5 L-6, 6 L-6)

ARCTOSTAPHYLLOS COLUMBIANA 'OREGON HYBRID'	OREGON HYBRID MANZANITA	5 GAL. CONT.	5' O.C.	4
CALAMAGROSTIS X ACUTIFOLIA 'KARL FOERSTER'	FOERSTER'S FEATHER REED GRASS	1 GAL. CONT.	36" O.C.	20
CORNUS STOLONIFERA 'KELSEYI'	KELSEY DOGWOOD	1 GAL. CONT.	30" O.C.	16
GAULTHERIA SHALLON	SALAL	1 GAL. CONT.	36" O.C.	22
JUNCUS PATENS	SPREADING RUSH	1 GAL. CONT.	30" O.C.	16
MAHONIA REPENS	CREEPING MAHONIA	1 GAL. CONT.	24" O.C.	55
PENNISETUM ALOPECUROIDES 'HAMELN'	DWARF FOUNTAIN GRASS	1 GAL. CONT.	24" O.C.	26
POLYSTICHUM MUNITUM	SWORD FERN	1 GAL. CONT.	30" O.C.	39
SPIRAEA BETULIFOLIA	WHITE SPIRAEA	1 GAL. CONT.	36" O.C.	13
VACCINIUM OVATUM	EVERGREEEN HUCKLEBERRY	1 GAL. CONT.	4' O.C.	10
ARCTOSTAPHYLLOS UVA-URSI 'MASSACHUSETTS'	KINNIKINNICK	1 GAL. CONT.	30" O.C.	36

ROUGH LAWN (NON-IRRIGATED)

BARK MULCH ONLY

PLANTING NOTES

1. CONTRACTOR SHALL PROVIDE PLANTING SOIL, SOIL AMENDMENTS, AND BARK MULCH TO THE COMPOSITION AND DEPTHS IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS OF THE CONTRACT DOCUMENTS.
2. ALL PLANTS SHALL BE INSTALLED IN ACCORDANCE WITH THE DRAWINGS AND THE SPECIFICATIONS PROVIDED AS PART OF THE CONTRACT DOCUMENTS.
3. QUANTITIES ARE LISTED FOR THE CONTRACTOR'S CONVENIENCE ONLY. ALL COUNTS MUST BE VERIFIED BY THE CONTRACTOR. IN THE CASE OF A DISCREPANCY BETWEEN THE LEGEND AND THE PLAN, PLANTS INDICATED ON THE PLAN SHALL SUPERCEDE QUANTITIES LISTED IN THE LEGEND.
4. UTILITY LOCATIONS SHOWN ON PLANS MAY DIFFER FROM FIELD CONDITIONS. CONTRACTOR TO FIELD VERIFY ALL UTILITIES BEFORE INSTALLATION. CONFLICTS BETWEEN ANY EXISTING AND PROPOSED UTILITIES ARE TO BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE IMMEDIATELY.
5. SEED ALL AREAS OUTSIDE OF PLANTING BEDS DISTURBED BY CONSTRUCTION.

GREENWORKS

LAND USE APPLICATION

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

PLANTING PLAN

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JUNE 2019

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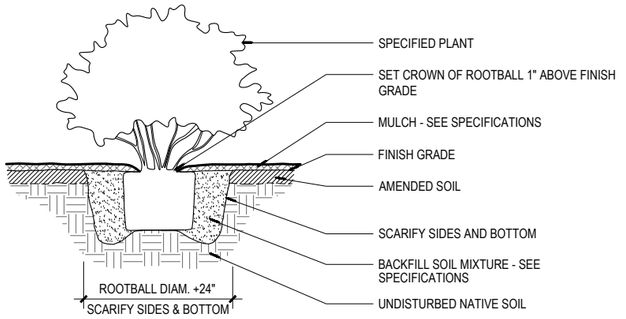

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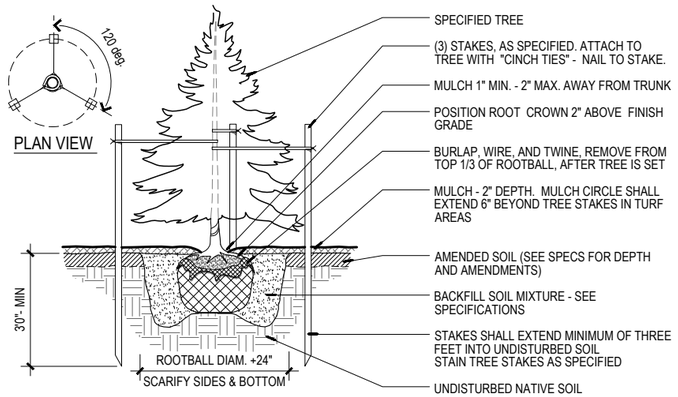

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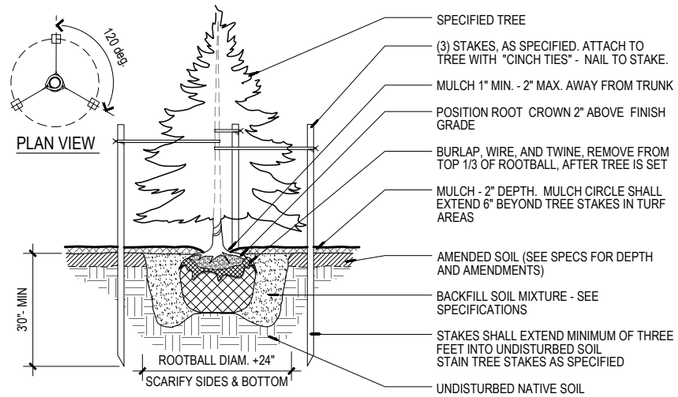

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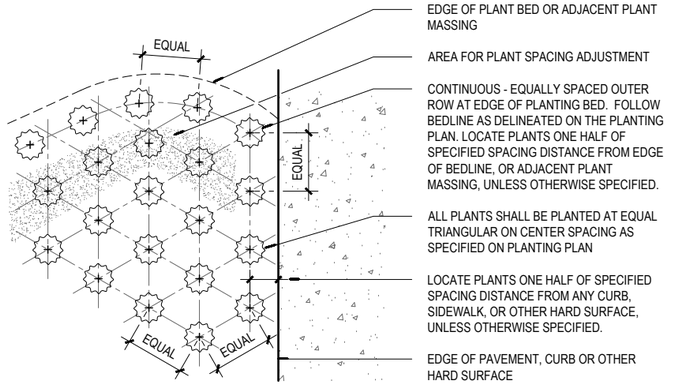

4 PLANT SPACING DIAGRAM

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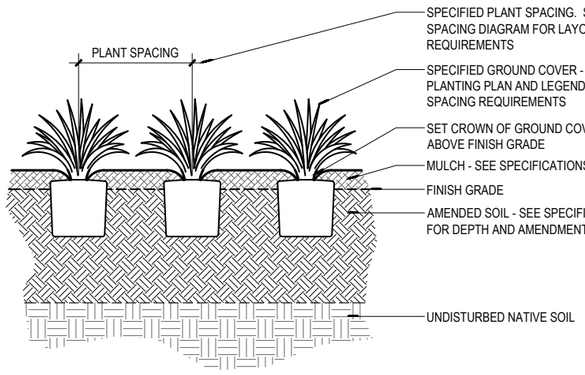

1 GROUND COVER PLANTING

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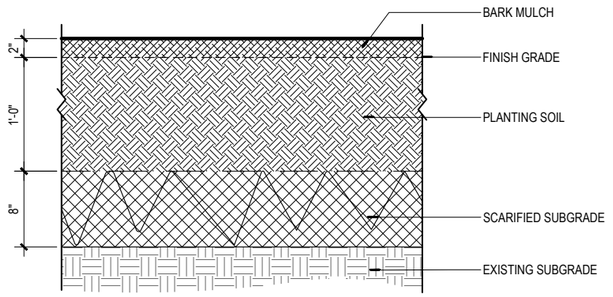
NOTES:

1. BARK MULCH LAYER IS AN ADDITION TO THE PLANTING SOIL AND IS NOT THE FINISH GRADE.
2. CONFIRM THE SUBGRADE IS AT PROPER ELEVATIONS AND IS PREPARED PRIOR TO SOIL INSTALLATION. SUBGRADE ELEVATIONS ARE TO SLOPE TO SUBSURFACE DRAINAGE LINES AND AWAY FROM STRUCTURES IF PRESENT.



6 SOIL PREPARATION - PLANTING BEDS

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WILSONVILLE OREGON

CITY OF WILSONVILLE, OREGON
MEMORIAL PARK PUMP STATION

PLANTING DETAILS

PROJECT NO.: 17-2136.204 | SCALE: AS SHOWN | DATE: JUNE 2019

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SECTION 4

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REPORTS AND OTHER DOCUMENTS

SECTION 4

Reports and Other Documents Checklist

General			Reference
	Outdoor Lighting (as applicable)		
	All conformance methods		Code compliance
	For each luminaire type all of the following:		
	Drawings, cut sheets or other documents containing:		
	Luminaire description		Plans E-5
	Mounting method		Outdoor lighting
	Mounting height		Plans E-5
	Lamp type and manufacturer		Outdoor lighting
	Lamp watts		Plans E-5
	Ballast		Plans E-5
	Optical system/distribution		Plans E-5
	Accessories such as shields		Plans E-5
Other General			Reference
	Traffic Report or Waiver of Traffic Report	4.140(.09)	N/A
	Soils and Drainage Report		Geotechnical report
	Draft copies of legal documents including easements, dedications, CC&R's.	4.140(.09)	N/A
Site Design Review			Reference
	Color board displaying specifications as to type, color, and texture of exterior surfaces of proposed structures.		Color board
	Outdoor Lighting (as applicable)	4.199.50 (.01)	See above
	All conformance methods	4.199.50 (.01)	
	For each luminaire type all of the following:	4.199.50 (.01)	
	Drawings, cut sheets or other documents containing:	4.199.50 (.01)	
	Luminaire description	4.199.50 (.01)	
	Mounting method	4.199.50 (.01)	
	Mounting height	4.199.50 (.01)	
	Lamp type and manufacturer	4.199.50 (.01)	
	Lamp watts	4.199.50 (.01)	
	Ballast	4.199.50 (.01)	
	Optical system/distribution	4.199.50 (.01)	
	Accessories such as shields	4.199.50 (.01)	
	Calculations demonstrating compliance with Oregon Energy Efficiency Specialty Code, Exterior Lighting	4.199.50 (.01)	Outdoor lighting
Tree Plan			
	Arborist Report		Arborist report

SECTION 4

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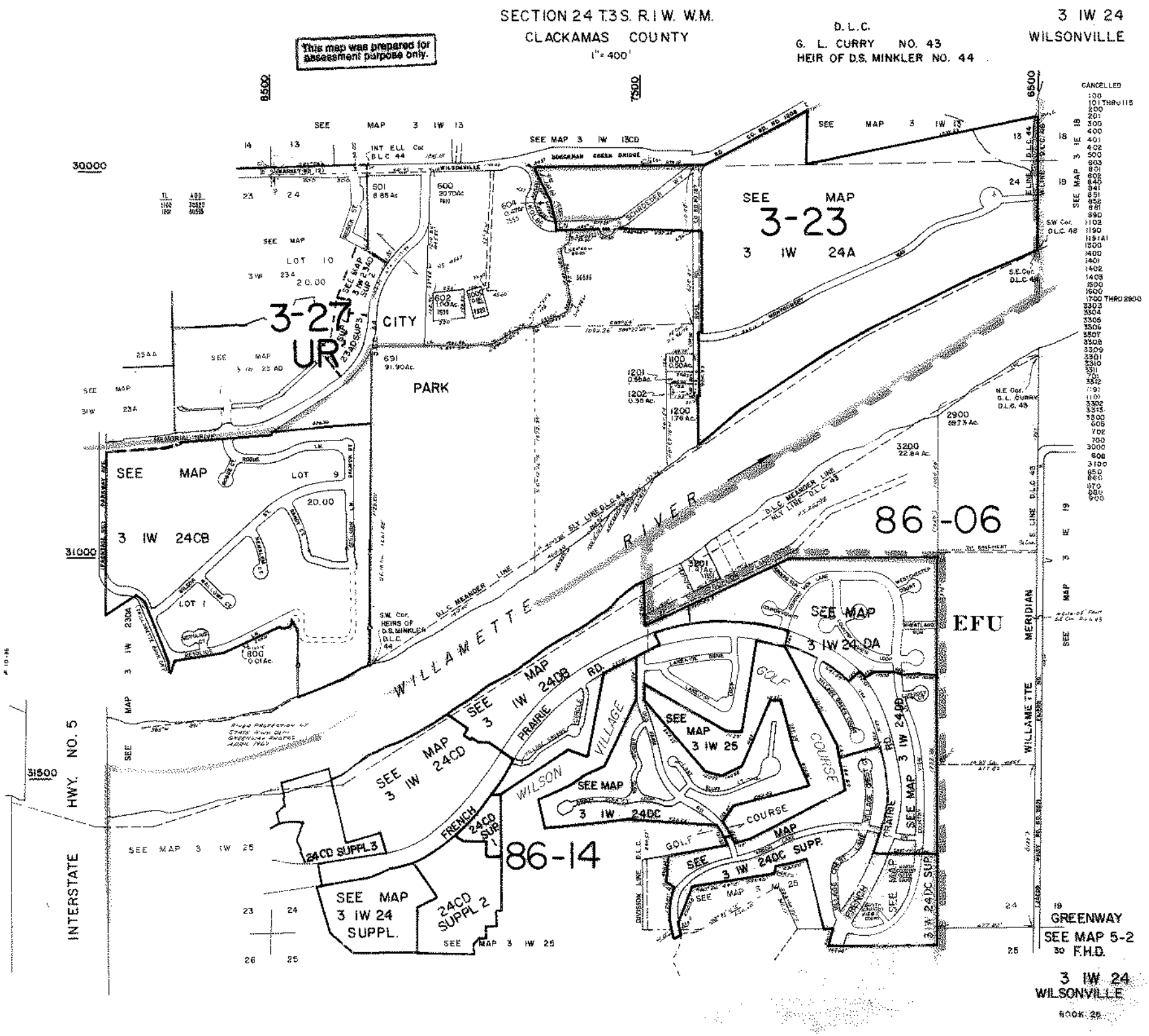
Tax Map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1"= 400'
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D.L.C.
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HEIR OF D.S. MINKLER NO. 44
3 1W 24
WILSONVILLE
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SEE MAP 3 1W 13CD
SEE MAP 3 1W 24
3-23
3 1W 24A
3-27
UR
CITY
PARK
SEE MAP 3 1W 24B
LOT 9
LOT 10
LOT 1
86-06
WILLAMETTE RIVER
SEE MAP 3 1W 24DA
EFU
SEE MAP 3 1W 24DB
SEE MAP 3 1W 24CD
SEE MAP 3 1W 25
SEE MAP 3 1W 24DC
24CD SUPPL 3
24CD SUPPL 2
SEE MAP 3 1W 24 SUPPL.
86-14
INTERSTATE HWY. NO. 5
WILLAMETTE MERIDIAN
GREENWAY
SEE MAP 5-2
30 F.H.D.
3 1W 24
WILSONVILLE
BOOK 25

SECTION 4

Draft Geotechnical Engineering Report
Memorial Park Pump Station
Wilsonville, Oregon

June 4, 2018

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Draft Geotechnical Engineering Report
Memorial Park Pump Station
Wilsonville, Oregon

June 4, 2018

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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Submitted To:
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Murraysmith, Inc.
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Portland, Oregon 97204

By:
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24-1-04234-001

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A Field Explorations
B Laboratory Test Results
C Slope Stability Analysis Results
D Important Information About Your Geotechnical/Environmental Report

DRAFT GEOTECHNICAL ENGINEERING REPORT
MEMORIAL PARK PUMP STATION
WILSONVILLE, OREGON

1.0 INTRODUCTION

1.1 General

This draft geotechnical engineering report presents the results of our services to support Murraysmith, Inc., with the design and construction of the Memorial Park Pump Station project at 8100 SW Wilsonville Road in Wilsonville, Oregon. The Vicinity Map, Figure 1, shows the location of the proposed project site. The City of Wilsonville (City) is the project owner, and Murraysmith is leading the project design. Shannon & Wilson, Inc. (Shannon & Wilson), is providing geotechnical engineering services for the project under a subcontract to Murraysmith.

Included in this report are the results of our field explorations and data collection, laboratory testing, and geotechnical engineering analyses and recommendations for the proposed pump station and pipelines. A separate Geotechnical Data Report (GDR) has also been prepared for this project by Shannon & Wilson that provides more descriptions and details of the data collection portion of our overall services for this project.

1.2 Project Understanding

The City intends to construct a new sanitary sewer pump station in Memorial Park at 8100 SW Wilsonville Road in Wilsonville, Oregon. The new pump station will connect to an existing pump station via a proposed pipeline. The proposed pump station has an inside diameter of approximately 12 feet and is planned to be constructed with precast concrete rings. The bottom of the wet well is embedded about 28 feet below the existing ground surface. With the recommended overexcavation as discussed in Section 7.5, the excavation depth could reach a depth of 34 feet below existing ground.

The proposed sewer pipeline will be an approximately 700 feet long, 21-inch -diameter PVC pipe and with invert depths approximately 13 to 18 feet below the existing ground surface. With a drainage layer and bedding at the base of the trench, the trench excavation would likely range from about 15 to 20 feet below existing grade; since this is a gravity pipeline, the maximum depth will be at the connection to the new pump station.

In addition, a new pipeline will be installed to connect the proposed pump station to an existing sewer line located approximately 22 feet north of the proposed pump station. We also understand that a new approximately 41-foot by 26-foot, single-story control building is planned for construction near the proposed pump station.

1.3 Scope of Services

Our services were performed in accordance with the scope described in our task order with Murraysmith, dated February 21, 2018. These services included the following tasks:

- Review available existing information and visit the site to observe existing site conditions, geologic hazards, site access for field explorations, and mark proposed exploration locations;
- Explore the subsurface conditions with three geotechnical borings, two piezometer installations, and three hand-augured borings;
- Conduct laboratory testing on select soil samples to characterize the subsurface soils and develop engineering soil parameters for geotechnical analyses;
- Prepare a Geotechnical Data Report (submitted previously);
- Perform geotechnical analyses corresponding to the proposed pump station, pipelines and single-story control building consisting of bearing capacity, lateral earth pressures, and slope stability;
- Provide appropriate construction considerations corresponding to earthwork, groundwater control, temporary excavations and erosion control; and
- Prepare this Draft Geotechnical Engineering Report.

2.0 GEOLOGIC AND SEISMIC SETTING

2.1 Regional Geology

The project site is located in the Willamette Lowland, at the northern end of the Central Willamette Valley (Gannett and Caldwell, 1998). The Willamette Lowland is a structural depression created by complex faulting and folding of Miocene (approximately 17 to 6 million years old) Columbia River Basalt Group (CRBG) basalt flows and older underlying basement rock.

In the Willamette Valley, the CRBG is generally overlain by Upper Miocene (approximately 10 to 5 million years old) deposits consisting of fine-grained micaceous fluvial and lacustrine sediments derived from the Columbia and Willamette Rivers. These sediments are collectively termed the Sandy River Mudstone (Orr and Orr, 2000).

The Sandy River Mudstone is described by Gannett and Caldwell as a micaceous arkosic siltstone, mudstone, and claystone. Overlying the Sandy River Mudstone is the Pliocene (approximately 5 to 1.8 million years old) Troutdale Formation, which is described as a quartzite-bearing basaltic conglomerate, vitric sandstone, and micaceous sandstone (Gannett and Caldwell, 1998). Composition and thicknesses of the two units vary with location.

Mapping at the project location by Schlicker and others (1967) includes the Sandy River Mudstone with the Troutdale Formation and describes the overall unit as poorly indurated silt, clay, and silty sand with occasional pebble conglomerate beds. Locally, the Troutdale Formation is underlying younger Pliocene/Pleistocene age sediments and Pleistocene age Catastrophic Flood Deposits, and it is exposed only in the bottom of steep ravines.

During the late stages of the last great ice age, between about 18,000 and 15,000 years ago, a lobe of the continental ice sheet repeatedly blocked and dammed the Clark Fork River in western Montana, which then formed an immense glacial lake called Lake Missoula. The lake grew until its depth was sufficient to buoyantly lift and rupture the ice dam, which allowed the entire massive lake to empty catastrophically.

Once the lake had emptied, the ice sheet again gradually dammed the Clark Fork Valley and the lake refilled, leading to 40 or more repetitive outburst floods at intervals of decades (Allen and others, 2009). These floods are collectively known as the Missoula Floods. During each short-lived episode, floodwaters washed across the Idaho panhandle, through the eastern Washington scablands, and through the Columbia River Gorge.

When the floodwater emerged from the western end of the gorge, it spread out over the Portland Basin and up the Willamette Valley as far south as Junction City, depositing a tremendous load of sediment (O'Connor and others, 2001). Boulders, cobbles, and gravel were deposited nearest the mouth of the gorge and along the main channel of the Columbia River. Great cobble-gravel bars reached across the basin, grading to thick blankets of micaceous sand and silt (Allen and others, 2009).

Rock Creek Gap, north of the Wilsonville area, constricted flows from the Missoula Floods, creating a high-energy water surge from the Tualatin Basin in the north emptying into the Central Willamette Valley to the south. The high-velocity water flowing through the gap entrained coarse gravels, cobbles, and boulders that were dropped out of suspension when the surge lost energy opening up into the Central Willamette Valley in the vicinity of Wilsonville. As a result, much of the Wilsonville area is underlain by coarse-grained Missoula Flood

Deposits. However, the project site is located just west of the area impacted by Rock Creek Gap, where the Missoula Flood Deposits consist predominantly of silt and fine sand.

In more recent times, rivers and streams, such as the Willamette River and Boeckman Creek, have deposited alluvial sediments in and along their channels and floodplains. Artificial fill has also likely been placed near the site during the development and grading of the current park topography.

2.2 Seismic Setting

Earthquakes in the Pacific Northwest occur largely as a result of the region's proximity to an active convergent plate boundary, the Cascadia Subduction Zone (CSZ). In the CSZ dense oceanic crust of the Explorer, Juan de Fuca, and Gorda Oceanic Plates are subducting beneath the overriding, less dense, westward-moving, continental crust of the North American Plate. Oblique convergence of these plates not only results in east-west compressive strain, but also in dextral shear, clockwise rotation, and north-south compression of accreted crustal blocks that form the leading edge of the North American Plate (Wells and others, 1998).

The CSZ extends about 750 miles from northern California to southern British Columbia, and lies approximately 130 miles west of the project site. Within the present understanding of the regional tectonic framework and historical seismicity, three broad seismogenic sources have been identified. These include the following:

- A mega-thrust source at the interface between the North American and Juan de Fuca plates in the CSZ;
- A deep intraslab source in the subducted Juan de Fuca Plate, within the CSZ; and
- A shallow crustal source within the North American Plate.

The following sections briefly describe the location, characteristics, and seismicity of each of the sources.

2.2.1 Cascadia Subduction Zone: Mega-Thrust Interface Source

At the subduction plate interface, the subducting oceanic slab and the overriding North American continental plates are locked together by friction. The strain stored in these locked plates is released in great megathrust M8 to M9 earthquakes that rupture when the frictional strength of the fault is exceeded and the fault slips (Atwater and Hemphill-Haley, 1997; Goldfinger and others, 2003 and 2012; Wang and others, 2003). Along the coast, this fault slip can trigger sudden land subsidence, strong ground shaking, tsunami inundation, and submarine landsliding.

Recent paleoseismic coastal studies have uncovered over a 5,000-year paleoseismic record of rapid land level changes and tsunamis associated with megathrust earthquakes along the 1,000-km length of the CSZ from northern California to Vancouver Island (e.g., Atwater, 1987; Grant, 1989; Darienzo and Peterson, 1990 and 1995; Obermeier, 1995; Meyers and others, 1996; Nelson and others, 1996; Peterson and Darienzo, 1996; Atwater and Hemphill-Haley, 1997; Williams and others, 2005).

Offshore, evidence from paleoseismic studies provides temporal correlation of shaking-induced submarine landsliding deposits (turbidites) found in deep-sea channels along the entire length of the CSZ (Goldfinger and others, 2003 and 2012). Based on the 10,000-year turbidite record, Goldfinger and others (2012) determined that the CSZ has ruptured not only along its entire length at about 500-year intervals but also along fault segments for a total of 41 great earthquakes in the last 10,000 years. The CSZ interface source is approximately 130 miles west of the site, with an average slip rate of approximately 40 millimeters (1.5 inches) per year (Personius and Nelson, 2006), with the most recent event occurring about 300 years ago in the year 1700 (Satake and others, 1996).

2.2.2 Cascadia Subduction Zone: Intraslab Source

CSZ intraslab earthquakes originate from within the subducting oceanic plates because of down-dip tensional forces and bending caused by mineralogical and density changes in the plates at depth. These earthquakes typically occur 28 to 37 miles beneath the surface. Because intraslab events involve high-angle normal faulting, the area of the rupture surface and magnitude is strongly dependent on the thickness of the subducting slab. Young subduction zones, such as the CSZ, generally have relatively thin subducting slabs. Thermal modeling of the CSZ (Hyndman and Wang, 1993) and the observed geometry of the Wadati-Benioff Zone (Jarrard, 1986) confirm the likelihood that the subducting slab is relatively thin.

Worldwide observations indicate that the largest intraslab earthquakes are on the order of M8, with the 12 largest of these occurring in older subducting slabs. The largest recorded intraslab earthquake beneath the Puget Lowland, the 1949 Olympia earthquake, was a surface wave magnitude M7.1 event. Ludwin and others (1991) estimate that the maximum magnitude from this source zone would be about 7.5.

At the project site, ground shaking produced by intraslab earthquakes would generally be less intense and less prolonged than ground motions generated by large subduction zone

interface earthquake events. Historic seismicity from this source zone includes the 1949 magnitude 7.1 Olympia earthquake; the 1965 magnitude 6.5 earthquake between Tacoma and Seattle; and the 2001 magnitude 6.8 Nisqually earthquake. While intraslab events have occurred frequently in the Puget Sound area, they are historically rare in Oregon.

2.2.3 Shallow Crustal Source

Shallow crustal earthquakes within the North American Plate have historically occurred in a diffuse pattern within western Oregon, typically within the upper 4 to 19 miles of the continental crust. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake at magnitude 6.8. Other examples include the 1993 magnitude 5.6 Scotts Mill earthquake, and 1993 magnitude 6.0 Klamath Falls earthquake.

Shallow crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database.

The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.6 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation, or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

According to the USGS Quaternary Fault and Fold database, there are 3 Class A features within approximately 10 miles of the Memorial Park Pump Station project alignment. Their names, general locations relative to the site, and the time since their most recent deformation are summarized in Table 1.

TABLE 1
USGS CLASS A QUATERNARY FAULTS WITHIN AN APPROXIMATE 10-MILE RADIUS OF THE MEMORIAL PARK PUMP STATION

Fault Name	USGS Class	Approximate Length	Approximate Distance and Direction from Pump Station	Slip Rate Category[b]	Time Since Last Deformation [c]
Canby-Molalla Fault	A	31.1 miles	3.8 miles NW	< 0.2 mm/yr	< 15 ka
Newberg Fault	A	3.1 miles	9.6 miles SW	< 0.2 mm/yr	< 1.6 Ma
Oatfield Fault	A	18.0 miles	9.9 miles SE	< 0.2 12mm/yr	< 1.6 Ma

Notes:
a. Approximate distance between project alignment and nearest extent of fault mapped at the ground surface.
b. mm = millimeters; yr = year.
c. Ma = "Mega-annum" or million years ago; ka = "Kilo-annum" or one thousand years ago.

3.0 SUBSURFACE EXPLORATIONS

The field exploration program for the Memorial Park pump station included three geotechnical borings, designated B-1 through B-3. The borings were drilled on March 22 and March 23, 2018, and all were advanced to a depth of 51.5 feet below the existing ground surface (bgs). Borings B-1 and B-3 were finished with 2-inch-diameter observation wells installed to depths of 33 feet and 25 feet, respectively, to allow for ongoing groundwater level measurements. Measurements are presented in Section 5.2, Groundwater.

Three additional hand auger explorations designated HA-1 through HA-3 were completed by Shannon & Wilson on May 11, 2018. Hand augers were advanced to depths ranging from 4.5 to 5 feet bgs. The exploration locations of these are shown on Figure 2, Site and Exploration Plan.

Details of the field explorations, including techniques used to advance and sample the borings and install the observation wells, are presented in Appendix A, Field Explorations. Also, the approach used to estimate the ground surface elevations that are shown on the boring logs is described in Appendix A; boring locations were not surveyed at the time of this report.

4.0 LABORATORY TESTING

The samples we obtained during field explorations were transported to the Shannon & Wilson laboratory for further examination. Representative samples were selected for a suite of laboratory tests. The testing program included moisture content analyses, Atterberg limits tests, and particle-size analyses. Testing was performed by Benchmark Geolabs of McMinnville, Oregon, and our own internal Shannon & Wilson laboratory in accordance with applicable ASTM International standards. Results of the laboratory tests and brief descriptions of the test procedures are presented in Appendix B, Laboratory Test Results.

5.0 SUBSURFACE CONDITIONS

5.1 Geotechnical Units

Shannon & Wilson grouped the materials encountered in our field explorations into three geotechnical units, as described below. The interpretation of the subsurface conditions is based on the explorations and regional geologic information from published sources. The geotechnical units are as follows:

- **Alluvium:** Very soft to medium stiff, Clay (CL and CH) and Silt (MH) to Lean Clay with Sand (CL), and Sandy Silt (ML); very loose to loose, Silty Sand (SM).
- **Catastrophic Flood Deposits:** Very soft to stiff, Silt (ML) to Silt with Sand (ML) and Sandy Silt (ML); medium dense, Silty Sand (SM) and Silty Gravel with Sand (GM).
- **Pliocene/Pleistocene Sediments:** Medium stiff to very stiff, Clay (CL and CH) to Lean Clay with Sand (CL).

These geotechnical units were grouped based on their engineering properties, geologic origins, and their distribution in the subsurface. Contacts between the units may be more gradational than shown in the boring logs in Appendix A. The Standard Penetration Test (SPT) N-values shown on the boring logs are as recorded in the field (uncorrected).

5.2 Groundwater

Groundwater levels were estimated in borings B-1 and B-3 during drilling on March 22, 2018, at depths of approximately 12.8 feet and 5.2 feet, respectively. Groundwater measurements were taken in borings B-1 and B-3 just prior to well development on March 29, 2018.

In borings B-1 and B-3, the depth to water was approximately 12.6 feet and 5.2 feet below the top of casing (btoc), respectively. On April 26, 2018, the depth to water was approximately 13.4 feet btoc in boring B-1 and 5.5 feet btoc in boring B-3. The top of casing is located approximately 4 inches below ground surface in borings B-1 and B-3.

All three borings were drilled during periods of extended rain, and the groundwater levels measured may not be representative of the typical water levels adjacent to the Boeckman Creek. The presence of clayey soils within approximately 8 feet of ground surface could also cause higher-than-average or perched groundwater levels.

Groundwater levels should be expected to vary with changes in topography, precipitation, and the level of Boeckman Creek. Generally, groundwater highs occur at the end of the wet season in late spring or early summer, and groundwater lows occur towards the end of the dry season in the early to mid-fall.

6.0 SEISMIC GROUND MOTIONS AND GEOLOGIC HAZARD EVALUATION

We understand that the City has not yet developed seismic design criteria for its sewer conveyance program. In lieu of specific guidance, the seismic hazard evaluation for this project was conducted in accordance with the American Society of Civil Engineer's (ASCE) Minimum Design Loads for Buildings and Other Structures, 2016 Edition (ASCE 7-16), which is based on earthquake ground motions with a 2,475-year return period. We also evaluated liquefaction triggering and liquefaction induced settlement for 475-year return period ground motions.

6.1 Seismic Ground Motions

ASCE 7-16 requires that geotechnical hazard analyses (liquefaction, specifically) be performed for Maximum Considered Earthquake Geometric Mean (MCE_G) ground motions, and adjusted for site class effects. Specifically, the peak ground acceleration used in the liquefaction-related hazard analyses, PGA_M is defined as:

$$PGA_M = F_{PGA} \times PGA \quad \text{(ASCE 7-16 equation 11.8-1)}$$

where:

PGA_M = MCE_G peak ground acceleration adjusted for site class effects

PGA = MCE_G peak ground acceleration of site class B/C boundary conditions

F_{PGA} = Site coefficient from ASCE 7-16 Table 11.8-1.

For this project, we calculated a PGA_M of 0.54g using a PGA of 0.37g and an F_{PGA} of 1.46. PGA is shown in ASCE 7-16 Figure 22-9 and is derived from the most recent U.S. Geological Survey (USGS) National Seismic Hazard Mapping Project ground motion hazard analyses results by Peterson and others (2014). F_{PGA} is a function of site class and PGA as indicated in ASCE 7-16 Table 11.8-1. The SPT "N" value resistances measured in the borings correspond to Site Class E.

Because the maximum earthquake magnitudes for sources vary significantly, we used a probabilistically-determined mean maximum magnitude of 7.7 for ground motions with a 2,475-year return period for analysis requiring magnitude.

6.2 Liquefaction

Liquefaction is a phenomenon in which excess pore water pressure in loose to medium dense, saturated, nonplastic to low plasticity silts and granular soils develops during ground shaking. The increase in excess pore pressure may result in a reduction of soil shear strength and a quicksand-like condition.

Important factors in evaluating a soil's susceptibility to liquefaction include relative density, the fines content (percent of soil by weight smaller than 0.075 millimeter, passing the No. 200 sieve), and the plasticity characteristics of the fines. Relative density can be estimated from SPT N-values that were performed for this project. We performed laboratory Atterberg limits testing to evaluate the plasticity of the site soils.

6.2.1 Screening

We conducted a preliminary screening for liquefiable soils based on the Bray and Sancio (2006) criteria, which suggests that soils with plasticity indices (PI values shown in Appendix D) below 12 with a natural moisture content greater than 0.85 times the liquid limit are potentially liquefiable and using the Boulanger and Idriss (2006) method which provides recommendations that the fine-grained soils with plasticity index greater than 7 would not be liquefiable. Based on review of the explorations and laboratory testing, our screening indicates that most of the silt deposits have plasticity indices less than 12 and are susceptible to liquefaction according to this Bray and Sancio (2006) soil plasticity criteria and the clays are not. A portion of the silt deposits have a PI less than 7 or are non-plastic and meet the criteria for liquefaction based on Boulanger and Idriss; however, certain silt samples have PI's between 7 and 12 and are not liquefiable under the Boulanger and Idriss criteria.

6.2.2 Liquefaction Analysis and Liquefaction-Induced Settlement

We evaluated liquefaction potential of the soils by performing liquefaction analyses on the borings (based on SPT N-values using Boulanger and Idriss (2014) method) and compared the results to Youd et al. (2001). We used the ground motion parameters described above (i.e., peak ground acceleration (PGA_M) of 0.54g at the surface and moment magnitude 7.7). Soil layers identified as potentially liquefiable in the explorations are summarized in Table 2.

TABLE 2.
SUMMARY OF LIQUEFACTION-INDUCED SETTLEMENT BELOW PIPE INVERT

Location	Approx. Top of Hole Elevation[1]	Approx. Pipe Invert/Base Elevation[2]	Approx. Groundwater Elevation	Approx. Liquefiable Layer Elevation[3]	Approx. Settlement at Pipe Invert (inch)	Approx. Settlement at Ground Surface (inch)
B-1 (wet well)	95	67	81.6	61.5 - 78	0	4 to 5
B-1 (SSMH 1)	95	76.8	81.6	61.5 - 78	3 to 4	4 to 5
B-2	92	77.6	84	62 - 75	4 to 6	4 to 6
B-3	92	78.8	86.5	63 - 75	3 to 4	5 to 7

Notes:
1. Portland Metro RLIS database (LiDAR) reference the North American Vertical Datum of 1988 (NAVD 88).
2. Pipe invert elevations estimated from draft 30 percent design drawings from Murraysmith and should be considered approximate.
3. Based on Bray and Sancio 2006.

Table 2 also presents total estimated liquefaction-induced settlement under the pipeline. Liquefaction-induced settlement magnitudes based on SPT N-values were estimated using Tokimatsu and Seed (1987), and Ishihara and Yoshimine (1992). Considering only the explorations that extended through the potentially liquefiable Missoula Flood Deposits and into the non-liquefiable Pliocene/Pleistocene deposits, estimated settlements generally range from 3 to 6 inches below the pipe invert. At a depth of approximately 28 feet bgs, the pump station is founded within the potentially liquefiable material. We provide a discussion related to overexcavation in Section 7.5.1 as a mitigation option for this hazard.

6.3 Potential Flotation Effect

The portions of the pipeline that are founded within the liquefied soil, such as the manhole located near STA +40, will be subject to buoyancy forces due to the dramatic increase in the pore water pressure associated with soil liquefaction. Liquefaction is anticipated within the pipe zone at the location boring B-1.

The assessment of potential pipeline flotation from liquefaction involves determining if sufficient resistance to buoyancy forces is provided by the weight of the pipeline and contents, and resistance of the surrounding soil to pipeline uplift. We recommend the risk for flotation be evaluated during final design based on the specific pipeline embedment within the liquefiable soil.

Seismic mitigation for flotation may include the use of backfilling with Controlled Low Strength Material (CLSM) above the pipeline, increasing the weight of the pipeline, or anchoring the pipeline with special foundation systems. However, as discussed in the Slope Stability section of this report, the pipeline is within an area where post-seismic instability may occur.

If CLSM is used it will result in additional lateral forces on the pipeline; therefore, we recommend consideration be given to the other methods. See Sections 7.4.1 and 7.4.2 for recommendations pertaining to uplift design of pipelines and manhole structures located in areas containing liquefiable soils.

6.4 Lateral Spreading

Lateral spreading hazards can exist in areas with mild slopes adjacent to a much steeper slope or vertical face. Lateral spreading failure can occur if soil liquefaction develops during a seismic event and the ground acceleration (inertial force) briefly surpasses the yield acceleration (shear strength) of the liquefied soil. This can cause both the liquefied soil and an overlying non-liquefied crust of soil to displace laterally down mild slopes or towards an embankment face. The displacements are cumulative and permanent in nature.

The proposed pump station is located over 13,800 feet from the Willamette River. Empirical data (Youd et al 2002) suggests that sites located this far from the free face are not within the lateral spread zone. In our opinion there is a low risk of lateral spread towards the Willamette River at the location of the proposed pump station.

As discussed in the Slope Stability section of this report, there is a potential for post seismic instability from the nearby Boeckman Creek. Using the Youd et al. (2002) empirical method, we conducted a lateral spreading hazard analysis at the proposed pump station towards Boeckman Creek, and near the location of boring B-1. This method assumes that only saturated, cohesionless soils at depths within 10 meters of the ground surface and a corrected SPT N-value ($N_{1(60)}$) of less than 15 are susceptible to lateral spreading. Additionally, the model is only valid for soils with a fine-grained particle content of less than 70 percent and an average grain size (D_{50}) between 0.06 millimeter (mm) and 10 mm. The lateral spread analysis predicted approximately 2 inches of lateral spread. However, we note that some of the soils included in our analysis had a fines content greater than 70 percent.

6.5 Slope Stability

We performed slope stability analysis at three cross-sections through the pipeline alignment and Boeckman Creek, based on available topographic information from the Portland Metro RLIS database (LiDAR), our subsurface explorations, and laboratory testing. The section at the west end of the alignment near the existing pump station and near boring B-3 is designated Section A-A', and the section at east end of the alignment near the proposed pump station and Boring B-1 is designated B-3. Section B-B' is located between Section A-A' and Section C-C' as shown on Figure 2, Site and Exploration Plan.

6.5.1 Approach

Slope stability is influenced by various factors, including the following: (1) the geometry of the soil mass and subsurface materials; (2) the weight of soil materials overlying a potential failure surface; (3) the shear strength of soils and/or rock along a potential failure surface; and (4) the hydrostatic pressure (groundwater levels) present within the soil mass and along a potential failure surface.

The stability of a slope can be expressed in terms of a factor of safety, which is defined as the ratio of resisting forces to driving forces. At equilibrium, the factor of safety is equal to 1.0, and the driving forces are balanced by the resisting forces. Slope movement is predicted when the driving forces exceed the resisting forces, i.e., the factor of safety is less than 1.0.

An increase in the factor of safety greater than 1.0, whether by increasing the resisting forces or decreasing the driving forces, reflects a corresponding increase in the stability of the mass. The actual factor of safety may differ from the calculated factor of safety, due to

variations or uncertainty in the soil strength, subsurface geometry, potential failure surface location and orientation, groundwater level, and other factors that are not completely known.

Shannon & Wilson performed slope stability analyses using the computer program SLOPE/W, Version 8.16 (Geo Slope International, 2016). The Morgenstern-Price method was used for rotational and irregular surface failure mechanisms. We utilized information from the closest explorations and laboratory testing to estimate material strength and unit weight parameters for the geologic units assumed to underlie the slope. Specifically, strength correlations based on SPT N-values from were used. Liquefied strength parameters were developed from correlations by Idriss and Boulanger (2007) and Kramer (2008). The soil properties for the geotechnical units defined in each analysis are included on the respective slope stability figure (Appendix C).

The slope stability at the cross-sections was evaluated for the static, seismic, and post-seismic (liquefied soil) conditions. See discussions of these various conditions below and Table 3 for tabulations of the results of our slope stability analysis.

6.5.1.1 Static

For slopes supporting or impacting essential facilities, a minimum factor of safety of 1.5 is recommended for the static condition.

6.5.1.2 Seismic

A minimum factor of safety of 1.1 is recommended for the seismic case. Shannon & Wilson performed pseudo-static analyses to evaluate the seismic slope stability using a horizontal seismic coefficient of 0.27, which is equal to one-half of the PGA_M. If the factor of safety of the critical failure surface was less than 1.1, potential displacements were estimated by following the procedures in the National Cooperative Highway Research Program (NCHRP) document NCHRP 611 (NCHRP, 2008).

6.5.1.3 Post-Seismic

A minimum factor of safety of 1.1 is recommended for the post-seismic (liquefied) condition. A failure surface with a factor of safety less than 1.1 indicates the potential for a flow failure caused by a loss of strength within a liquefied soil layer. A flow failure is initiated when a shear failure occurs along a failure surface and is often characterized by large rapid ground movement of the soil mass inside the failure zone.

6.5.2 Results of the Slope Stability Analyses

We evaluated the stability of the pipeline alignment on the three cross-sections for static, seismic, and post-seismic conditions (see Appendix C). Based on our analysis, the proposed pipeline alignment will satisfy the minimum stability factor of safety requirements for all three cross-sections in the static condition, and Cross-Section A and Cross-Section B in the seismic and post-seismic (liquefied soil) condition. In Cross-Section C-C the factor of safety is less than 1.1 under the seismic condition, and the proposed pump station is located partially within a potential failure zone under the post-seismic (liquefied) condition. The slope stability results are summarized in Table 3 and Appendix C.

TABLE 3
SUMMARY OF SLOPE STABILITY RESULTS

Stability Section	Condition	Factor of Safety[1]
A-A'	Static	1.7
	Seismic	1.1
	Post-Seismic	1.8
B-B'	Static	3.1
	Seismic	1.2
	Post-Seismic	1.1
C-C'	Static	2.2
	Seismic	< 1.1
	Post-Seismic	<1.1

Note: 1. Minimum Factor of Safety of potential failure surfaces extending through the proposed pipeline and/or appurtenant structures.

Up to two inches of movement is predicted for the seismic case in Cross-Section C-C'. Significant movement is possible under the post-seismic (flow failure) condition. Estimating the displacement inside the flow failure zone is not possible using conventional pseudo-static analysis such as those performed for the purposes of this report.

As discussed in the "Lateral Spread" section of this report, an attempt to determine the liquefaction induced lateral displacement towards Boeckman Creek at the location of the pump

station was made using the Youd et al. (2002) empirical method. The lateral spread analysis predicted approximately 2 inches of lateral spread. However, as previously discussed, not all of the site conditions are within the range considered applicable for the empirical method developed by Youd. A more accurate estimate of the movement inside the flow failure zone would require advanced numerical modeling (such as a two-dimensional FLAC analysis) and additional field testing, including shear wave velocity measurements, which are outside of our current scope of services.

To satisfy a no-movement criterion in the seismic case, the pipeline would need to be offset approximately 125 feet from Boeckman Creek. Alternatively, as discussed in the "Seismic Hazard Mitigations" and "Increased Lateral Forces" section of this report, seismic resiliency of the pump station can be achieved by designing the pump station to withstand the lateral earth pressures caused by the flow failure.

6.6 Increased Lateral Forces

The pump station, pipes, and manholes located inside the flow failure zone are subject to increased lateral forces (assuming they are not able to accommodate the displacement). The Oregon Department of Transportation (ODOT) Geotechnical Design Manual (GDM) provides the following guidance for calculating forces acting on restrained buried structures, such as those described above.

The force exerted by the liquified soils can be estimated as 30 percent of the overburden; while the force exerted above the non-liquefiable crust within the flow failure or lateral spread zone can be modeled as passive soil forces with an equivalent unit weight of 350 pounds per cubic foot (Yokoyama et al 1997). See section 7.3 for a detailed discussion of lateral forces outside of the flow failure zones.

6.7 Decreased Bearing Capacity

Manholes founded within liquefiable layers, such as the manhole located near STA +40, are subject to reduced bearing capacities. Additionally, manholes which are founded above the liquefiable layer, but have foundations which are located within two times the diameter of the manhole foundation, are subject to reduced bearing capacities. The allowable post-seismic bearing capacity is presented in Section 7.5.1 of this report.

6.8 Fault Rupture

As shown in Table 1, the Canby-Molalla fault is mapped 3.8 miles from the proposed alignment. However, because the slip-rate is less than 1 mm/year, it is our opinion that the potential for a hazard posed by ground surface fault rupture across the alignment is low.

6.9 Other Hazards

Due to the location and topography of the site and depth of potentially liquefiable soils, it is our opinion that the risk for tsunami and seiche at the site are not present or very low.

6.10 Seismic Hazard Mitigations

Along the pipeline alignment, the most significant hazards are flotation (in areas which will have negative load during liquefaction), and pipeline breaks from ground displacements. Slope stability is a concern at the pump station and control building location. Here the creekbank does not satisfy the minimum Factor of Safety requirements for the seismic or post-seismic condition, indicating that a flow failure could extend back to the pump station and control building. In addition to lateral movement, the control building could be subject to differential settlement caused by liquefaction induced settlement.

Strategies for seismic risk mitigation include designing the pump station walls to support the increased lateral earth pressures in the flow failure zone; supporting the control building on augercast piles designed to support the lateral earth pressures in the flow failure zone; mitigating liquefaction hazards through ground improvement; relocating the pump station outside of the flow failure zone; and designing the control building to be supported on a mat foundation capable of withstanding large vertical settlements, or developing a contingency plan if parts of the control building or pump station fail.

Additional numerical analysis (FLAC 2D) could also be performed to determine if the pump station could accommodate the predicted horizontal displacements in the flow failure zone, but this would require additional analysis and field measurements of shear wave velocities, which are outside of our current scope of work.

Mitigation strategies along the pipeline largely consist of protecting the pipeline with weighted pipe, where liquefied soil buoyant forces could cause flotation; selection of material and joints capable of withstanding the predicted lateral forces; locating the pipeline outside of the zone of

the flow failure; or use of pipe materials and pipe joints capable of withstanding the anticipated ground displacements. See Table 4 for a summary of mitigation alternatives.

TABLE 4
COMPARISON OF SEISMIC MITIGATION ALTERNATIVES

Alternative	Description	Advantages	Disadvantages
Resisting Deformation	• Design pump station-walls and pipes to resist lateral forces from flow failure, Support pump station foundation on mat foundations directly on crushed rock over non-liquefiable materials. Alternatively use over-lapping drilled shafts (a secant wall), sheet piles with tie-backs, or slurry wall panels. • Support control building on foundations (such as augercast piles) that extend through liquefiable soils into the non-liquefiable soils. An additional alternative in this category may consist of constructing auger-cast piles for the building in a tri-angular pattern between the pump station and Boeckman Creek to reduce lateral spread..	▪ Could provide additional resiliency, using conventional construction techniques such as augercast piles (pending structural analysis) and additional structural reinforcement of the pump station.	▪ Additional cost and structural analysis would be required to mitigate risk. Modifications to cast in-place- rings may be required. ▪ Augercast piles, drilled shafts, and slurry panel walls, generate surface spoils. ▪ May require change in pipeline material to higher strength or thicker material.
Avoiding Hazard	Move pipeline and pump station away from Boeckman Creek in areas of flow failures.	▪ Added resiliency, with potential to prevent pipeline failure. ▪ May be less expensive than resisting deformation and ground improvement for modest increases in pipe length.	▪ Potential long-term impact on recreational value of park land. ▪ Expanded work areas and additional footprint.
Ground Improvement (Deep Soil Mixing)	Construct a grid of continuous soil mixing columns extending to the non-liquefiable soils.	▪ High-quality mitigation with significant risk reduction. ▪	▪ Relatively high construction cost. ▪ Relatively difficult construction QA/QC. ▪ Requires specialty equipment and contractor. ▪ Construction generates surface spoils.

Alternative	Description	Advantages	Disadvantages
Adding flexibility and ability to withstand ground deformation	Flexible joints and connections. Weighting pipe to prevent flotation.	▪ Least expensive remediation methods. ▪ May reduce number of pipe breaks. ▪ Relatively simple construction QA/QC.	▪ May not prevent all pipe failures. ▪ Additional geotechnical analysis required to predict extend of soil movement in flow failure zone.

For an improved understanding of the liquefaction-related hazards present at the site, we recommend considering a two-dimensional FLAC analysis (results include estimated lateral displacements), prior to implementation of a costly mitigation strategy for lateral spread.

7.0 BURIED PIPELINE AND CONTROL BUILDING DESIGN

7.1 Modulus of Soil Reaction for Flexible Pipe

The modulus of soil reaction, E', for flexible pipeline design, characterizes the stiffness of the pipe zone backfill placed at the sides of buried flexible pipelines. E' is an empirical parameter (Spangler's Iowa formula) that is dependent on the deflection and the pressure developed at the spring line of the pipe.

Variables also depend on the depth of the pipe, the type and density of the backfill, the thickness of compacted pipe zone backfill between the pipe and the trench wall, and the type of native soil. Shannon & Wilson understands this "composite" E' will be developed by the MurraySmith's design team. Based on Table 6 from the U.S. Department of the Interior Bureau of Reclamation Manual 25, 2nd Edition, and the relative consistency (density) of the soils encountered in the field explorations, Shannon & Wilson recommends an E' value of 500 psi for the native soil only. This value should be used to determine a composite E' based on the variables described above.

Note that if the native soils in the trench sidewalls adjacent to the pipe zone are not properly dewatered and become unstable during excavation due to vibrations during excavation and shoring placement and backfilling, the E' value of the pipe zone should be significantly reduced by amounts such as 50 to 60 percent, depending on the soil characterization. Also, similar or larger reductions should be considered if native soils are liquefiable under the design seismic event.

7.2 Bedding Pipe Zone and Trench Backfill

7.2.1 Bedding

The pipe bedding zone in the trench should be constructed with imported, well-graded, clean crushed rock material suitable for compaction and allowing for flexible joints. The on-site excavation spoils will be predominantly fine-grained, non-plastic to low-plasticity silts with zones of medium-plasticity clays that are not suitable for use as bedding material. The bedding material should consist of imported, ¾-inch minus crushed aggregate, as specified in Oregon Standard Specification for Construction (OSSC 2018), Item 00405.12, Bedding.

Provided that the subgrade soil is competent and is not disturbed by the excavation equipment, the minimum thickness of granular bedding below the invert of the pipeline should be 6 inches. In areas where wet, weak, or disturbed subgrade conditions are encountered, the required subgrade stabilization (subgrade overexcavation/replacement) will likely result in thicker pipe bedding.

We understand that the City of Wilsonville does not typically require the use of separation geotextile between the trench subgrade and pipe bedding materials. However, if native soil migration or softening of the native subgrade soils is observed during construction, or is a result of construction activities, we recommend a non-woven geotextile such as Mirafi 140N, Amoco Style 4550 (or equivalent), be placed between the subgrade soils and the bedding layer.

Based on groundwater level readings in piezometer in borings B-1 and B-3, high groundwater is expected along the majority of the length of the gravity pipeline. For example, at B-1, near the connection to the pump station, the bottom of the trench excavation appears to be about 7 feet below the groundwater level. At B-3, near the western end of the gravity pipeline, the bottom of the trench excavation appears to be about 9 feet below the groundwater level. In Section 8.0 we discuss recommendations for an external dewatering system outside the trench to control groundwater. However, for constructability and to aid in control of groundwater as a supplemental system in these high groundwater areas, we recommend installation of a crushed rock drainage layer at least 12 inches thick; it should be installed below the pipe bedding to facilitate sump pumping within the trench. The drainage layer should be constructed with open, free-draining crushed rock materials with a 1½- to 3/4-inch gradation, conforming to Oregon Standard Specifications for Construction (OSSC 2018, 00430.11).

The crushed rock for the working mat/drainage system should also have less than 2 percent by weight passing the No. 200 wet sieve; and 90 percent of particles by weight retained on the U.S. No. 4 sieve should have at least two fractured faces. In areas where the drainage rock described above is used, the material may also serve as the pipe bedding, depending on requirements of pipe material and joints. Under this drainage layer on the native subgrade, we also recommend placing a non-woven geotextile such as Mirafi 140N, Amoco Style 4550 (or equivalent),

7.2.2 Pipe Zone

For the pipe zone material, bedding material specified in OSSC 2018, Item 00405.12, should be used for flexible pipes. Typically, the pipe zone materials should extend at least 6 inches above the top of the pipe, or as determined by the manufacturer. Pipe zone compaction should be at least 90 percent of maximum density, as determined by a proctor, conforming to AASHTO T99.

7.2.3 Trench Backfill

Above the pipe zone, the pipelines and buried structures can be backfilled with select native material, except in areas where long-term settlement of backfill could be an issue. The soils encountered at the site during our subsurface investigation program are generally suitable for placement as trench backfill during warm, dry weather when moisture content can be maintained by air drying and/or addition of water. The moisture content of the near-surface soils can be expected to vary depending on the time of year and recent weather conditions.

The silt and clay fraction of the near-surface soils is moisture-sensitive, and during wet weather, native on-site soils may become unworkable because of excess moisture content. In order to reduce moisture content, discing and drying of native soils will be required. Select earth backfill in non-settlement-sensitive areas should be compacted to a minimum of 90 percent of maximum density, as determined by a proctor conforming to AASHTO T99.

In locations where backfill is placed in settlement-sensitive areas, we recommend the use of ¾-inch minus crushed aggregate, with less than 5 percent by dry weight passing a U.S. Standard No. 200 Sieve, and it should meet OSSC 2018 00405.14 (Class B Backfill). We recommend the backfill be compacted to at least 90 percent of the maximum dry density, as

determined by AASHTO T 99. Within 4 feet of the ground surface, the backfill should be compacted to within 95 percent of the maximum dry density, as determined by AASHTO T 99. Non-vibratory compaction techniques shall be used on 6-inch-thick loose lifts when compaction is performed within 35 feet of existing structures.

7.3 Lateral Earth Pressures on Embedded Structures

The lateral earth pressures on embedded walls for manholes were evaluated as equivalent fluid pressures. In our analysis, we assume that the embedded structures will be designed as non-yielding walls with a level backfill surface. Lateral earth pressures were determined for the native soil backfill compacted to 90 percent of maximum as determined by AASHTO T 99. Table 5 presents the recommended lateral earth pressure values for the static and seismic conditions, and Table 6 presents the recommended lateral earth pressure values for the post-seismic condition.

TABLE 5
LATERAL EARTH PRESSURES FOR NATIVE SOIL EMBEDDED STRUCTURES (STATIC AND SEISMIC CASES)

Groundwater Design Conditions	Static Pressure (psf)	Surcharge Pressure (psf)	Seismic Pressure (psf)	Hydrostatic Pressure (psf)
Above Water Level	$55H_s$	0.5q	$28H_s$	NA
Below Water Level	$55H_s+24H_w$	0.5q	$28H_s$	$62H_w$

In Table 5, H_s is defined as the portion of the buried wall height above the project design groundwater level. H_w is defined as the groundwater height above the bottom of the buried wall; and q is the surcharge load, with q in units of pounds per square foot. The static and hydrostatic pressures are applied as linear pressure distributions increasing with depth. The seismic pressure is applied as a uniform distribution.

TABLE 6
LATERAL EARTH PRESSURES FOR NATIVE SOIL EMBEDDED STRUCTURES (POST-SEISMIC CASE)

Groundwater Design Conditions*	Static Pressure (psf)	Surcharge At-Rest Pressure (psf)	Liquefied Soil Pressure (psf)	Hydrostatic Pressure (psf)
Above Water Level	$55H_s$	0.5q	NA	NA
Below Water Level (above Liq. Zone)	$55H_s+24H_{n\text{-}l(above)}$	0.5q	NA	$62H_{n\text{-}l(above)}$
Below Water Level in Liquefied Zone	NA	0.5q	$110(H_s+H_{n\text{-}l(above)})+100H_{liq}$	NA
Below Liquefied Zone	$0.5(110H_s+48H_{n\text{-}l(above)}+38H_{liq})+24H_{n\text{-}l(below)}$	0.5q	NA	$62(H_{n\text{-}l(above)}+H_{liq}+H_{n\text{-}l(below)})$

*where applicable

In Table 6, H_s is defined as the portion of the buried wall height above the project design groundwater level and q is the surcharge load, with q in units of pounds per square foot. $H_{n\text{-}l(above)}$ is defined as the height of the non-liquefiable soil above the liquefied soil layer and below the groundwater level. H_{liq} is defined as the thickness of the liquefiable soil layer. $H_{n\text{-}l(below)}$ is defined as the height of the non-liquefiable soil below the liquefied soil layer and above the bottom of the structure.

7.4 Uplift Design for Potential Flotation Effects

7.4.1 Pipeline

The assessment of potential pipeline flotation from liquefaction involves determining if sufficient resistance to buoyancy forces is provided by the weight of the pipeline and contents, and resistance of the surrounding soil to pipeline uplift. We recommend the risk for flotation be evaluated based on the specific pipeline embedment within the liquefiable soil. For the discussion on seismic mitigation for flotation, please refer to Section 6.3.

For preliminary evaluation purposes, the project structural engineer can evaluate flotation hazards by treating the liquefied soil as a heavy viscous fluid with a unit weight of 95 pounds per cubic foot (pcf). The depth of the fluid can be taken as the distance from the design groundwater elevation to the bottom of the pipeline. For soil weight above the pipeline and above the design groundwater level, 110 and 130 pcf can be used for native and crushed rock backfill material,

respectively. For backfill below the groundwater level, buoyant values of 47 and 67 pcf can be used for native and crushed rock backfill, respectively. For CLSM, a unit weight of 145 pcf above the design groundwater level and about 83 pcf below the groundwater can be used.

7.4.2 Manholes

We recommend, that, for uplift design of the manholes and the pump station, the water table is assumed to be at the highest groundwater levels measured in the nearest piezometer, plus the additional height of water, to account for the wettest period during project design life. For manholes with a narrow foundation extension beyond the manhole wall, uplift resistance can be computed as adhesion skin resistance between the manhole and the surrounding backfill soil in addition to the dead weight of the manhole. For adhesion against select native soil backfill, we recommend a value of 100 pounds per square foot (psf). If additional uplift resistance is needed, deep foundations or tie-down anchors can be considered.

If additional resistance is needed, consideration should be given to extending the foundation beyond the manhole sidewalls and using the dead weight above the foundation. For resistance to uplift, typically we use the buoyant weight of the backfill projected vertically above the outside edge of foundations extending beyond the vertical walls. However, the adhesion value cannot be used in conjunction with an extended footing and the dead weight resistance of the backfill material.

If additional uplift resistance beyond dead weight and skin friction resistance is needed, deep foundations or tie-down anchors can be considered.

7.5 Foundation Recommendations

7.5.1 Manhole Foundations

Manholes may be placed on crushed rock over firm native soils. The footprint of the over-excavation should extend 2 feet outside the edge of the structure and 1.5 feet below the structure subgrade. The over-excavated material should be replaced with an engineered free-draining, crushed rock fill consisting of imported crushed rock underlain by a layer of non-woven geotextile fabric. With this subgrade preparation, non-woven fabric, and crushed rock layer, a subgrade modulus of 150 pci may be used for foundations.

If the recommended crushed rock fills are constructed as described above, the proposed manholes can be supported on conventional shallow foundations founded on the crushed rock mat with a net allowable bearing capacity of 2,000 psf. A total static settlement of less than 1 inch and a differential settlement on the order of 50 percent of the total settlement are estimated, with the proposed structures supported on the crushed rock layer.

Our settlement estimate assumes that no disturbance to the foundation soil subgrade would be permitted during excavation and fill placement. The bearing capacity for structures founded in liquefiable soils will be reduced during a seismic event. For the manhole structures with an assumed minimum width of 4 feet, and founded an average of 12 feet bgs, a reduced allowable seismic bearing pressure of 500 psf may be used. The reduced bearing pressure assumes a factor of safety of 1.5 for the seismic condition.

7.5.2 Pump Station Foundation

Based on the 30 percent plans, the top of the proposed wet well slab for the pump station will be approximately 28 feet below the existing ground surface at an approximate elevation of 67 feet. Assuming a concrete slab (mat) thickness of 1.5 feet and a combined thickness of an addition 1.5 feet for leveling course (6 inches) and drainage layer (12 inches), the resulting excavation would be about 31 feet below existing grade, which is about elevation 64 feet.

Based on our seismic hazards analysis, soils at an elevation of 78 to 61.5 feet are susceptible to liquefaction. Therefore, we recommend additional overexcavation to the top of the stiff Pliocene / Pleistocene Sediments at an approximate elevation of 61.5 feet (i.e. overexcavation an additional 3 to 3.5 feet). This over-excavated zone should be backfilled with additional thickness of crushed rock drainage layer material. The footprint of the overexcavation should extend 2 feet outside the edge of the wet well and 1.5 feet below the structure subgrade

If the recommended crushed rock fills are constructed as described above, the proposed wet well for the pump station can be supported on conventional shallow foundations founded on the crushed rock mat drainage/working mat with a net allowable bearing capacity of 3,500 psf. A total static settlement of less than 1 inch and a differential settlement on the order of 50 percent of the total settlement are estimated, with the proposed structures supported on the crushed rock layer. Our settlement estimate assumes that no disturbance to the foundation soil subgrade would be permitted during excavation and fill placement.

7.5.3 Control Building Foundations

Based on the results of our seismic hazard and slope stability analysis, we recommend that the control building be founded on deep foundation elements consisting of 24-inch-diameter augercast piles. An augercast pile is constructed by drilling down to the prescribed bearing stratum with a hollow-stem, continuous-flight auger. The auger is left in place to support the walls of the borehole.

A high-strength grout mix is then pumped through the hollow stem under pressure while the auger is slowly withdrawn from the hole. Care is required to coordinate the rate of grout placement with the rate of auger withdrawal to prevent the sides of the hole from sloughing in and necking, thereby reducing the pile cross section area.

Immediately after grout placement, a rebar cage is lowered into the grout shaft. This type of pile requires installation by an experienced and competent foundation contractor, as well as full-time observation and QA/QC documentation under the supervision of an experienced geotechnical engineer to assure satisfactory installation.

Due to the potential of soil liquefaction under the design earthquake event, the seismic loading requires that axial compressive and uplift resistances for the proposed control building will have to be derived from the deeper soil strata. Therefore, it is recommended that the piles be embedded a minimum of 5 feet into the underlying Pliocene/Pleistocene Sediments at an approximate elevation of 55 feet.

Table 7 shows the allowable axial compressive and uplift load capacities of the 24-inch augercast pile if it is extended to a depth of 40 feet below the ground surface (i.e. approximate elevation of 55 feet).

TABLE 7
ULTIMATE AND ALLOWABLE LOAD CAPACITIES AUGERCAST PILES

Pile Diameter (inches)	Ultimate Axial Compressive Capacity (kips)	Ultimate Uplift Capacity (kips)	Downdrag Load (kips)	Allowable Axial Compressive Capacity (kips)	Allowable Uplift Capacity (kips)
Static Loading Condition					
24	160	120	-	55	40
Seismic Loading Condition					
24	80	40	40	25	25

The allowable compressive and uplift capacities have a factor of safety (FS) of 3.0 under static loading conditions and a FS of 1.5 under seismic loading conditions. The seismic downdrag load, which is mainly due to the settlement of the non-liquefiable crust during the seismic event, is estimated at 50 kips. The downdrag loads were treated as reduction to the pile compressive capacities in Table 3. The project structural engineer should add the downdrag load in the pile structural evaluation to verify that the piles have sufficient internal strength to accommodate this additional load.

Minor pile settlement will result from the proposed structural loads. Based upon our experience and engineering analyses, we anticipate that the maximum static or seismic, total and differential settlements, for the augercast pile should be less than ½-inch and ¼-inch (over the short dimension of the structure), respectively.

The augercast piles will be subjected to lateral loads resulting from static and seismic earth pressures. We anticipate that the laterally loaded pile analyses may be performed with the aid of the LPile computer program. Static and Seismic geotechnical input parameters for LPile are provided in Tables 8 and 9.

The estimated lateral resistance parameters presented in Tables 8 and 9 are recommended for soldier piles with center-to-center spacing greater than five pile (pre-bore) diameters (5D). Based on this assumption, the pile group effects are not considered. If the pile spacing is less than 5D, the appropriate P-Multiplier must be established and applied, as recommended by the AASHTO LRFD Bridge Design Specifications, Section 10.7.2.4.

TABLE 8
STATIC LPILE GEOTECHNICAL INPUT PARAMETERS FOR 24-INCH-DIAMETER AUGERCAST PILE FOUNDATIONS

Approximate Elevation (feet)		Soil Description	*p-y* Model	Soil Effective Unit Weight (pcf)		Friction Angle (deg)[2]	*p-y* Modulus k (pci)[2]	Undrained Cohesion (psf)	Strain Factor ε_{50}
Upper Bound	Lower Bound			Above Groundwater	Below Groundwater				
BOF[1]	83	Very soft Lean Clay with Sand to Fat Clay	Soft Clay (Matlock)	110	--	--	--	150	0.02
83	78	Very soft Lean Clay with Sand to Fat Clay	Soft Clay (Matlock)	--	48	--	--	150	0.02
78	64.5	Very soft to medium stiff Silt to Silt with Sand	Sand (Reese)	--	50	32	40	--	--
64.5	61.5	Medium dense Silty Sand	Sand (Reese)	--	50	34	45	--	--
61.5	Base	Stiff Fat Clay	Stiff Clay w/o Free Water	--	58	--	--	1,500	0.007

[1]BOF = bottom of footing
[2]pci = pounds per cubic inch, deg = degrees

TABLE 9
SEISMIC LPILE GEOTECHNICAL INPUT PARAMETERS FOR 24-INCH-DIAMETER AUGERCAST PILE FOUNDATIONS

Approximate Elevation (feet)		Soil Description	*p-y* Model	Soil Effective Unit Weight (pcf)		Friction Angle (deg)[2]	*p-y* Modulus k (pci)[2]	Undrained Cohesion (psf)	Strain Factor ε_{50}
Upper Bound	Lower Bound			Above Groundwater	Below Groundwater				
BOF[1]	83	Very soft Lean Clay with Sand to Fat Clay	Soft Clay (Matlock)	110	--	--	--	150	0.02
83	78	Very soft Lean Clay with Sand to Fat Clay	Soft Clay (Matlock)	--	48	--	--	150	0.02
78	64.5	Liquefied	Sand	--	50	4	5	--	--

		Soil	(Reese)						
64.5	61.5	Liquefied Soil	Sand (Reese)	--	50	20	26	--	--
61.5	Base	Stiff Fat Clay	Stiff Clay w/o Free Water	--	58	--	--	1,500	0.007

[1]BOF = bottom of footing
[2]pci = pounds per cubic inch, deg = degrees

8.0 CONSTRUCTION CONSIDERATIONS

8.1 Groundwater Control

8.1.1 Pipeline Trenches

The depth to groundwater and subsurface soil conditions within the trench excavation vary across the site. In general, construction of the pipe will require excavation through sands and non-plastic to low plasticity silts below the water table along the majority of the alignment.

In areas where sands and non-plastic to very low plasticity silts are present, and the excavations are 3 to 4 feet below the water levels, an external dewatering system outside the trench such as wells or well points are recommended. Wells or wellpoints mitigate the potential for running sands and pore water pressure build-up in the soil, which could soften, disturb, or weaken the subgrade and may result in long term settlements of the pipeline.

We recommend the external dewatering systems would consist of dewatering wells and vacuum wellpoints. Typically, the practical limits of an efficiently operating well point dewatering systems is equal to or less than an 18-foot vertical lift of water. Where deeper dewatering is needed, wells are recommended.

8.1.2 Internal Pipeline Trench Dewatering

We recommend supplementing external wellpoint or well dewatering systems with pumping from localized, well-constructed, filtered sumps internal to the trench excavation. The internal sumping systems should be designed by the Contractor. However, we recommend an engineered sumping system, operated within a drainage layer, to control water, stabilize the subgrade, and provide a workable condition for the manholes and pipeline installation.

The sump pumps should be installed at sufficient spacing to keep the groundwater level below the surface of the drain rock. The drainage layer should be constructed with very open, free-draining crushed rock materials, with 1½- to 3/4-inch gradation. The crushed rock for the

working mat/drainage system should also have less than 2 percent by weight passing the No. 200 wet sieve, and with 90 percent fracture on at least two faces applying to the combined aggregate retained on the U.S. No. 4 sieve.

As previously mentioned, the use of a non-woven geotextile between the native subgrade soils and the drainage layer/bedding material may be necessary to prevent the migration of native soil into the drainage layer and bedding, and possible deformation of the pipe bedding and pipe zone into the native soil.

Along the open-cut pipeline where groundwater was encountered in explorations within the trench elevation, the crushed rock drainage layer should be at least 1 foot thick. The drainage rock should be compacted by non-vibratory self-propelled compaction equipment or hand compaction non-vibratory methods. The crushed rock should be compacted to a firm surface with approved compaction equipment and the approved number of passes (complete coverages).

8.1.3 Pump Station

At the pump station location, Silty Sand was located between depths of 30 and 34 feet below ground surface in boring B-1. If a laterally restrained, "top down" shoring system, such as Slide Rail and/or Shore-Trak ™ shoring system is used for the excavation, a dewatering well is recommended to control water as the shoring is being installed. This dewatering well is also needed to dewater the pipe trench at the connection to the pump station, since the trench is about 20 feet deep and 7 feet below the groundwater, as previously mentioned.

If sheet piles, or shafts, embedded a minimum of 10 feet into the stiff to very stiff clay deposits (Pliocene/Pleistocene Deposits) are used as an alternative to Slide Rail and/or Shore-Trak ™ shoring system, it may be possible to dewater the pump station excavation using an internal sumping system within the drainage layer describe in Section 7.5.2. However, we recommend this dewatering well still be installed, because of the deep pipeline connection to the pump station.

8.1.4 External Dewatering Systems

External dewatering systems should be designed by the Contractor to draw groundwater levels down to below the bottom of the excavations where required, and dewater the sand and non-plastic silt during construction. This would help prevent disturbance and instability during excavations and construction of permanent facilities, which would likely lead to constructability issues and short-term and long-term settlement.

In trench dewatering is required as described above, and where the depth below ground surface to the desired drawdown elevation exceeds the practical vertical lift limitation of a vacuum wellpoint (18 feet or less), the Contractor could consider the following approaches:

- Install the vacuum well points and vacuum header pipe at a lower elevation—i.e., install the system from a partially excavated surface or bench above the groundwater table; and
- Install dewatering wells instead of vacuum wellpoints, since the dewatering wells are not constrained by a vertical lift limitation.

We anticipate that, based on the variability of the soils to be dewatered, vacuum well points would need to be installed on 5- to 7-foot centers. If dewatering wells are selected, we anticipate they would need to be closely spaced, as close as 30-to 40-foot centers.

The Contractor is responsible for design, installation, operation, and removal of the dewatering systems. The type of dewatering system (i.e., vacuum well points and/or dewatering wells), and the spacing and depth of dewatering system components, will depend on the Contractor's dewatering system design.

Also, where external dewatering system are planned or have been installed, observation wells for groundwater measurements should also be installed close the trench and the water levels measured to confirm successful groundwater drawdown has occurred prior to beginning trench excavation below the groundwater levels. Vacuum well points and dewatering wells should be developed immediately upon completion, using methods such as over-pumping until a visibly clear discharge is achieved. Also, observation wells should be developed as part of their installation procedure to ensure accurate water level measurements.

8.1.5 Additional Dewatering Considerations

There are several options when considering how to specify dewatering, including defining the dewatering requirements and criteria. Typically, the alternatives are as follows:

- The engineering team would provide an end result only requirement or criteria, such as lowering the groundwater 2 feet below the excavation and/or maintaining water levels at the bottom of the excavations within a drainage layer, and allow the Contactor to totally determine means and methods to achieve this.
- The engineering team would perform a conceptual design; or, based on experience, not only describe end result requirements and criteria, but also provide guidance and/or the

limitations the Contractor has to base his design on. For example, maximum wellpoint spacing of 6 feet is a limitation, and the Contactor has to design with this in mind.

- The engineering team essentially designs basis of the dewatering system, leaving only minor aspects of the materials and installation up to the Contractor.

There are pros and cons to each of these alternatives; and to choose a project approach to develop construction plans and specifications including method of bidding, we recommend discussions between the geotechnical engineer of record (Shannon & Wilson), lead civil firm (Murraysmith), and the Owner (City of Wilsonville). Also of value is to involve a contractor with dewatering knowledge and experience in the discussions.

8.2 Temporary Pipeline Excavation Stability

The majority of the pipeline excavation will be performed through or along an existing access road. If shoring is used to mitigate the risk to adjacent pavements, utilities and structures, consideration can be given to utilizing laterally restrained shoring systems to provide full-time lateral support to the trench sidewalls during the trench excavation, pipe installation, backfilling, and compaction of the trench pipeline and backfill materials. The preferred laterally restrained shoring systems include the proprietary shoring systems, such as the Slide Rail and/or Shore-Trak ™ mentioned above.

We anticipate the construction could be accomplished with a suitably designed trench shield (often referred to as trench boxes) designed or selected by the Contractor. Where open-cut trenching will not damage property or trees, open-cut excavation may be performed.

In general, temporary earth slopes may be cut near vertical for excavations less than 4 feet in depth. If the excavation is more than 4 feet in depth, flatter slopes will be required in accordance with OSHA. Based on the subsurface condition, the soil encountered in the excavations can be classified as OSHA Type C soil. Therefore, for planning purposes of excavations of less than 20 feet, a temporary 1 Horizontal:1.5 Vertical (1H:1.5V) slope above the groundwater level should meet OSHA and local agency requirements.

If a trench box system is used as shoring in place of a laterally restrained proprietary shoring system, crushed rock should be used to fill the voids between the trench sidewall and the outside of the box immediately after excavating the trench and placing the trench box. The voids should be filled with ¾-inch minus imported crushed rock materials (OSSC, Item 00405.12) immediately after the trench box is placed, to maintain tight contact to the sidewall soils.

Selection of the shoring system and the safety of temporary excavation and cut slopes should be made the responsibility of the Earthwork Contractor. The Earthwork Contractor should be aware of, and familiar with, applicable local, state, and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards. Site safety generally is the sole responsibility of the Contractor, who also is solely responsible for the means, methods, and sequencing of construction operations.

We are providing the above information and opinions solely as a service to our client. Under no circumstances should the information provided and opinions expressed above be interpreted to mean that Shannon & Wilson is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

8.3 Erosion Control

Erosion of the soil at the site will occur as exposed surfaces are disturbed due to construction activities and exposure to climatic conditions. Excavated surfaces should be protected by a weather-resistant cover or erosion-control product, if left exposed. Temporary erosion and runoff control measures should be in place prior to and during construction. Erosion-control measures should remain in place and be maintained by the Contractor until disturbed areas are stabilized. The expected erosion control work consists of furnishing, installing, maintaining, removing, and disposing of water sediments and should be executed in accordance with OSSC, Section 00280.

9.0 LIMITATIONS

This GER with the data collected has been completed for the exclusive use of Murraysmith and the City for specific application to the proposed Memorial Park pump station project.

No interpretations between exploration locations are included in this report. The interpretations, conclusions, and recommendations that are contained in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practices in this area at the time this report was prepared. We make no warranty, either express or implied.

The scope of our geotechnical services described in this GER has not included an environmental evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below the site for evaluation or disposal of contaminated soils or groundwater, should they be encountered, except as noted in this report.

The subsurface explorations were performed to characterize soil conditions at limited locations at the site and our observations are specific to the locations and depths noted on the borings and in this letter report. No amount of subsurface exploration can precisely predict the characteristics, quality, or distribution of subsurface site conditions. Potential variation includes but is not limited to the following: varying conditions between borings, changes to the site and subsurface conditions due to the passage of time or intervening causes (natural and manmade), and seasonal or recharge source-influenced fluctuations of groundwater conditions.

We appreciate the opportunity to work with Murraysmith on this project. If you have questions concerning the information contained within this report, please feel free to contact us at (503) 210-4750.

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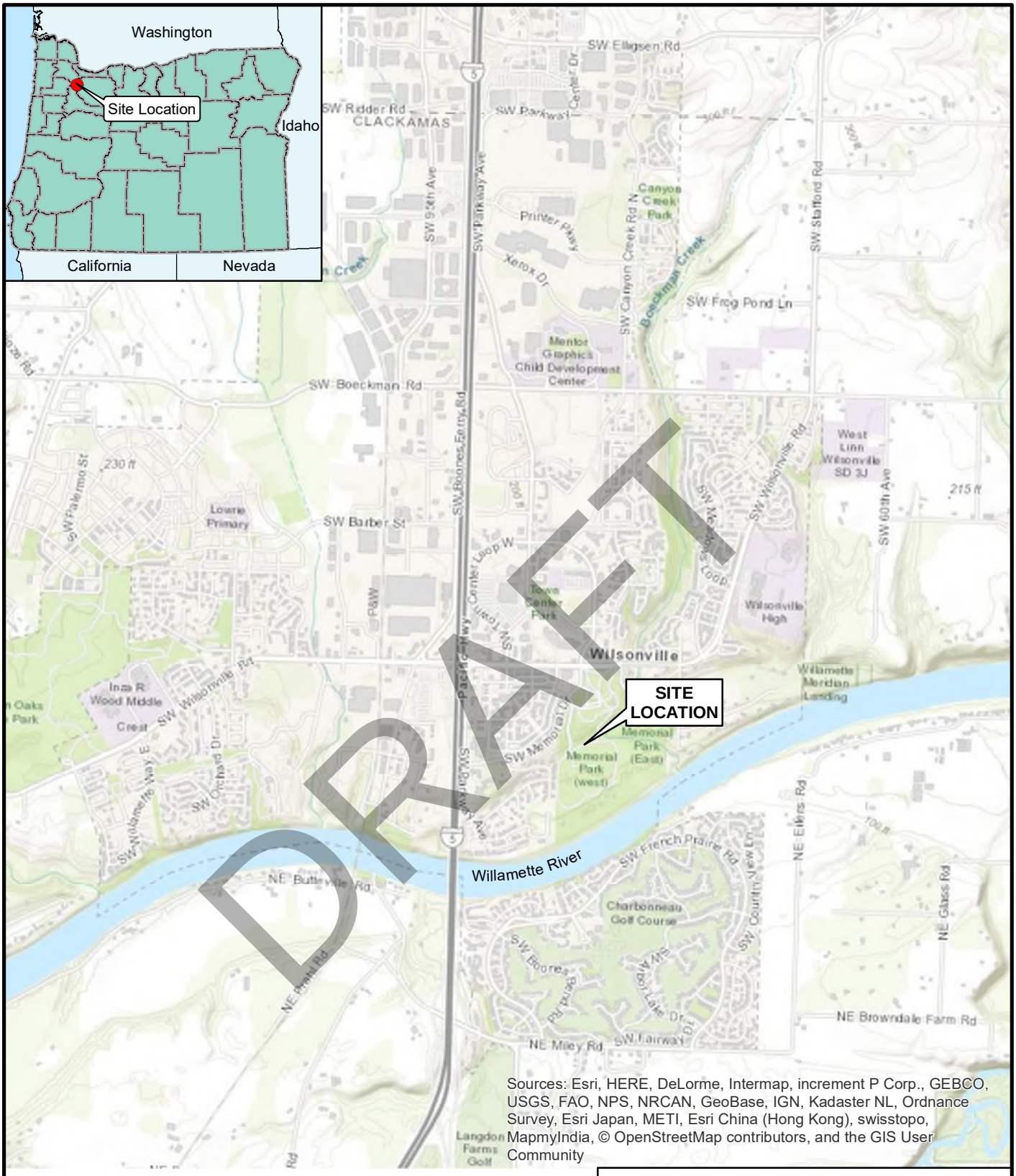

Memorial Park Pump Station
Wilsonville, Oregon

VICINITY MAP

May 2018

24-1-04234-001

[redacted]

FIG. 1

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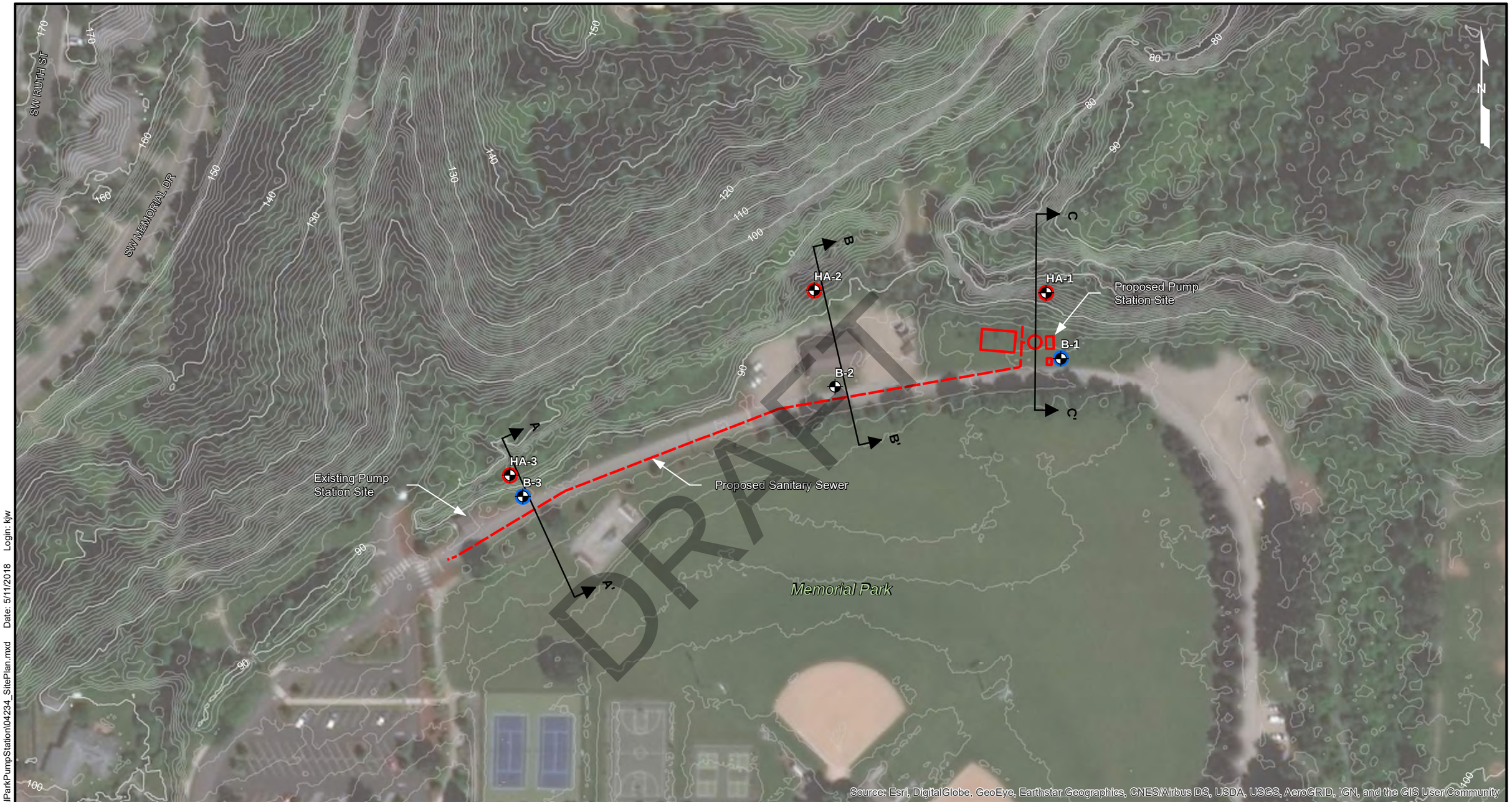

LEGEND

- Designation and ApproximateLocation of Boring
- Designation and Approximate Location of Boring with Piezometer
- Designation and Approximate Location of Hand Auger
- A A' Designation and Location of Stability Analysis Model

0 50 100 200
Scale in Feet

NOTES

1. Boring locations were measured in the field relative to existing site features and are approximate.
2. Proposed Pump Station Site location estimated from "Memorial Park-Final Option.pdf" provided by murraysmith on March 19, 2018.

Memorial Park Pump Station
Wilsonville, Oregon

SITE AND EXPLORATION PLAN

May 2018 24-1-04234-001

[redacted] **FIG. 2**

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APPENDIX A

FIELD EXPLORATIONS

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APPENDIX A

DRILLING EXPLORATIONS

A.1 GENERAL

The field exploration program for the Memorial Park pump station project includes three geotechnical borings, designated B-1 through B-3, and Hand Auger HA-1 through HA-3. Completed borehole locations were measured in the field relative to existing site features. Approximate elevations (NAVD 88) were estimated from the Memorial Park Sanitary Sewer As-Built drawings by MacKay & Sposito (dated November 23, 2010) and are presented on the drill logs in this appendix. Approximate boring locations are shown on the Site and Exploration Plan, Figure 2. This appendix describes the techniques used to advance and sample the borings and presents logs of the materials encountered, along with borehole installation and backfill details.

A.2 DRILLING

Borings B-1 through B-3 were drilled on March 22 and March 23, 2018, using a truck-mounted CME-75 drill rig provided and operated by Western States Soil Conservation, Inc. (Western States), of Hubbard, Oregon. The borings were drilled to a total depth of 51.5 feet using mud rotary drilling techniques. Shannon & Wilson geology staff was on site during drilling to locate the borings, observe drilling, collect samples, and maintain logs of the materials encountered.

A.2.1 Disturbed Sampling

Disturbed samples were collected in the borings, typically at 2.5- to 5-foot-depth intervals, using a standard 2-inch outside diameter (O.D.) split spoon sampler in conjunction with Standard Penetration Testing. In a Standard Penetration Test (SPT), ASTM D1586, the sampler is driven 18 inches into the soil using a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler the last 12 inches is defined as the standard penetration resistance, or N-value. The SPT N-value provides a measure of in situ relative density of cohesionless soils (silt, sand, and gravel), and the consistency of cohesive soils (silt and clay). All disturbed samples were visually identified and described in the field, sealed to retain moisture, and returned to our laboratory for additional examination and testing.

SPT N-values can be significantly affected by several factors, including the efficiency of the hammer used. Automatic hammers generally have higher energy transfer efficiencies than cathead driven hammers. Based on information we received from Western States, the energy transfer efficiency of the hammer of the CME-75 truck rig used on site averaged 86 percent

when measured in December 2016. All N-values presented in this report are in blows per foot, as counted in the field. No corrections of any kind have been applied.

A.2.2 Undisturbed Sampling

Undisturbed samples were collected at selected depths using 3-inch O.D. thin-wall Shelby tubes, which were pushed into the undisturbed soil at the bottoms of boreholes with a hydraulic ram. The soils exposed at the ends of the tubes were identified and described in the field. After examination, the ends of the tubes were sealed to preserve the natural moisture of the samples. The sealed tubes were stored in the upright position and care was taken to avoid shock and vibration during their transport to and storage in the laboratory.

A.3 HAND-AUGER BORINGS

Hand-auger borings HA-1 through HA-3 were located and drilled by Shannon & Wilson staff on May 11, 2018. The borings were manually excavated to depths ranging from 4.5 to 5.0 feet using hand-auger tooling, which creates an approximately 2.7- to 3-inch-diameter hole. Representative disturbed samples were collected from the hand-auger cuttings during drilling, sealed to retain moisture, and returned to our laboratory for additional examination and testing.

A.4 BOREHOLE INSTALLATIONS AND ABANDONMENT

A.4.1 Observation Well

Observation wells were installed to depths of 33 feet in boring B-2 and 25 feet in boring B-3 to allow for ongoing groundwater level measurements. The wells were constructed using 2-inch-diameter, schedule 40 polyvinyl chloride (PVC) pipe. The bottom 10 feet of pipe are machine slotted (screened) to allow groundwater to enter. The annulus around the screened section of pipe is backfilled with a sand filter pack. The annulus around the solid PVC pipe above is backfilled with bentonite chips. The well is protected at the surface with a flush-mount monument set in concrete. Well construction details and measured water levels are shown on the Log of Boring B-1 and B-3 on Figures A2 and A4, respectively.

A.4.2 Borehole Abandonment

Boring B-2 was backfilled in accordance with Oregon Department of Water Resources regulations, using bentonite chips and matching surface material. Hand augers were backfilled with excavated material.

A.5 MATERIAL DESCRIPTIONS

Soil samples were described and identified visually in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The specific terminology used is defined in the Soil Description and Log Key, Figure A1. Consistency, color, relative moisture, degree of plasticity, peculiar odors, and other distinguishing characteristics of the samples were noted.

Once transported to the Shannon & Wilson laboratory, the samples were re-examined, various classification tests were performed, and the field descriptions and identifications were modified, where necessary. Shannon & Wilson refined the visual-manual soil descriptions and identifications based on the results of the laboratory tests, using elements of the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. However, ASTM D2487 was not followed in full because it requires that a suite of tests be performed to fully classify a single sample.

A.6 LOGS OF BORINGS

Summary logs of borings are presented in Figures A2 through A7. Material descriptions and interfaces on the logs are interpretive, and actual changes may be gradual. The left-hand portion of the boring logs provides description, identification, and geotechnical unit designation for the materials encountered in the boring. The right-hand portion of the boring logs shows a graphic log, sample locations and designations, well installation details, groundwater information, and a graphical representation of N-values, natural water contents, Atterberg limits, fines content, and sample recovery.

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

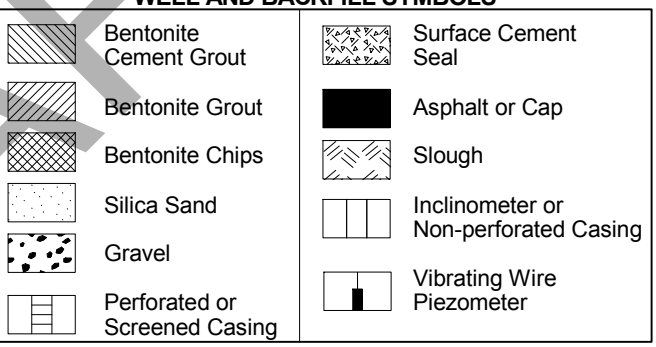
PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS



PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Memorial Park Pump Station
Wilsonville, Oregon

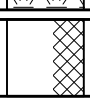
SOIL DESCRIPTION AND LOG KEY

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A1
Sheet 1 of 3

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)
FILL	Placed by humans, both engineered and nonengineered. May include various soil materials and debris.				The Fill graphic symbol is combined with the soil graphic that best represents the observed material

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the *CL-ML* area of the plasticity chart.
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.
3. The soil graphics above represent the various USCS identifications (i.e., *GP*, *SM*, etc.) and may be augmented with additional symbology to represent differences within USCS designations. *Sandy Silt (ML)*, for example, may be accompanied by the *ML* soil graphic with sand grains added. Non-USCS materials may be represented by other graphic symbols; see log for descriptions.

Memorial Park Pump Station
Wilsonville, Oregon

SOIL DESCRIPTION AND LOG KEY

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GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4%
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10%
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20%
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20%

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
approx.	Approximate/Approximately
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Memorial Park Pump Station
Wilsonville, Oregon

SOIL DESCRIPTION AND LOG KEY

May 2018 24-1-04234-001

Total Depth:	51.5 ft.	Northing:	~ 603,284 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 95 ft.	Easting:	~ 7,621,085 ft.	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME-75 Truck Rig #5	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:	Hammer Efficiency = 86%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Very soft to medium stiff, brown mottled orange-brown, *Lean Clay with Sand (CL)*; wet; fine sand; medium plasticity; trace organics; micaceous; slight iron oxidation and staining.

ALLUVIUM

83.0
12.0

Very soft to medium stiff, tan-brown, *Fat Clay (CH)*; moist; trace fine sand; high plasticity; micaceous; moderate iron oxidation and staining.

78.0
17.0

Very soft, blue-gray, *Silt to Silt with Sand (ML)*; wet; few to little fine sand; low plasticity; trace organics and organic debris; micaceous; stratified with few to little interbeds of *Silty Sand (SM)*.

CATASTROPHIC FLOOD DEPOSITS

At 25 feet grades to *Sand with Silt (ML)*; stratified with some interbeds of *Silty Sand (SM)*.

68.0
27.0

Soft to medium stiff, dark gray, *Silt with Sand (ML)*; moist; fine sand; low plasticity; trace organics; micaceous.

64.5
30.5

Medium dense, dark gray, *Silty Sand (SM)*; wet; trace fine subrounded gravel; fine to medium sand, trace coarse sand; nonplastic fines; micaceous.

61.5
33.5

Stiff, light blue-gray mottled orange-brown, *Fat Clay (CH)*; moist; high plasticity; moderate iron oxidation and staining.

PLIOCENE/PLEISTOCENE SEDIMENTS

CONTINUED NEXT SHEET

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10, S-11A, S-11B, S-12, S-13

4/26/2018

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *lbs / inches*

140 lbs / 30 inches

0 20 40 60 80 100

5 4 10 3 0 0 15 5 0 20 1 0 25 4 30 15 35 13

0 20 40 60 80 100

LEGEND

- Standard Penetration Test
- 3" O.D. Shelby Tube
- Groundwater Level on Date Shown
- Recovery (%)
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF BORING B-1

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A2
Sheet 1 of 2

REV 3

Total Depth:	*51.5 ft.*	Northing:	*~ 603,284 ft.*	Drilling Method:	*Mud Rotary*	Hole Diam.:	*5 in.*
Top Elevation:	*~ 95 ft.*	Easting:	*~ 7,621,085 ft.*	Drilling Company:	*Western States*	Rod Type:	*NWJ*
Vert. Datum:		Station:	~	Drill Rig Equipment:	*CME-75 Truck Rig #5*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:	~	Other Comments:	*Hammer Efficiency = 86%*		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Continued:

Stiff, light blue-gray mottled orange-brown, *Fat Clay (CH)*; moist; high plasticity; moderate iron oxidation and staining.

PLIOCENE/PLEISTOCENE SEDIMENTS

Stiff, tan mottled orange-brown, *Lean Clay (CL)*; moist; trace fine to coarse sand; medium to high plasticity; moderate iron oxidation and staining; trace hard, sand-sized iron oxide deposits.

Completed: March 22, 2018

Elev. Depth (ft.)

53.0
42.0

43.5
51.5

Symbol | Samples | Ground Water | Depth, ft.

S-14
S-15
S-16

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *lbs / inches*

140 lbs / 30 inches

0 20 40 60 80 100

9
13
9

45 50 55 60 65 70 75

0 20 40 60 80 100

LEGEND

- Standard Penetration Test
- 3" O.D. Shelby Tube
- Groundwater Level on Date Shown
- Recovery (%)
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF BORING B-1

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A2
Sheet 2 of 2

REV 3

MASTER_LOG_E 24-1-04234.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 6/4/18 Log: KTR Rev: CKS Typ: ATH

Total Depth:	*51.5 ft.*	Northing:	*~ 603,252 ft.*	Drilling Method:	*Mud Rotary*	Hole Diam.:	*5 in.*
Top Elevation:	*~ 93 ft.*	Easting:	*~ 7,620,845 ft.*	Drilling Company:	*Western States*	Rod Type:	*NWJ*
Vert. Datum:		Station:	~	Drill Rig Equipment:	*CME-75 Truck Rig #5*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:	~	Other Comments:	*Hammer Efficiency = 86%*		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Very loose to loose, brown mottled orange-brown, *Silty Sand (SM)*; moist to wet; fine to medium sand; nonplastic to low plasticity fines; few organics; micaceous; slight iron oxidation and staining.

ALLUVIUM

85.0 / 8.0

Very soft to soft, dark gray, *Lean Clay with Sand (CL)*; wet; fine sand; low to medium plasticity; micaceous.

82.0 / 11.0

Very soft to medium stiff, dark gray to blue-gray, *Fat Clay to Elastic Silt (CH/MH)*; moist to wet; trace fine sand; high plasticity; few organics; micaceous.

76.0 / 17.0

Very soft to soft, dark gray, *Silt to Silt with Sand (ML)*; wet; fine to medium sand; low plasticity; trace organics; micaceous.

CATASTROPHIC FLOOD DEPOSITS

63.0 / 30.0

Medium dense, dark gray, *Silty Gravel with Sand (GM)*; wet; fine to coarse, subangular to rounded gravel; fine to coarse sand; nonplastic fines.

61.9 / 31.1

Medium stiff to very stiff, light blue-gray mottled orange-brown, *Fat Clay (CH)*; moist; trace fine sand; high plasticity.

PLIOCENE/PLEISTOCENE SEDIMENTS

CONTINUED NEXT SHEET

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

S-1, S-2A, S-2B, S-3, S-4, S-5, S-6, S-7, S-8, S-9A, S-9B, S-10

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *lbs / inches*

140 lbs / 30 inches

0 20 40 60 80 100

5: 4, 2 | 10: 0, 2 | 15: 5, 0 | 20: 2, 2 | 25: 2 | 30: 23 | 35: 18

0 20 40 60 80 100

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

LEGEND

Standard Penetration Test

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF BORING B-2

May 2018 | 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A3
Sheet 1 of 2

REV 3

MASTER_LOG_E 24-1-04234.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 6/4/18 Log: KTR Rev: CKS Typ: ATH

Total Depth:	*51.5 ft.*	Northing:	*~ 603,252 ft.*	Drilling Method:	*Mud Rotary*	Hole Diam.:	*5 in.*
Top Elevation:	*~ 93 ft.*	Easting:	*~ 7,620,845 ft.*	Drilling Company:	*Western States*	Rod Type:	*NWJ*
Vert. Datum:		Station:	~	Drill Rig Equipment:	*CME-75 Truck Rig #5*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:	~	Other Comments:	*Hammer Efficiency = 86%*		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *lbs / inches*

140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Medium stiff to very stiff, light blue-gray mottled orange-brown, *Fat Clay (CH)*; moist; trace fine sand; high plasticity; moderate iron oxidation and staining; trace hard, sand-sized iron oxide deposits.

PLIOCENE/PLEISTOCENE SEDIMENTS

S-11 S-12 S-13

14 15 7

45 50 55 60 65 70 75

41.5

51.5

Completed: March 22, 2018

LEGEND

Standard Penetration Test

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF BORING B-2

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A3
Sheet 2 of 2

REV 3

MASTER_LOG_E 24-1-04234.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 6/4/18 Log: KTR Rev: CKS Typ: ATH

Total Depth:	51.5 ft.	Northing:	~ 603,138 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 92 ft.	Easting:	~ 7,620,513 ft.	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME-75 Truck Rig #5	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:	Hammer Efficiency = 86%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Soft, brown, *Sandy Silt (ML)*; wet; fine sand; low plasticity; trace organics; micaceous; slight iron oxidation and staining.

ALLUVIUM

85.8 / 6.2

Very soft to medium stiff, dark gray to dark brown, *Lean Clay (CL)*; wet; trace fine sand; low to medium plasticity; trace to few organics; micaceous; stratified.

80.0 / 12.0

Medium stiff, dark gray, *Fat Clay (CH)*; wet; trace fine sand; high plasticity; trace organics; micaceous.

75.0 / 17.0

Very soft to soft, dark gray, *Silt (ML)*; wet; trace fine to medium sand; nonplastic to low plasticity; trace organics; micaceous.

CATASTROPHIC FLOOD DEPOSITS

68.0 / 24.0

Stiff, dark gray, *Sandy Silt (ML)*; wet; trace fine gravel; fine to coarse sand; nonplastic to low plasticity; micaceous.

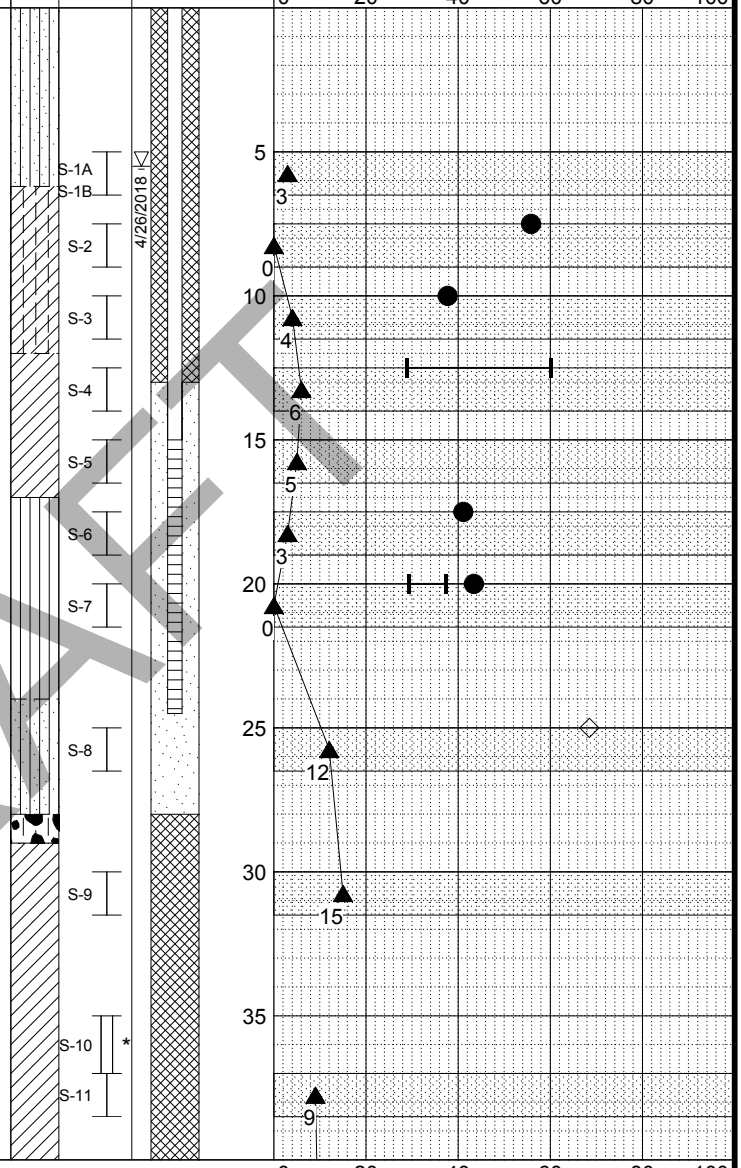
64.0 / 28.0

Driller indicates gravel from 28 to 29 feet.

63.0 / 29.0

Stiff to very stiff, light gray mottled orange-brown, *Fat Clay (CH)*; moist; high plasticity; moderate iron oxidation and staining.

PLIOCENE/PLEISTOCENE SEDIMENTS



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered
Standard Penetration Test
3" O.D. Shelby Tube
Groundwater Level on Date Shown

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF BORING B-3

May 2018 | 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A4
Sheet 1 of 2

REV 3

Total Depth:	51.5 ft.	Northing:	~ 603,138 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 92 ft.	Easting:	~ 7,620,513 ft.	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME-75 Truck Rig #5	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:	Hammer Efficiency = 86%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *lbs / inches*

140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Stiff to very stiff, light gray mottled orange-brown, *Fat Clay (CH)*; moist; high plasticity; moderate iron oxidation and staining

50.0
42.0

PLIOCENE/PLEISTOCENE SEDIMENTS

Stiff, red-brown and light gray mottled orange-brown, *Lean Clay with Sand (CL)*; moist; fine to coarse sand; medium to high plasticity; micaceous; moderate iron oxidation and staining; few hard, sand-sized iron oxide deposits.

S-12

S-13

40.5
51.5

Completed: March 22, 2018

45 50 55 60 65 70 75

10

9

0 20 40 60 80 100

LEGEND

* Sample Not Recovered

Standard Penetration Test

3" O.D. Shelby Tube

Groundwater Level on Date Shown

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ——— Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF BORING B-3

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A4
Sheet 2 of 2

REV 3

MASTER_LOG_E 24-1-04234.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 6/4/18 Log: KTR Rev: CKS Typ: ATH

Total Depth:	*4.5 ft.*	Northing:	~	Drilling Method:	*Hand Boring*	Hole Diam.:	*3 in.*
Top Elevation:	~	Easting:	~	Drilling Company:	*Shannon & Wilson, Inc.*	Rod Type:	~
Vert. Datum:		Station:	~	Drill Rig Equipment:	*Hand Auger*	Hammer Type:	~
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Brown, *Lean Clay to Silt (CL/ML)*; moist to wet; trace to few fine sand; medium plasticity; trace organics and rootlets.

ALLUVIUM

Gray, *Silty Sand (SM)*; wet; fine to medium sand; low plasticity; trace organics.

Gray and brown, *Silty Sand (SM)*; wet; fine to coarse sand; nonplastic to low plasticity fines; little to some organics, wood fragments and wood debris.

Hand auger refusal on wood at approximately 4.5 feet below ground surface; possible buried log.

Completed: May 11, 2018

Elev. Depth (ft.): 2.0, 3.5, 4.5

Symbol

Samples: S-1, S-2, S-3, S-4, S-5

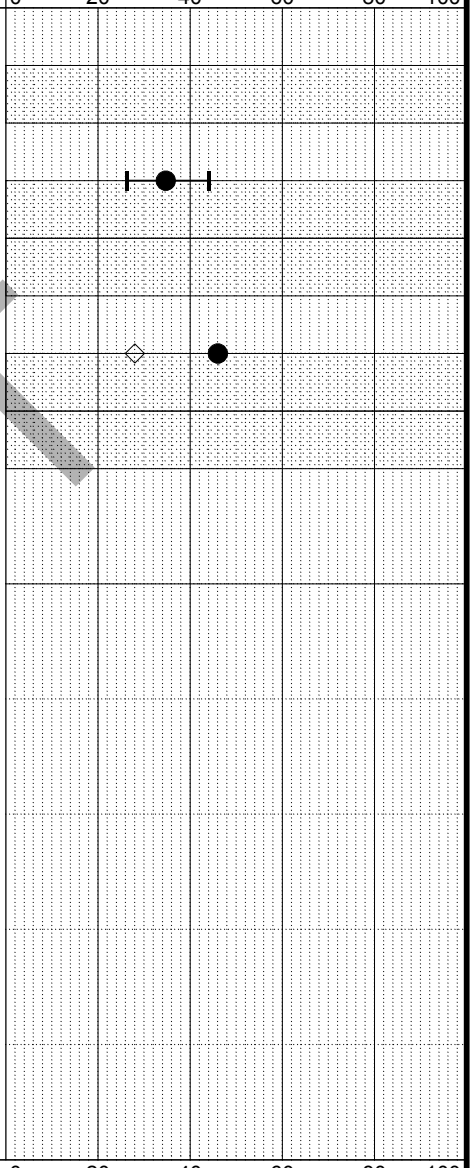
Ground Water: During Drilling

Depth, ft.: 5

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60 80 100



0 20 40 60 80 100

LEGEND

Grab Sample

Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit — Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF HAND AUGER HA-1

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
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FIG. A5

REV 3

MASTER_LOG_E 24-1-04234.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 6/4/18 Log: PTO Rev: CKS Typ: PTO

Total Depth:	5 ft.	Northing:	~	Drilling Method:	Hand Boring	Hole Diam.:	3 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Shannon & Wilson, Inc.	Rod Type:	~
Vert. Datum:		Station:	~	Drill Rig Equipment:	Hand Auger	Hammer Type:	~
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60 80 100

Brown, *Lean Clay (CL)*; moist; medium plasticity; trace organics and rootlets; micaceous; slight iron oxidation and staining.

ALLUVIUM

S-1 S-2 S-3 S-4 S-5 S-6 S-7

2.0

Dark gray to dark brown, *Fat Clay to Elastic Silt (CH/MH)*; moist; high plasticity.

5

Completed: May 11, 2018

5.0

0 20 40 60 80 100

LEGEND

Grab Sample

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF HAND AUGER HA-2

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A6

REV 3

Total Depth:	*5 ft.*	Northing:	~	Drilling Method:	*Hand Boring*	Hole Diam.:	*3 in.*
Top Elevation:	~	Easting:	~	Drilling Company:	*Shannon & Wilson, Inc.*	Rod Type:	~
Vert. Datum:		Station:	~	Drill Rig Equipment:	*Hand Auger*	Hammer Type:	~
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Brown, *Silt to Lean Clay (ML/CL)*; moist; trace fine sand; low to medium plasticity; trace to few organics.

ALLUVIUM

Dark gray to dark brown, *Lean Clay (CL)*; wet; medium to high plasticity; trace to few organics.

Completed: May 11, 2018

Elev. Depth (ft.): 1.5; 5.0

Symbol; Samples: S-1, S-2, S-3, S-4, S-5, S-6

Ground Water: During Drilling

Depth, ft.: 5

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60 80 100

LEGEND

Grab Sample

Groundwater Level ATD

Recovery (%)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Memorial Park Pump Station
Wilsonville, Oregon

LOG OF HAND AUGER HA-3

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A7

REV 3

MASTER_LOG_E 24-1-04234.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 6/4/18 Log: PTO Rev: CKS Typ: PTO

APPENDIX B

LABORATORY TEST RESULTS

APPENDIX B

LABORATORY TEST RESULTS

TABLE OF CONTENTS

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B.1 GENERAL B-1

B.2 SOIL TESTING B-1
- B.2.1 Moisture (Natural Water) Content B-1
- B.2.2 Atterberg Limits B-2
- B.2.3 Particle-Size Analysis B-2

FIGURES

B1 Atterberg Limits Results
B2 Grain Size Distribution

ATTACHMENT

Benchmark Geolabs Laboratory Test Results

APPENDIX B

LABORATORY TEST RESULTS

B.1 GENERAL

Soil samples obtained during the field explorations were described and identified in the field in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM D2488. The specific terminology used is presented on Appendix A, Figure A1. The samples were reviewed in the Shannon & Wilson laboratory. The physical characteristics of the samples were noted, and the field descriptions and identifications were modified, where necessary, in accordance with terminology presented in Appendix A, Figure A1.

Representative samples were selected for various laboratory tests. We refined our visual-manual soil descriptions and identifications based on the results of the laboratory tests, using elements of the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. The refined descriptions and identifications were then incorporated into the Logs of Borings, presented in Appendix A. Note that ASTM D2487 was not followed in full because it requires that a suite of tests be performed to fully classify a single sample.

The soil testing program included moisture content analyses, Atterberg limits tests, and particle-size analyses. The testing on the soil samples from the borings were performed by Benchmark Geolabs of McMinnville, Oregon and the results are attached to this Appendix. Results of the Benchmark Geoloab testing are also displayed graphically on Figures B1 and B2. The testing on the soil samples from the hand auger explorations, were performed by Shannon & Wilson, of Lake Oswego Oregon. The testing was performed in accordance with applicable ASTM standards. General testing procedures are summarized in the following paragraphs.

B.2 SOIL TESTING

B.2.1 Moisture (Natural Water) Content

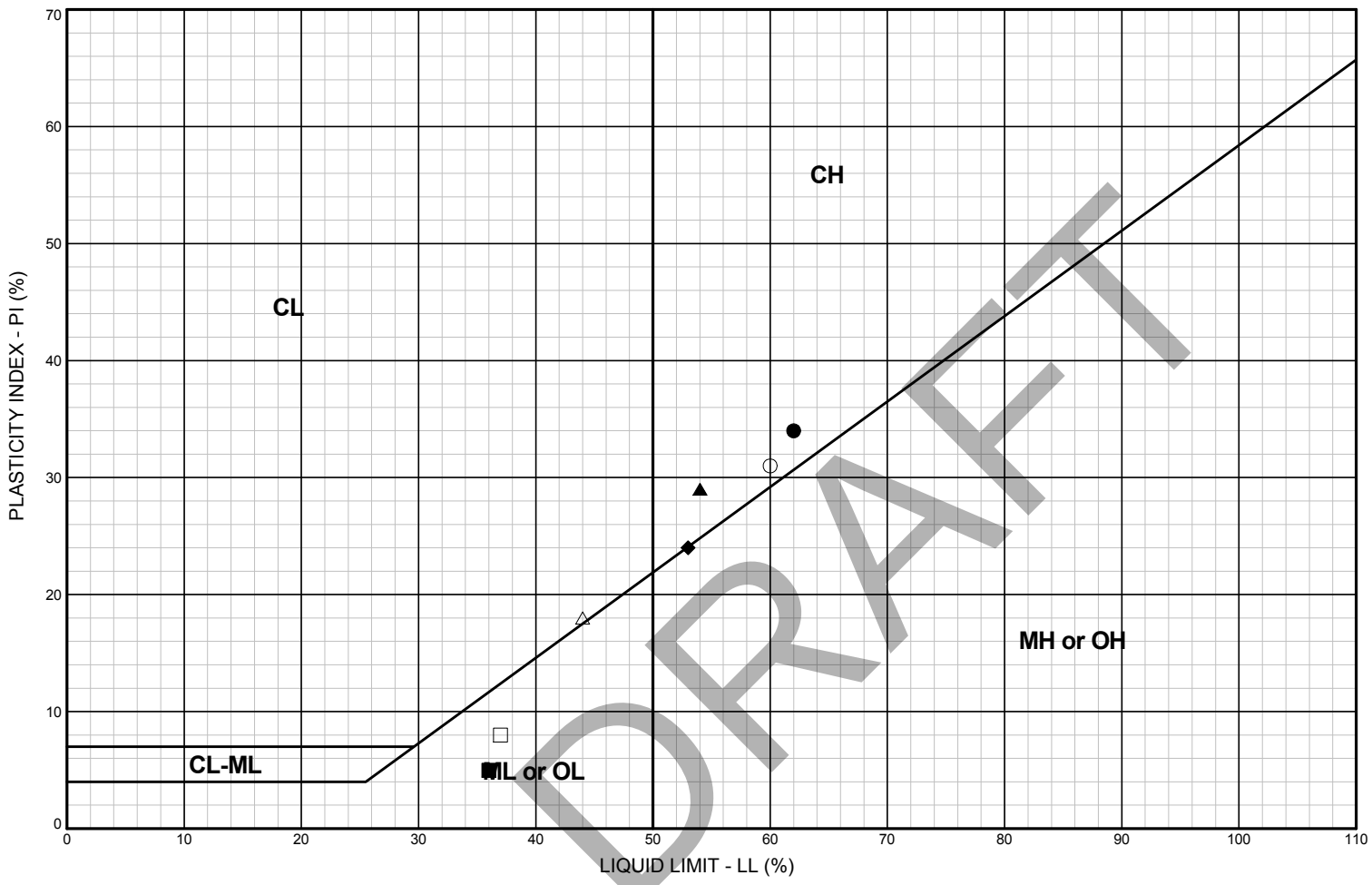
Natural moisture content analyses were performed in accordance with ASTM D2216 on selected soil samples. The natural moisture content is a measure of the amount of moisture in the soil at the time the explorations are performed and is defined as the ratio of water weight to dry soil weight, expressed as a percentage. The results of the moisture content analyses are presented graphically on the Logs of Borings in Appendix A.

B.2.2 Atterberg Limits

Atterberg limits were determined for four samples in accordance with ASTM D4318. This analysis yields index parameters of the soil that are useful in soil identification, as well as in a number of analyses, including liquefaction analysis. An Atterberg limits test determines a soil's liquid limit (LL) and plastic limit (PL). These are the maximum and minimum moisture contents at which the soil exhibits plastic behavior. A soil's plasticity index (PI) can be determined by subtracting PL from LL. The LL, PL, and PI of tested samples are presented on Figure B1, Atterberg Limits Results. The results are also shown graphically on the Logs of Borings in Appendix A. For the purposes of soil description, Shannon & Wilson uses the term nonplastic to refer to soils with a PI less than 4, low plasticity for soils with a PI range of 4 to 10, medium plasticity for soils with a PI range of 10 to 20, high plasticity for soils with a PI greater than 20.

B.2.3 Particle-Size Analysis

Particle-size analyses were conducted on two samples to determine their grain-size distributions. Grain size distributions were determined in accordance with ASTM D6913. For all samples, a wet sieve analysis was performed to determine the percentage (by weight) of each sample passing the No. 200 (0.075 mm) sieve. The material retained on the No. 200 sieve was then shaken through a series of sieves to determine the distribution of the plus No. 200 fraction. Results of all particle-size analyses are presented on Figure B2, Grain Size Distribution. The percentage of each sample passing the No. 200 sieve is also shown graphically on the Logs of Borings in Appendix A.



NOTES

1) Atterberg limits tests were performed in general accordance with ASTM D4318 unless otherwise noted in the report.

2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

3) Plasticity adjectives used in sample descriptions correspond to plasticity index as follows:
- Nonplastic (NP) (< 4%)
- Low Plasticity (4 to 10%)
- Medium Plasticity (10 to 20%)
- High Plasticity (> 20%)

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	LL %	PL %	PI %[3]	NAT. W.C. %	FINES %
● B-1, S-5	15.0	*CH*	*Fat Clay*	62	28	34		
■ B-1, S-9	25.0	*ML*	*Silt with Sand*	36	31	5	40	
▲ B-1, S-14	40.0	*CH*	*Fat Clay*	54	25	29		
◆ B-2, S-5	15.0	*CH/MH*	*Fat Clay to Elastic Silt*	53	29	24		
○ B-3, S-4	12.5	*CH*	*Fat Clay*	60	29	31		
□ B-3, S-7	20.0	*ML*	*Silt*	37	29	8	43	
△ HA-1, S-2	1.5	*CL/ML*	*Lean Clay to Silt*	44	26	18	35	

Memorial Park Pump Station
Wilsonville, Oregon

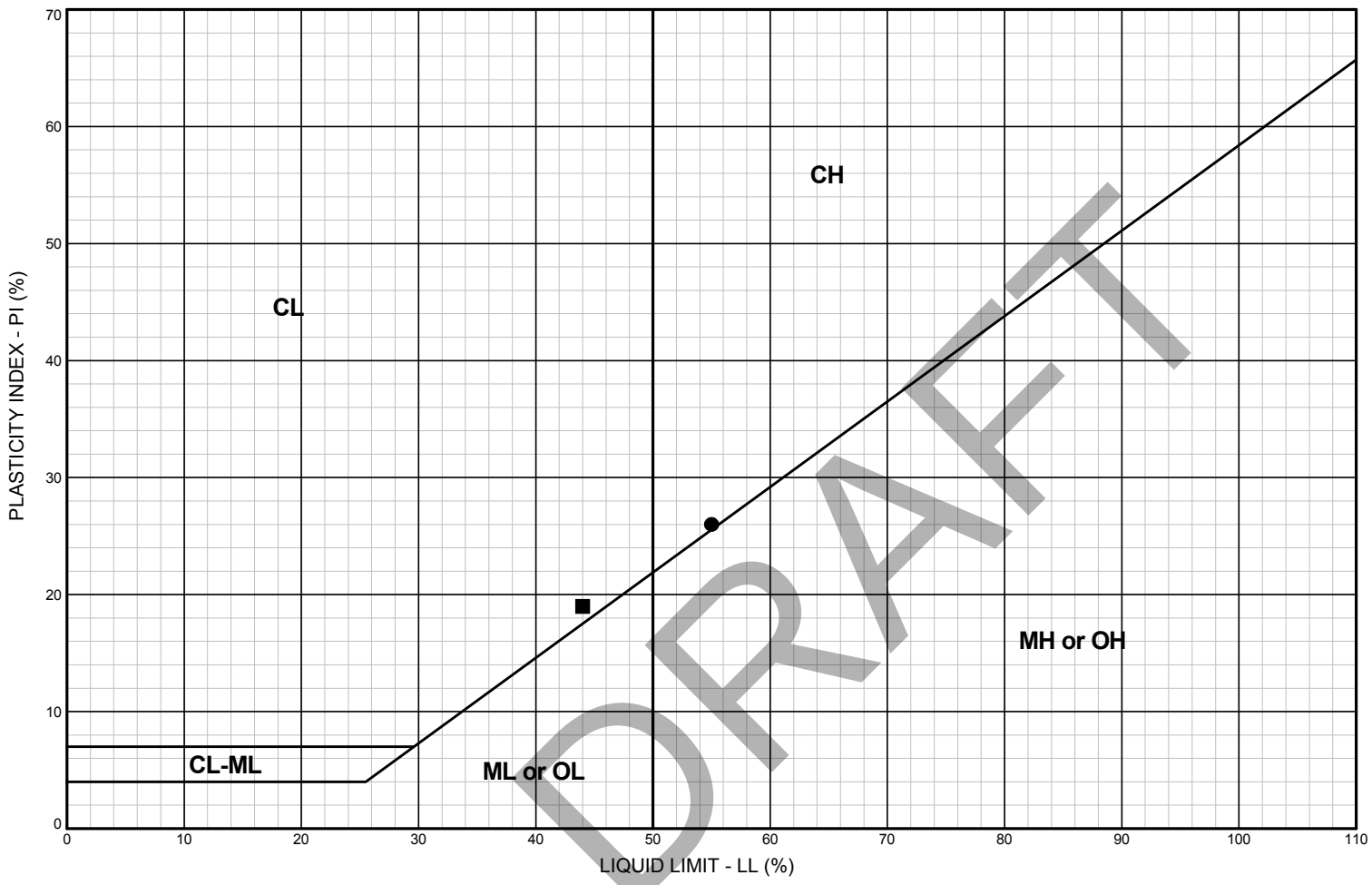
ATTERBERG LIMITS RESULTS

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B1
Sheet 1 of 2

FIG. B1



NOTES

1) Atterberg limits tests were performed in general accordance with ASTM D4318 unless otherwise noted in the report.

2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

3) Plasticity adjectives used in sample descriptions correspond to plasticity index as follows:
- Nonplastic (NP) (< 4%)
- Low Plasticity (4 to 10%)
- Medium Plasticity (10 to 20%)
- High Plasticity (> 20%)

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	LL %	PL %	PI %[3]	NAT. W.C. %	FINES %
● HA-2, S-6	3.5	*CH/MH*	*Fat Clay to Elastic Silt*	55	29	26	38	
■ HA-3, S-5	3.5	*CL*	*Lean Clay*	44	25	19	42	

Memorial Park Pump Station
Wilsonville, Oregon

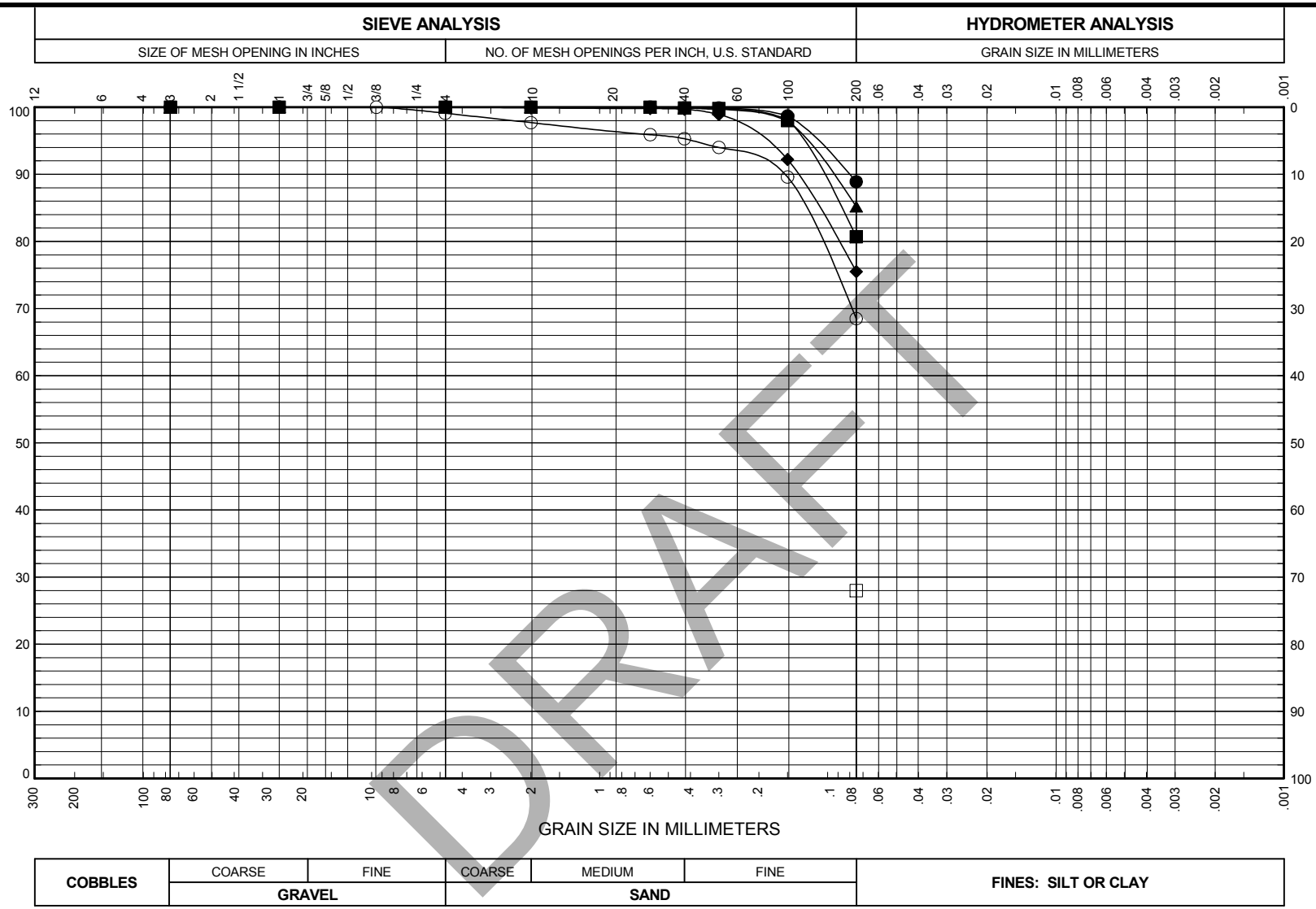
ATTERBERG LIMITS RESULTS

May 2018 24-1-04234-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B1
Sheet 2 of 2

FIG. B1



NOTES:
1) Sieve analyses were performed in general accordance with ASTM D6913, sieve with hydrometer analyses were performed in general accordance with ASTM D422, and amount finer than #200 sieve analyses were performed in general accordance with ASTM D1140 unless otherwise noted in the report.
2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	GRAVEL %	SAND %	FINES %	NAT. W.C. %	DRY DENSITY PCF
● B-1, S-8	22.5	*ML*	*Silt*	0	11	89		
■ B-1, S-10	27.0	*ML*	*Silt with Sand*	0	19	81		
▲ B-2, S-7	20.0	*ML*	*Silt with Sand*	0	15	85		
◆ B-2, S-8	25.0	*ML*	*Silt with Sand*	0	25	76		
○ B-3, S-8	25.0	*ML*	*Sandy Silt*	1	31	69		
□ HA-1, S-4	3.0	*SM*	*Silty Sand*	-	-	28	46	

Memorial Park Pump Station
Wilsonville, Oregon

GRAIN SIZE DISTRIBUTION

May 2018 24-1-04234-001

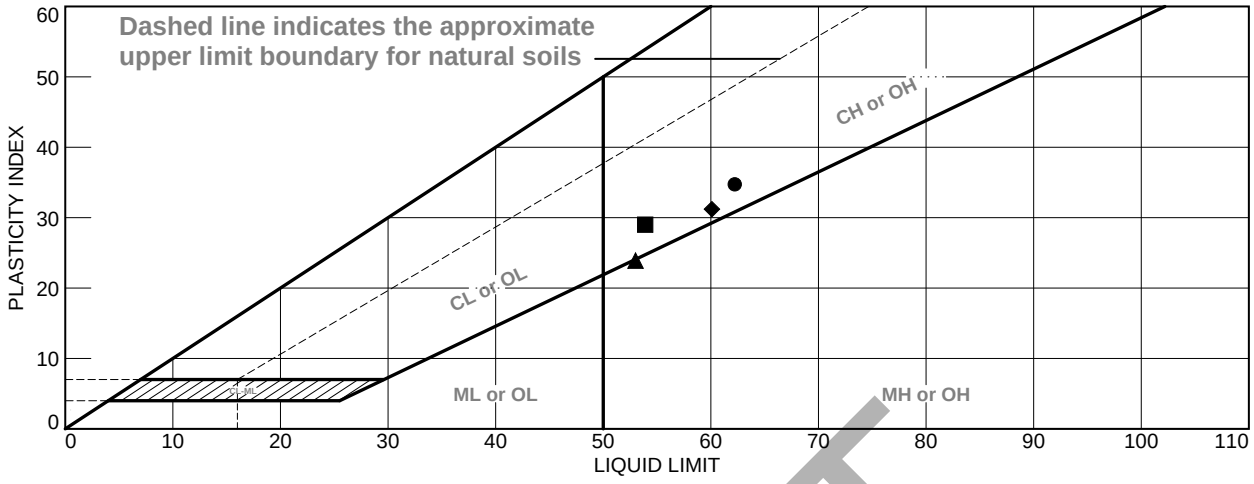
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

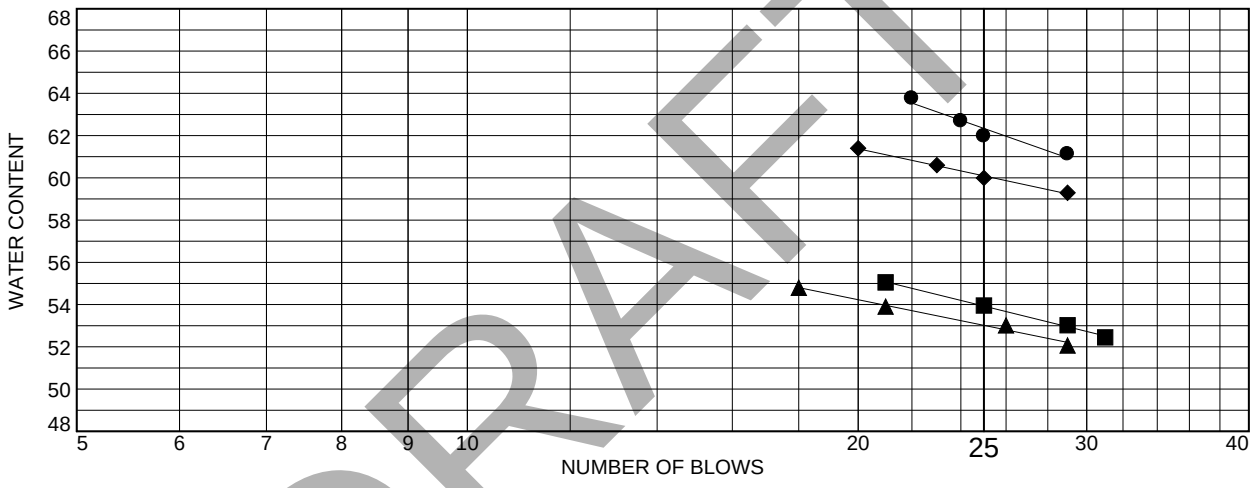
FIG. b2

FIG. b2

GSA MAIN 24-1-04234.GPJ SHAN WILGDT 5/30/18

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Very Dark Greenish Gray Fat CLAY	62.3	27.7	34.6			
■	Mottled Gray Fat CLAY	53.9	24.9	29.0			
▲	Very Dark Greenish Gray Fat CLAY	53.0	29.1	23.9			
◆	Dark Gray Fat CLAY	60.1	28.9	31.2			

Project No. 020-008 **Client:** Shannon & Wilson

Project: Memorial Park Pump station - 24-*1-04234

●**Source of Sample:** B-1 **Depth:** 15-16.5 **Sample Number:** S5

■**Source of Sample:** B-1 **Depth:** 40-41.5 **Sample Number:** S-14

▲**Source of Sample:** B-2 **Depth:** 15-16.5 **Sample Number:** S-5

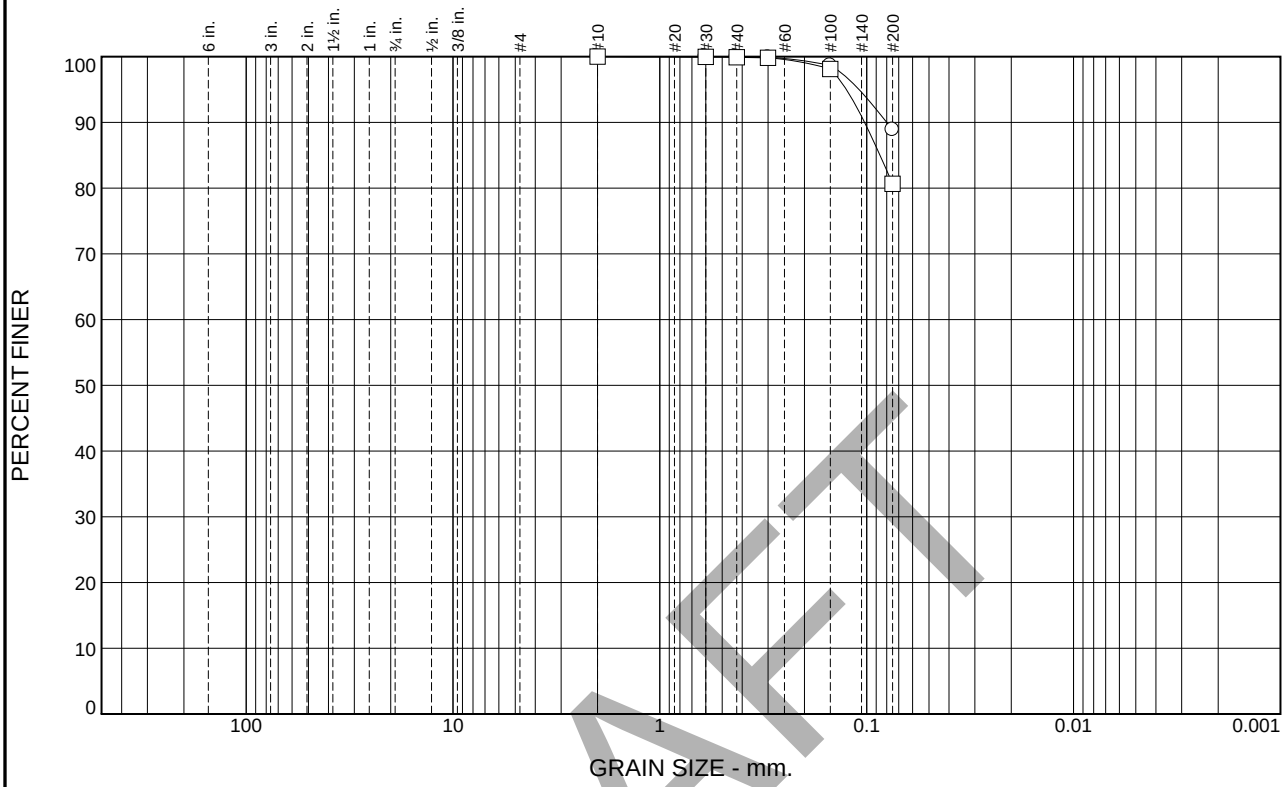
◆**Source of Sample:** B-3 **Depth:** 12.5-14 **Sample Number:** S4

Remarks:

Benchmark Geolabs, LLC

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.0	11.1	88.9					
□	0.0	0.0	19.3	80.7					

SIEVE inches size	○ PERCENT FINER	□ PERCENT FINER
GRAIN SIZE		
D_{60}		
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○ PERCENT FINER	□ PERCENT FINER
#10	100.0	100.0
#30	100.0	100.0
#40	99.9	99.9
#50	99.9	99.8
#100	98.7	98.1
#200	88.9	80.7

Material Description

○ Very Dark Gray SILT

□ Very Dark Gray SILT w/ Sand

REMARKS:

○

□

○ Source of Sample: B-1 Depth: 22.5-24 Sample Number: S-8

□ Source of Sample: B-1 Depth: 27-28.5 Sample Number: S10

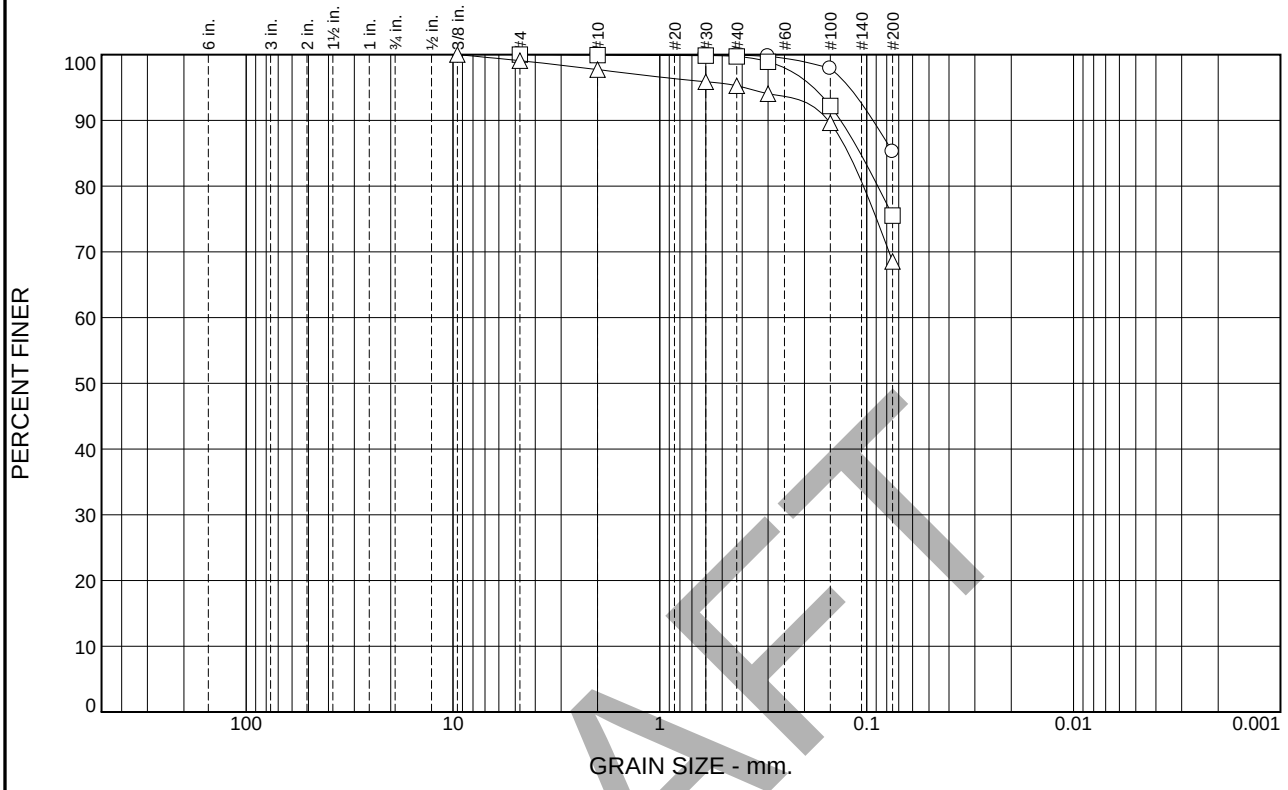
Benchmark Geolabs, LLC

Client: Shannon & Wilson

Project: Memorial Park Pump station - 24-*1-04234

Project No.: 020-008 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.0	14.8		85.2				
□	0.0	0.0	24.5		75.5				
△	0.0	0.9	30.6		68.5				

SIEVE inches size	PERCENT FINER ○	□	△
3/8"			100.0
GRAIN SIZE			
D_{60}			
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		100.0	99.1
#10	100.0	99.9	97.7
#30	99.9	99.8	95.9
#40	99.9	99.7	95.3
#50	99.7	98.9	94.0
#100	97.9	92.2	89.6
#200	85.2	75.5	68.5

Material Description

○ Dark Gray SILT W/ Sand

□ Dark Gray SILT w/ Sand

△ Dark Gray Sandy SILT

REMARKS:

○

□

△

○ Source of Sample: B-2 Depth: 20-21.5 Sample Number: S7

□ Source of Sample: B-2 Depth: 25-26.5 Sample Number: S8

△ Source of Sample: B-3 Depth: 25-26.5 Sample Number: S8

Benchmark Geolabs, LLC

Client: Shannon & Wilson

Project: Memorial Park Pump station - 24-*1-04234

Project No.: 020-008

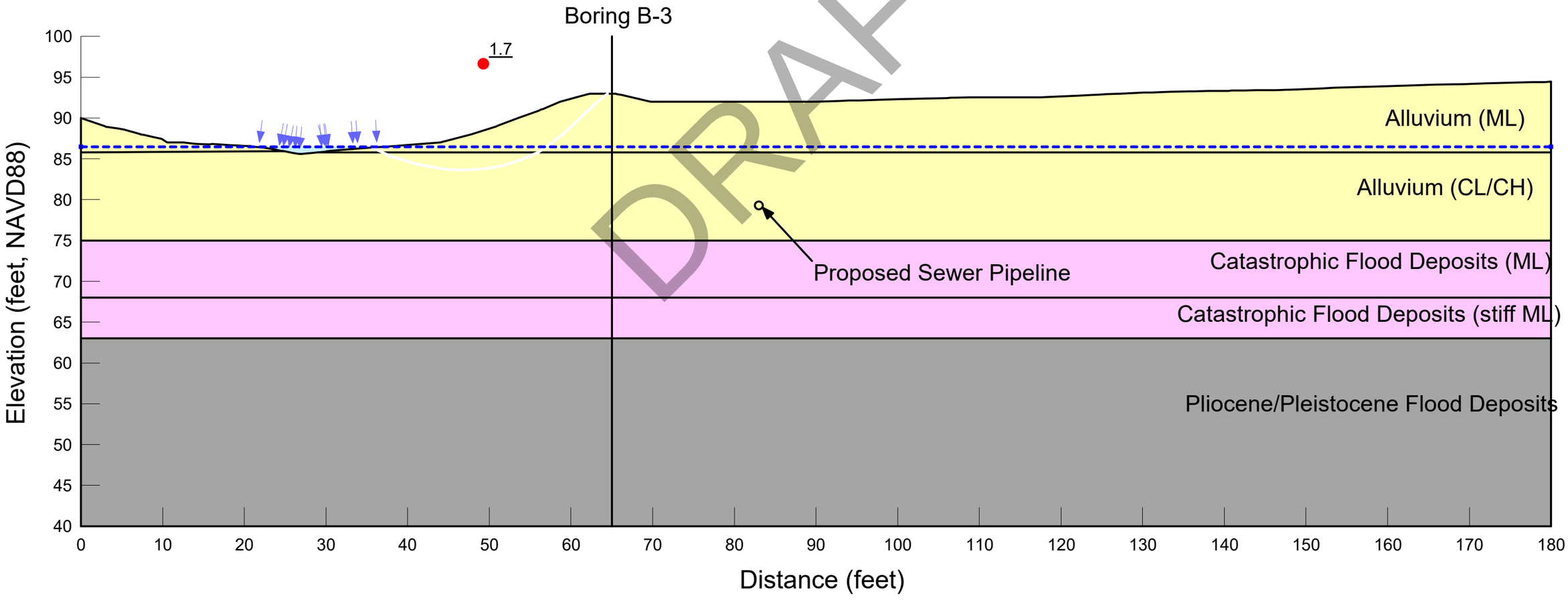
Figure

APPENDIX C

SLOPE STABILITY ANALYSIS RESULTS

Memorial Park Pump Station
Section A-A'
Morgenstern-Price
Static
Hor. Seismic Coef: 0

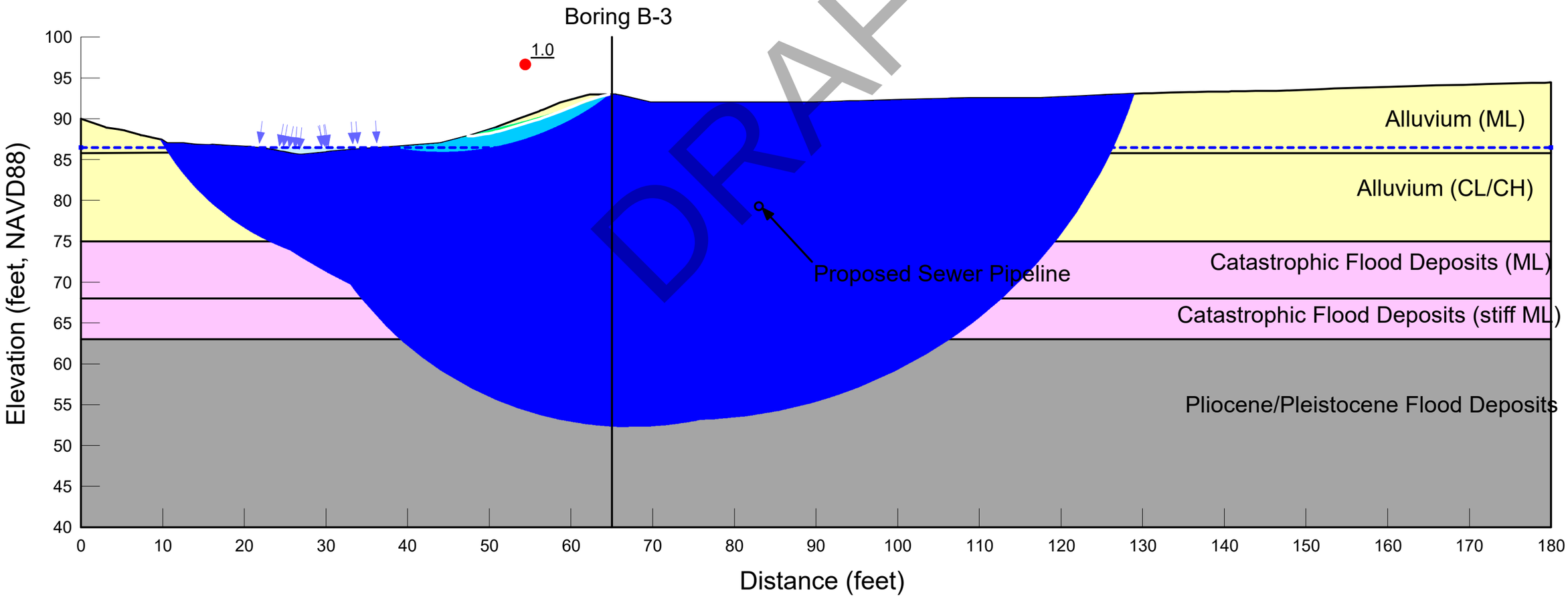
		(pcf)	(psf)	(°)
	Alluvium (ML)	110	0	32
	Alluvium (CL/CH)	110	0	26
	Catastrophic Flood Deposits (ML)	110	0	31
	Catastrophic Flood Deposits (stiff ML)	110	0	33
	Pliocene/Pleistocene Sediments	120	200	32



Memorial Park Pump Station
Section A-A'
Morgenstern-Price Seismic
Hor. Seismic Coef: 0.27

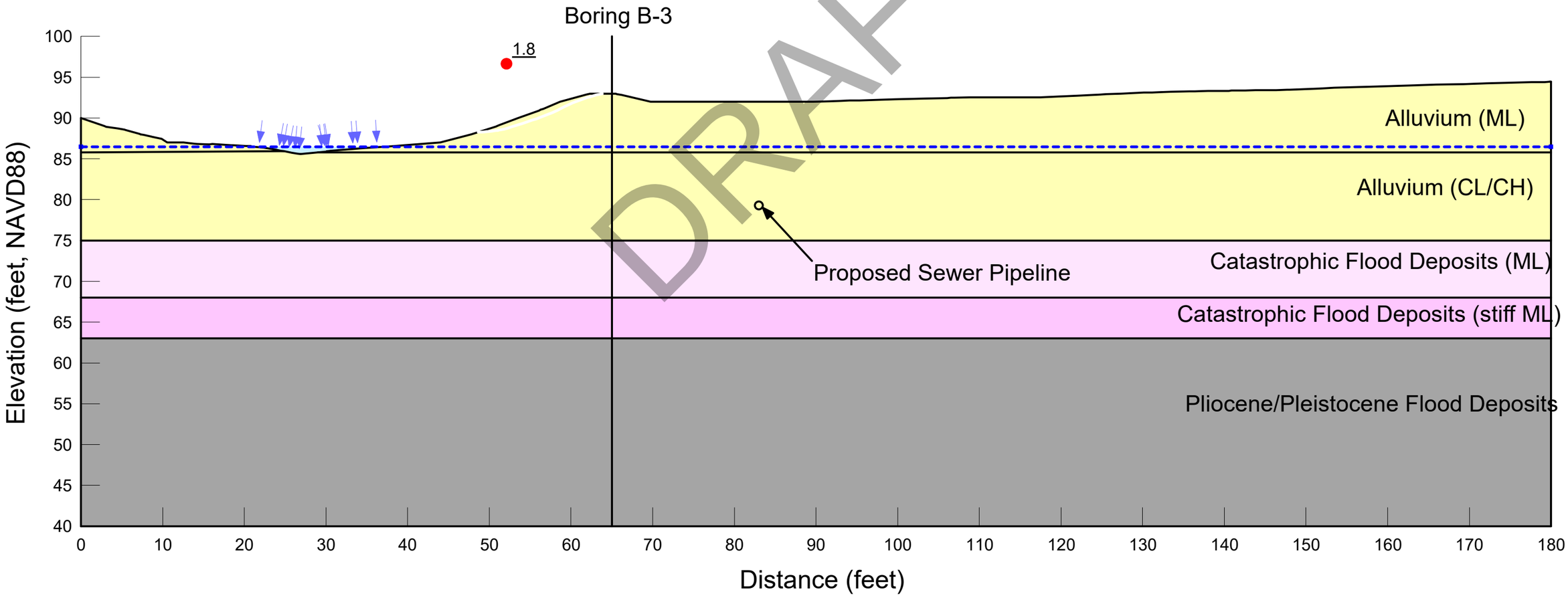
Factor of Safety
- ≤ 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- 1.0 - 1.1
- ≥ 1.1

		(pcf)	(p
	Alluvium (ML)	110	0
	Catastrophic Flood Deposits (ML)	110	0
	Catastrophic Flood Deposits (stiff ML)	110	0
	Pliocene/Pleistocene Sediments	120	2(
	Alluvium (CL/CH) (Undrained)	110	5(



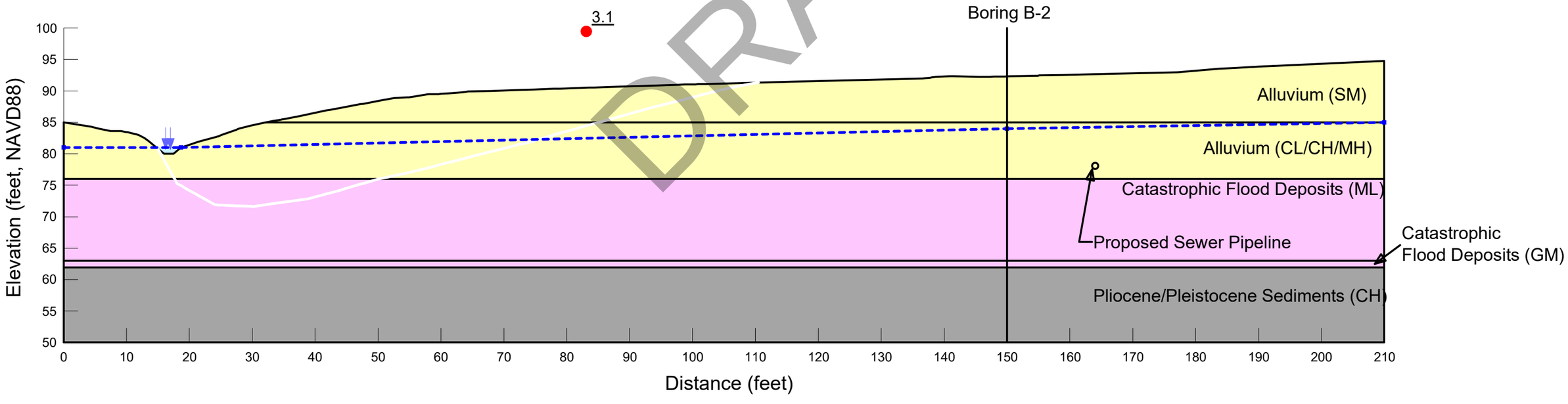
Memorial Park Pump Station
Section A-A'
Morgenstern-Price
Post-Seismic
Hor. Seismic Coef: 0

		(pcf)	(psf)	(°)
	Alluvium (ML)	110	0	32
	Catastrophic Flood Deposits (stiff ML)	110	0	33
	Pliocene/Pleistocene Sediments	120	200	32
	Alluvium (CL/CH) (Undrained)	110	500	0
	Catastrophic Flood Deposits (ML) (Liq.)	110	0	5



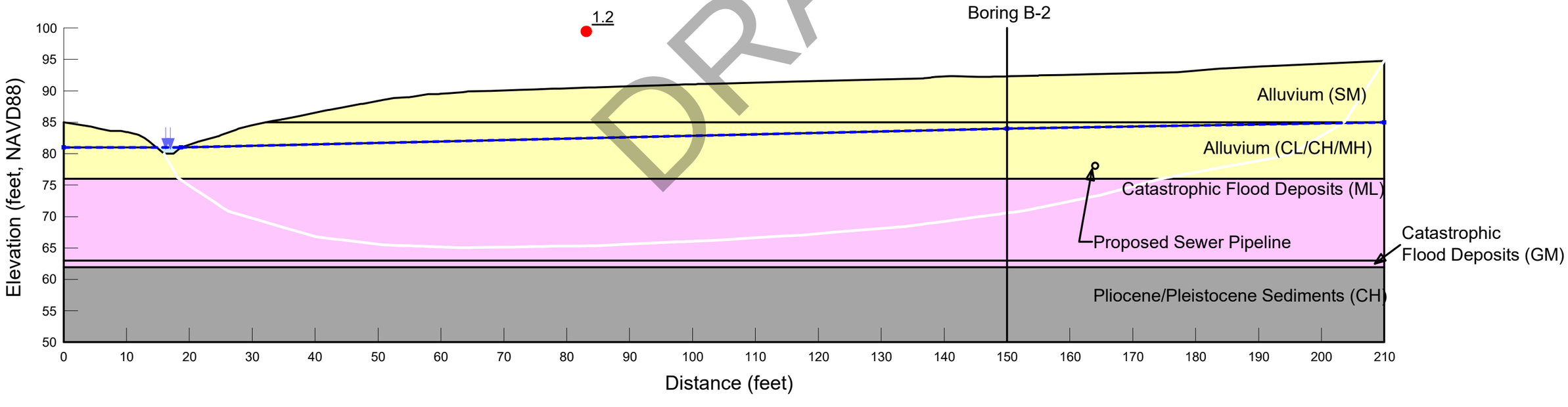
Memorial Park Pump Station
Section B-B'
Morgenstern-Price
Static
Hor. Seismic Coef: 0

		(pcf)	(psf)	(°)
	Alluvium (SM)	110	0	32
	Alluvium (CL/CH/MH)	110	0	26
	Catastrophic Flood Deposits (ML)	110	0	31
	Catastrophic Flood Deposits (GM)	115	0	34
	Pliocene/Pleistocene Sediments	120	200	32



Memorial Park Pump Station
Section B-B'
Morgenstern-Price Seismic
Hor. Seismic Coef: 0.27

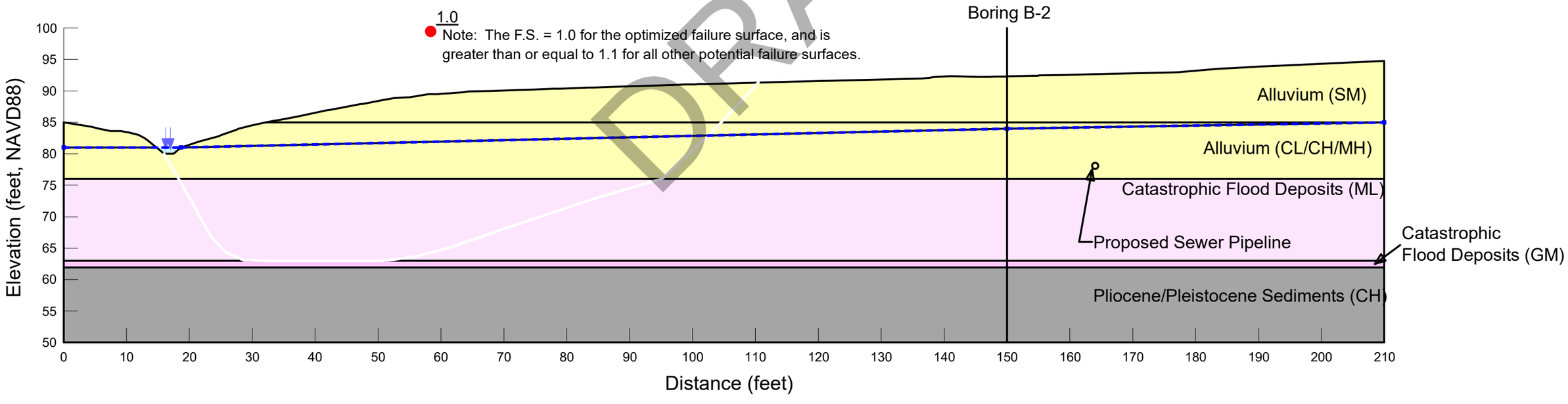
		(pcf)	(psf)	(°)
	Alluvium (SM)	110	0	32
	Alluvium (CL/CH/MH)	110	0	26
	Catastrophic Flood Deposits (ML)	110	0	31
	Catastrophic Flood Deposits (GM)	115	0	34
	Pliocene/Pleistocene Sediments	120	200	32
	Alluvium (CL/CH/MH) (Undrained)	110	500	0



Memorial Park Pump Station
Section B-B'
Morgenstern-Price
Post-Seismic
Hor. Seismic Coef: 0

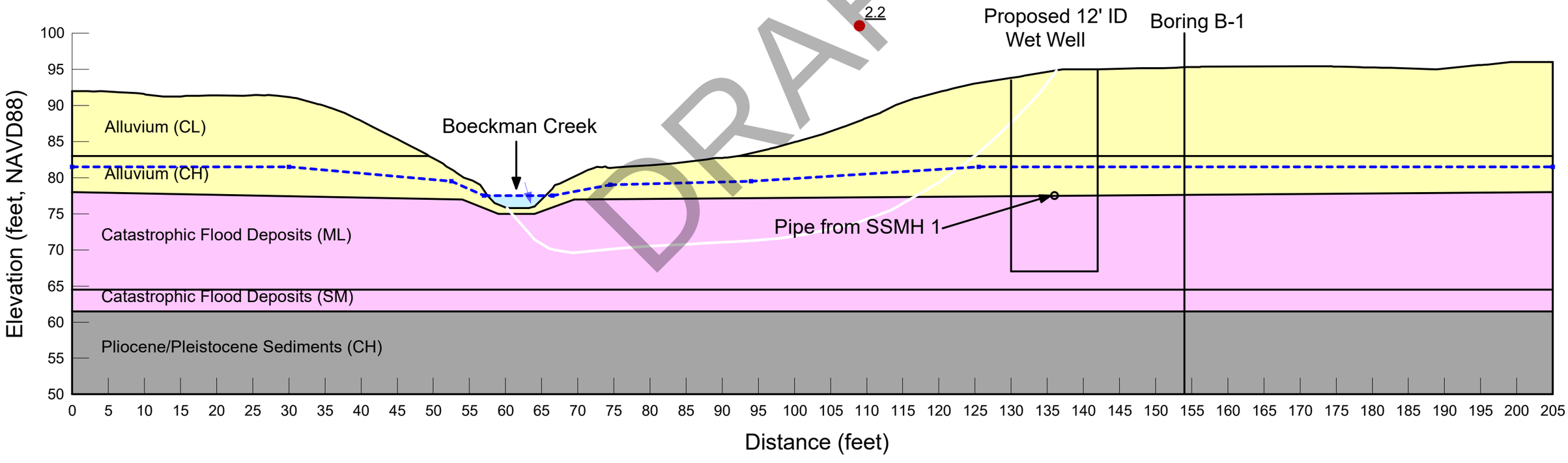
Factor of Safety
- ≤ 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- 1.0 - 1.1
- ≥ 1.1

		(pcf)	(psf)	(°)
	Alluvium (SM)	110	0	32
	Alluvium (CL/CH/MH)	110	0	26
	Catastrophic Flood Deposits (GM)	115	0	34
	Pliocene/Pleistocene Sediments	120	200	32
	Catastrophic Flood Deposits (ML) (Liq.)	110	0	4
	Alluvium (CL/CH/MH) (Undrained)	110	500	0



Memorial Park Pump Station
Section C-C'
Morgenstern-Price
Static
Hor. Seismic Coef: 0

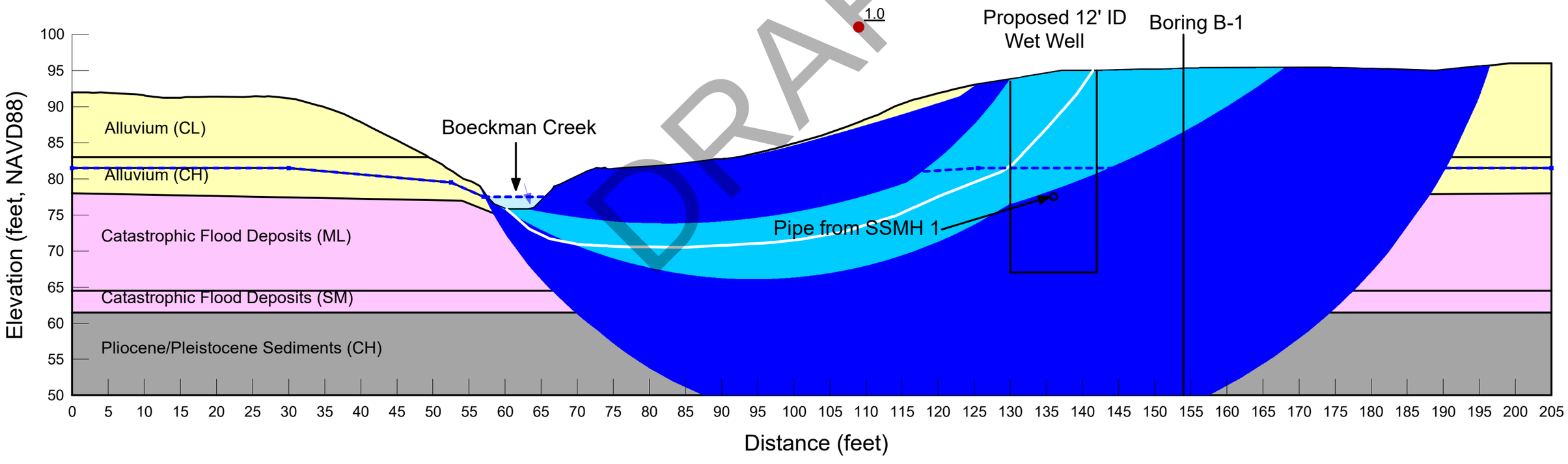
		(pcf)	(psf)	(°)
	Alluvium (CL)	110	100	30
	Alluvium (CH)	110	200	24
	Catastrophic Flood Deposits (ML)	110	0	32
	Catastrophic Flood Deposits (SM)	115	0	34
	Pliocene/Pleistocene Sediments	120	200	32



Memorial Park Pump Station
Section C-C'
Morgenstern-Price Seismic
Hor. Seismic Coef: 0.27

Factor of Safety
- ≤ 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- 1.0 - 1.1
- ≥ 1.1

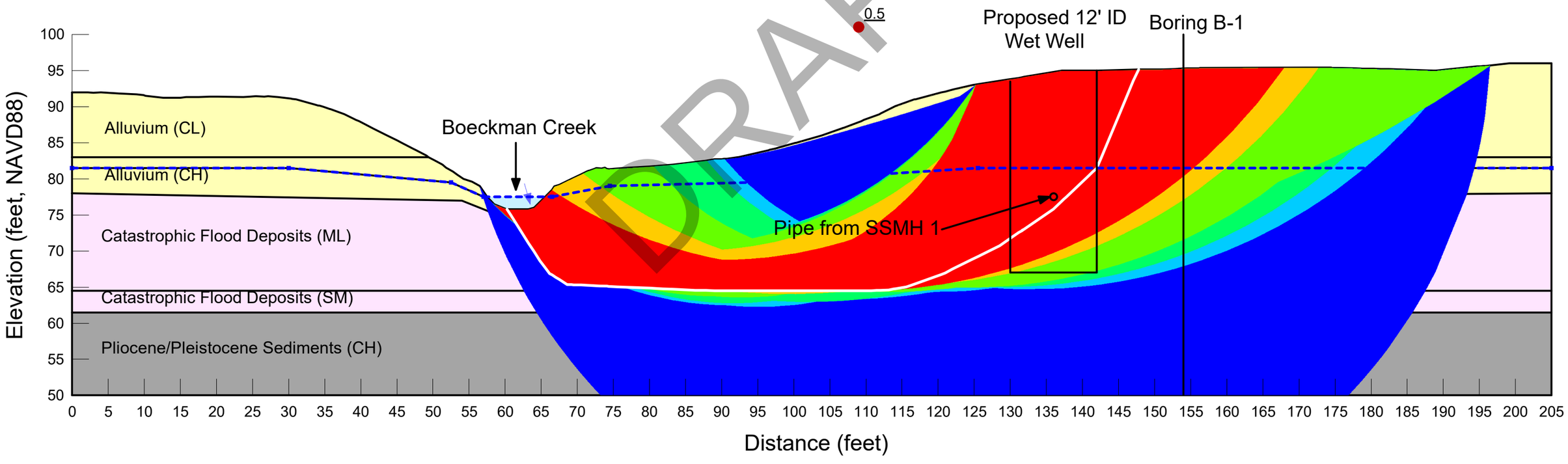
		(pcf)	(psf)	(°)
	Alluvium (CL)	110	100	30
	Alluvium (CH)	110	200	24
	Catastrophic Flood Deposits (ML)	110	0	32
	Catastrophic Flood Deposits (SM)	115	0	34
	Pliocene/Pleistocene Sediments	120	200	32
	Alluvium (CH) (Undrained)	110	500	0



Memorial Park Pump Station
Section C-C'
Morgenstern-Price
Post-Seismic
Hor. Seismic Coef: 0

Factor of Safety
- ≤ 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- 1.0 - 1.1
- ≥ 1.1

		(pcf)	(psf)	(°)
	Alluvium (CL)	110	100	30
	Alluvium (CH)	110	200	24
	Pliocene/Pleistocene Sediments	120	200	32
	Catastrophic Flood Deposits (ML) (Liq.)	110	0	4
	Catastrophic Flood Deposits (SM) (Liq.)	115	0	20
	Alluvium (CH) (Undrained)	110	500	0



APPENDIX D

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to and part of Report: 24-1-04234-001

Date: May 2018
To: Murraysmith, Inc.
Mr. Adam Crafts, PE

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

SECTION 4

murraysmith

Outdoor Lighting Information

OLF 3RH LED
Security Floodlight

Catalog Number

Notes

Type

Hit the Tab key or mouse over the page to see all interactive elements.

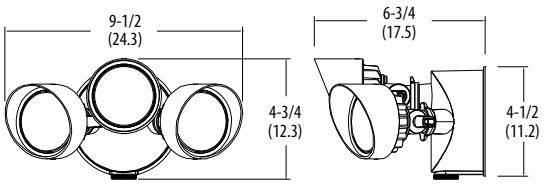
Specifications

Width: 9.50" *(24.1cm)*

Height: 4.75" *(12.1 cm)*

Depth: 6.75" *(17.1 cm)*

Weight: 2.0 lbs. *(0.90 kg)*



Introduction

The OLF 3RH LED security floodlight provides more light with enhanced design features offering more choices from an LED security flood offering.

Delivering 3,100 lumens, at only 36 input watts, OLF 3RH replaces up to (2) 150W PAR incandescent lamps offering 88% energy savings. OLF 3RH offers with or without dusk-to-dawn photocell control, offering a flexible and cost effective solution for any application requiring reliable security lighting.

Ordering Information

EXAMPLE: OLF 3RH 40K 120 PE BZ

OLF					
Series	**Number of heads**	**Color Temperature[1]**	**Voltage**	**Control**	**Finish**
OLF	3RH 3 heads, round	40K 4000K [1]	120 120 volts	(blank) none PE Dusk-to-dawn photocell	BZ Bronze WH White

Complete list of configurations available:

- OLF 3RH 40K 120 BZ
- OLF 3RH 40K 120 PE BZ
- OLF 3RH 40K 120 WH
- OLF 3RH 40K 120 PE WH

NOTES

1. Correlated color temperature (CCT) shown is nominal per ANSI C78, 377-2008.
2. LED lifespan based on IESNA LM-80-08 results and calculated per IESNA TM-21-11 methodology.

FEATURES & SPECIFICATIONS

INTENDED USE
36 watt LED wall or ceiling mount security floodlight delivers 3,100 lumens for an energy-ecient replacement of (2) 150W incandescent security lights. The OLF LED provides years of maintenance-free general illumination for outdoor applications. Ideal for entrances, walkways, cooridors, yards, driveways and patios.

CONSTRUCTION
Rugged cast-aluminum, corrosion-resistant housing with dark bronze or white polyester powder paint for lasting durability. LED lamp heads are thermally isolated from the driver that is located in the rear housing, promoting a long service life. Lenses are sealed to keep out moisture, dirt and bugs. LEDs maintain 70% of light output at 50,000 hours of service life[2].

ELECTRICAL
Consumes 36 input watts utilizing 120V 60Hz driver. Available in models with and without dusk-to-dawn photocell. Rated for outdoor installations, -40°C minimum ambient.

INSTALLATION
Mounts to a recessed junction box on wall or ceiling. Crossbar and hardware provided. Wet location listed for mounting 4 feet above ground. Tool-less adjustable heads allow for precise aiming. Neighbor-friendly visors are adjustable or removable.

LISTINGS
UL/cUL listed Listed to U.S. and Canadian safety standards for wet locations. Tested in accordance with IESNA LM-79 and LM-80 standards.

WARRANTY
Five-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx.

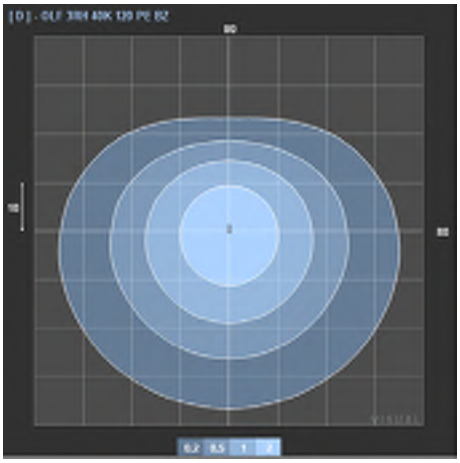
Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

Photometric Diagrams

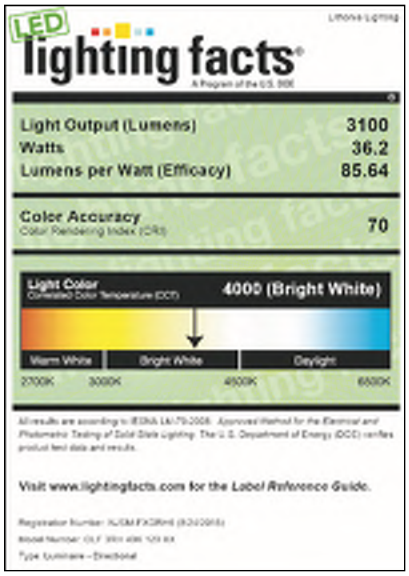
Full photometric data report available within 2 weeks from request. Contact Acuity tech support.

LEGEND

- 0.1 fc
- 0.2 fc
- 0.5 fc
- 1.0 fc



Lighting Facts Labels



OLWX1 LED
LED Wall Luminaire

Catalog Number

Notes

Type

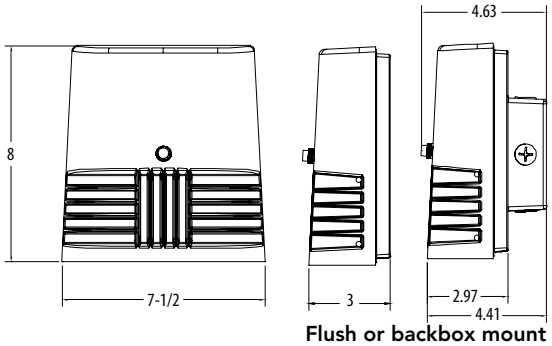
Hit the Tab key or mouse over the page to see all interactive elements.

Introduction

The OLWX1 is versatile and energy efficient. It is designed to replace up to 250W metal halide while saving over 87% in energy costs. Whether you are mounting it to a recessed junction box, conduit/ through wiring, as an up light, as a down light, or as a flood light – the OLWX1 has all applications covered.

Specifications

Width:	7-1/2" *(19 cm)*
Height:	8" *(20.3 cm)*
Depth:	3" *(7.62 cm)*
Weight:	5 lbs *(2.27kg)*



Flush or backbox mount

Ordering Information

EXAMPLE: OLWX1 LED 20W 50K

OLWX1 LED											
Series	**Performance Package**		**Color Temperature**		**Voltage**		**Controls**		**Finish**	
OLWX1 LED	13W	13 watts	40K	4000 K [1]	(blank)	MVOLT [2]	(blank)	None	(blank)	Dark bronze
	20W	20 watts	50K	5000 K	120	120V [3]	PE	120V button photocell [1,3]		
	40W	40 watts			347	347V				

Accessories

Ordered and shipped separately.

OLWX1TS	Slipfitter – size 1
OLWX1YK	Yoke – size 1
OLWX1THK	Knuckle – size 1

NOTES

1 Not available with 347V option.
2 MVOLT driver operates on any line voltage from 120-277V (50/60Hz).
3 Specify 120V when ordering with photocell (PE option).

FEATURES & SPECIFICATIONS

INTENDED USE

The versatility of the OLWX1 LED combines a sleek, low-profile wall pack design with energy efficient, low maintenance LEDs for replacing up to 250W metal halide fixtures. Mounting accessories are available to convert the OLWX1 LED into an energy efficient flood light.

OLWX1 LED is ideal for outdoor applications such as building perimeters, loading areas, driveways and sign and building flood lighting.

CONSTRUCTION

Cast-aluminum housing with textured dark bronze polyester powder paint for durability. Integral heat sinks optimize thermal management through conductive and convective cooling. LEDs are protected behind a glass lens. Housing is sealed against moisture and environmental contaminants (IP65 rated). See Lighting Facts label and photometry reports for details.

ELECTRICAL

Light engine consists of 1 high-efficiency Chip On Board (COB) LED with integrated circuit board mounted directly to the housing to maximize heat dissipation and promote long life (L73/100,000 hours at 25°C). Electronic drivers have a power factor >90% and THD <20% and a minimum 2.5kV surge rating. Flood light mounting accessories include an additional 6kV surge protection device. LEDs are available in 4000K and 5000K CCTs.

INSTALLATION

Easily mounts to recessed junction boxes with the included wall mount bracket, or for surface mounting and conduit entry - with the included junction box with five 1/2" threaded conduit entry hubs. Flood light mounting accessories (sold separately) include knuckle, integral slipfitter and yoke mounting options. Each flood mount accessory comes with a top visor and vandal guard. Luminaire may be wall or ground mounted in downward or upward orientation.

LISTINGS

UL Listed to U.S. and Canadian safety standards for wet locations. Rated for -40° C minimum ambient. Tested in accordance with IESNA LM-79 and LM-80 standards. DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org to confirm which versions are qualified.

WARRANTY

5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx.

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25°C. Specifications subject to change without notice.

LITHONIA LIGHTING

One Lithonia Way • Conyers, Georgia 30012 • Phone: 800.279.8041 • www.lithonia.com

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts.

Fixture Model Number	CCT	System Watts	Lumens	LPW	B	U	G	CRI
OLWX1 LED 13W 40K	4000 K	14 W	1,271	91	1	0	0	>70
OLWX1 LED 13W 50K	5000 K	14 W	1,289	92	1	0	0	>80
OLWX1 LED 20W 40K	4000 K	20 W	2,697	135	1	0	0	>70
OLWX1 LED 20W 50K	5000 K	19 W	2,663	140	1	0	0	>70
OLWX1 LED 40W 40K	4000 K	39 W	4,027	101	2	0	0	>70
OLWX1 LED 40W 50K	5000 K	37 W	4,079	110	2	0	0	>70

Electrical Load

Fixture Model Number	Rated Power (watts)	Input current at given input voltage (amps)				
		120V	208V	240V	277V	347V
OLWX1 LED 13W 40K	14 W	0.12	0.07	0.06	0.06	0.04
OLWX1 LED 13W 50K	14 W	0.12	0.07	0.06	0.06	0.04
OLWX1 LED 20W 40K	20 W	0.20	0.12	0.10	0.09	0.06
OLWX1 LED 20W 50K	19 W	0.20	0.12	0.10	0.09	0.06
OLWX1 LED 40W 40K	39 W	0.37	0.21	0.19	0.16	0.11
OLWX1 LED 40W 50K	37 W	0.37	0.21	0.19	0.16	0.11

Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

	0°C	10°C	20°C	25°C	30°C	40°C
13W	1.06	1.03	1.01	1.00	0.99	0.96
20W	1.06	1.04	1.01	1.00	0.99	0.96
40W	1.07	1.04	1.01	1.00	0.99	0.96

Projected LED Lumen Maintenance

Data references the extrapolated performance projections in a **25°C ambient**, based on 10,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11).

To calculate LLF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Operating Hours	0	25,000	50,000	100,000
OLWX1 LED 13W	1.00	0.92	0.85	0.73
OLWX1 LED 20W	1.00	0.92	0.85	0.73
OLWX1 LED 40W	1.00	0.94	0.88	0.79

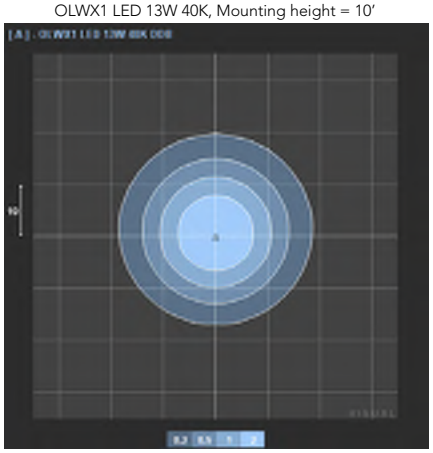
Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit the Lithonia Lighting OLWX1 LED homepage. Tested in accordance with IESNA LM-79 and LM-80 standards

LEGEND

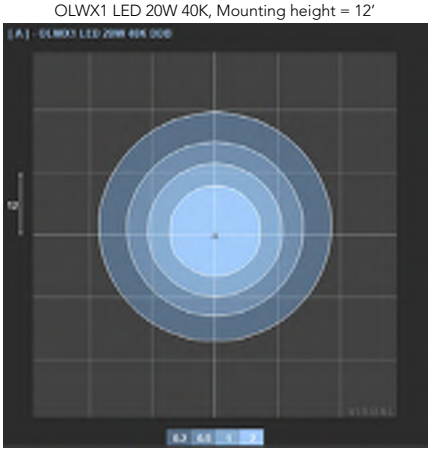
- 0.2 fc
- 0.5 fc
- 1.0 fc
- 2.0 fc

OLWX1 LED 13W 40K, Mounting height = 10'



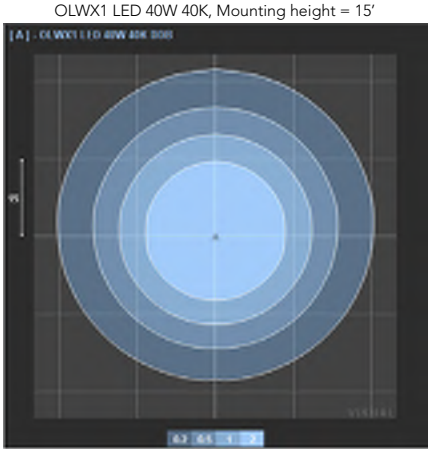
Test No. LTL22697 tested in accordance with IESNA LM-79-08.

OLWX1 LED 20W 40K, Mounting height = 12'



Test No. LTL22696 tested in accordance with IESNA LM-79-08.

OLWX1 LED 40W 40K, Mounting height = 15'



Test No. LTL22695 tested in accordance with IESNA LM-79-08.

Accessories

OLWX1TS
Slipfitter – size 1

Standard size tenon is 2 1/8".
The slip fitter has a range of 2" to 2 3/8".

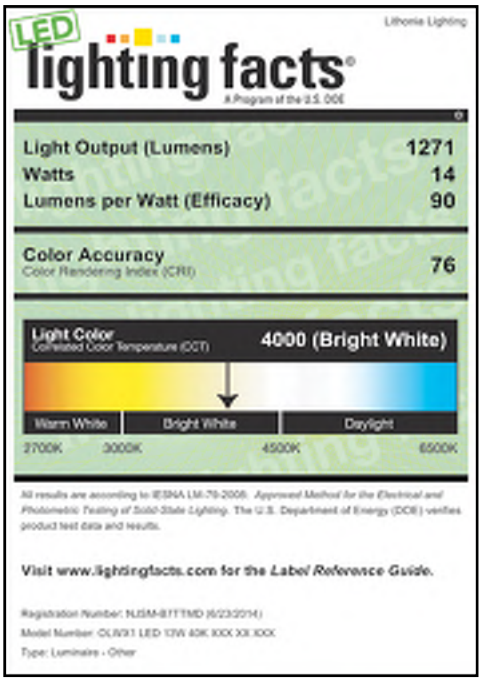
OLWX1YK
Yoke – size 1

OLWX1THK
Knuckle – size 1

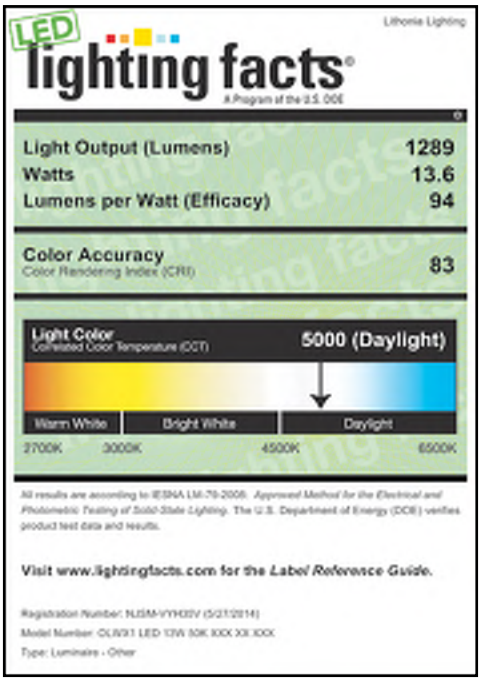
Top Visor and Vandal Guard included with accessories

Lighting Facts Labels

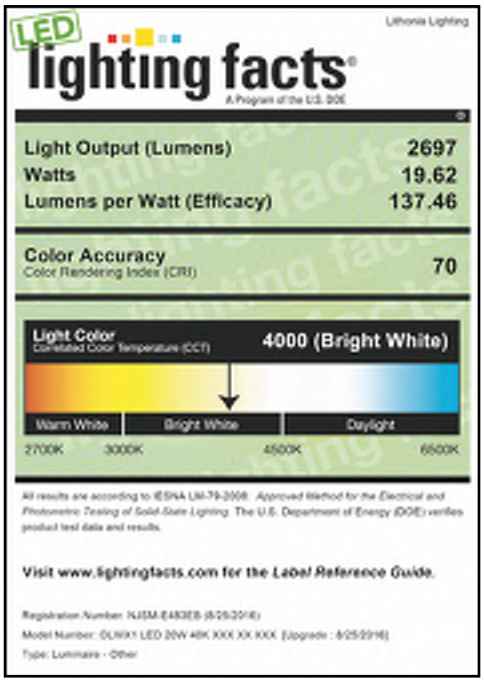
OLWX1 LED 13W 40K XXX XX XXX



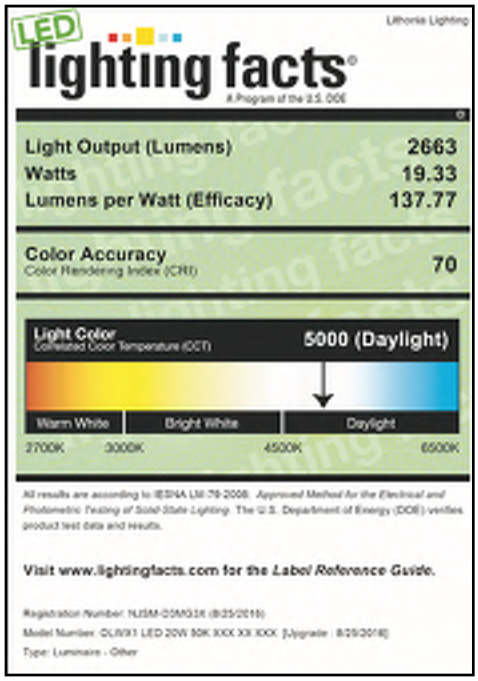
OLWX1 LED 13W 50K XXX XX XXX



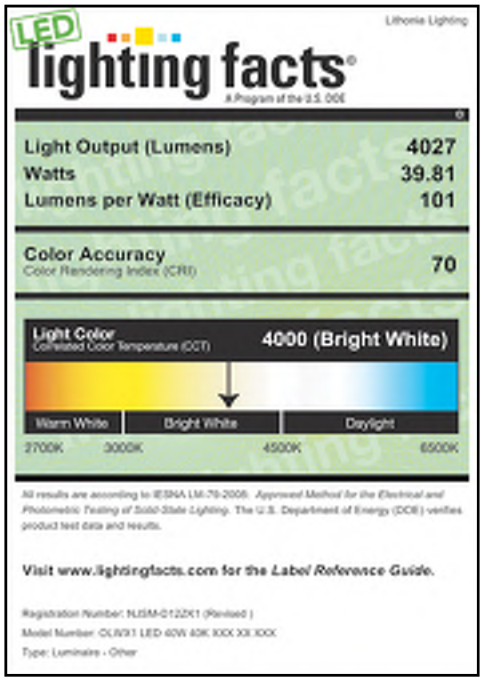
OLWX1 LED 20W 40K XXX XX XXX



OLWX1 LED 20W 50K XXX XX XXX



OLWX1 LED 40W 40K XXX XX XXX



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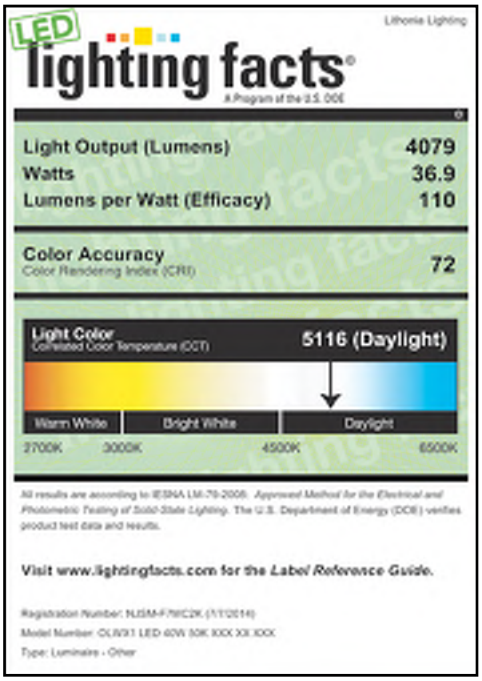
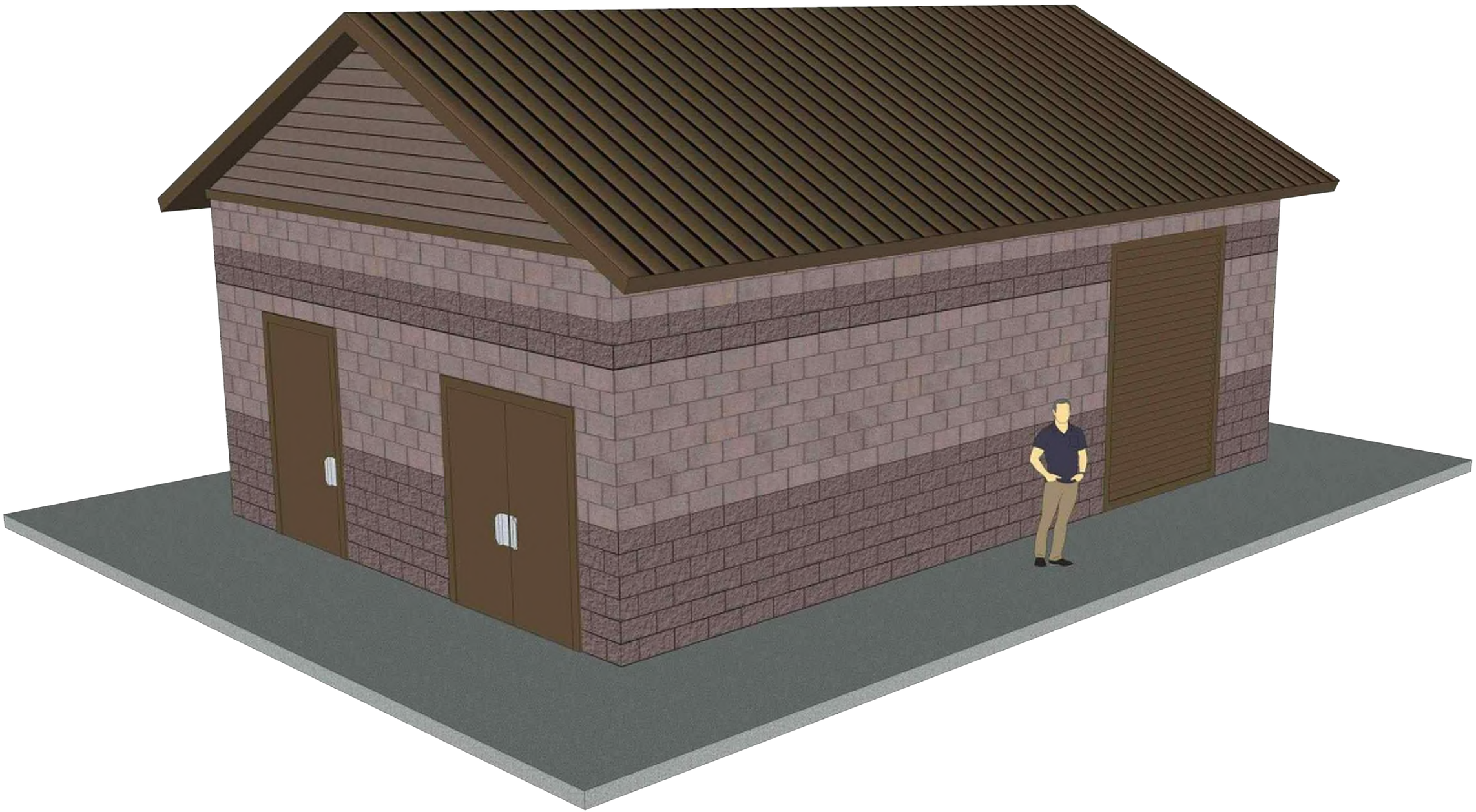


SECTION 4

murraysmith

Building Rendering



SECTION 4

murraysmith

Color Board

COLOR SAMPLES ARE PROVIDED

CMU BLOCK
ROUGH FACE AND GROUND FACE BLOCKS
COLOR: DRIFTWOOD (MUTUAL MATERIALS)

METAL DOORS, ROOF AND LOUVER
COLOR: WEATHERED COPPER

GABLE END LAP SIDING
COLOR: MINK (SHERWIN WILLIAMS 6004)

SECTION 4

murraysmith

Tree Layout and Data

3004
88.494
tvDEC!14

3002
90.678
tvDEC!12

2174
91.327
tvDEC!10

2183
90.312
tvDEC!10

3013
90.765
tvDEC!26

3009
89.077
tvDEC!3@18

3008
87.517
tvDEC!14

2173
92.228
tvDEC!24

2177
89.840
tvDEC!10

2182
90.876
tvDEC!2@36

2185
88.215
tvDEC!12

3016
88.638
tvDEC!36

3011
88.682
tvDEC!5@6

2178
90.314
tvDEC!16

2184
91.429
tvDEC!6

3019
88.877
tvDEC!2@20

3020
88.936
tvDEC!16

3015
90.564
tvDEC!18

2176
91.334
tvDEC!24

2181
91.220
tvDEC!40

3018
89.298
tvDEC!18

3007
92.059
tvDEC!14

2175
91.119
tvDEC!14

2163
96.272
tvDEC!24

3017
89.666
tvDEC!18

3014
90.697
tvDEC!2@8

3012
91.150
tvDEC!30

3002
91.854
tvDEC!16

3006
92.113
tvDEC!16

3001
91.943
tvDEC!8

2172
92.681
tvDEC!18

3005
92.078
tvDEC!12

3323
89.978
tvBIRCH!8

3322
89.985
tvBIRCH!8

2004
95.712
tvDEC!12

3321
90.153
tvBIRCH!8

3080
95.230
tvDEC!12

3081
95.180
tvDEC!14

2006
95.411
tvDEC!16

2005
95.588
tvDEC!15

3320
90.361
tvBIRCH!8

3319
90.676
tvBIRCH!8

3078
94.144
tvDEC!2

3079
94.925
tvDEC!16

2003
96.431
tvDEC!14

2002
96.859
tvDEC!4

3318
90.413
tvBIRCH!8

3076
93.355
tvDEC!6

3077
93.930
tvDEC!14

3075
93.393
tvDEC!14

2001
97.364
tvDEC!12

3074
92.835
tvDEC!14

3261
92.335
tvDEC!12

3317
90.216
tvBIRCH!8

3259
92.358
tvDEC!5

3258
91.981
tvDEC!3

3257
91.838
tvDEC!2

3315
91.766
tvORN!5@3

3256
91.961
tvDEC!3

3255
91.963
tvDEC!4

3314
91.606
tvDEC!3@4

3254
92.231
tvDEC!4

3253
91.863
tvDEC!4

3562
91.150
tvC!12

3251
92.110
tvDEC!4

3250
91.658
tvDEC!4

BASE FLOOD ELEVATION
OF 93 (NAVD 88) PER
2010 AS-BUILT SURVEY

25 0 25 50
SCALE IN FEET

PLAN - LOWER PARK ALONG SEWER ALIGNMENT

Memorial Park Pump Station Improvements

TREE SURVEY AND DATA

murraysmith

17-2136

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Treatment
2001	beech	*Fagus* spp.	12	11.5	F	sunscald or old wound on south face from 0-5'	retain
2002	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	5	6	G		retain
2003	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	16.5	18	G	codominant leaders with included bark and seam	retain
2004	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	14	16	G	self-correcting trunk sweep	retain
2005	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	16.5	20	G	codominant stems with some included bark	retain
2006	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	17	22	F	codominant leaders with included bark and seam with separation; few small broken branches hanging in crown	retain
2163	bigleaf maple	*Acer macrophyllum*	26.5	30	G	self-correcting trunk sweep, codominant leaders, one-sided crown to parking lot, dead and broken branches, some crown decay	retain
2172	bigleaf maple	*Acer macrophyllum*	20	30	F	one-sided crown, dead and broken branches, crown decay	retain
2173	bigleaf maple	*Acer macrophyllum*	2x16	16	F	codominant stems, trunk and crown decay, upright stand grown structure	retain
2174	bigleaf maple	*Acer macrophyllum*	9.5	14	F	small high live crown, one-sided to stream	retain
2175	bigleaf maple	*Acer macrophyllum*	14.5	20	P	small high one-sided live crown, trunk decay with hollows	retain
2176	bigleaf maple	*Acer macrophyllum*	24	38	G	codominant leaders, some included bark, some crown decay	retain
2177	bigleaf maple	*Acer macrophyllum*	8.5	14	P	poor structure, small one-sided crown to stream, some basal decay, broken branch dangling in crown	retain

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Treatment
2178	bigleaf maple	*Acer macrophyllum*	15	22	F	poor structure, one-sided crown, dead and broken branches, crown decay, some ivy	retain
2181	bigleaf maple	*Acer macrophyllum*	36	42	G	self-correcting trunk sweep, codominant stems, dead and broken branches, some crown decay	retain
2182	bigleaf maple	*Acer macrophyllum*	2x34	40	F	codominant stems, one with codominant leaders and included bark with active separation, trunk decay visible inside, porta potty is target	retain
2183	sweet cherry	*Prunus avium*	8	8	F	invasive species, poor structure, some ivy	retain
2184	dogwood	*Cornus* spp.	5..5	16	F	moderate structure, one-sided c crown, natural lean	retain
2185	bigleaf maple	*Acer macrophyllum*	10.5	10	F	broken leader, dead and broken branches, poor structure, some basal decay	retain
3001	bigleaf maple	*Acer macrophyllum*	9	28	P	previous codominant stem failure, poor structure, one branch remains	remove
3002	bigleaf maple	*Acer macrophyllum*	12	12	P	poor structure, small one-sided crown, crown decay, old trunk wound	retain
3003	bigleaf maple	*Acer macrophyllum*	18	20	P	codominant stems, one failed, poor structure, dead failed tree hung up in crown	retain
3004	bigleaf maple	*Acer macrophyllum*	10	0	D	dead, overtopped with ivy, decay	retain
3005	bigleaf maple	*Acer macrophyllum*	12	26	F	one-sided crown in direction of lean to grass, poor structure, broken leader from 3003 hung up leaning against trunk of 3004	retain

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Treatment
3006	bigleaf maple	*Acer macrophyllum*	15	14	F	stand grown upright crown, dead and broken branches, crown decay	retain
3007	bigleaf maple	*Acer macrophyllum*	16	30	P	poor structure, very one-sided crown with excessive lean to south, dead and broken branches, crown decay	remove
3008	bigleaf maple	*Acer macrophyllum*	14	16	G	one-sided crown to stream, dead and broken branches, crown decay	retain
3009	bigleaf maple	*Acer macrophyllum*	16,22,25	35	P	codominant stems, moderate structure, some crown decay	retain
3010	deciduous	unknown	4	6	P	very poor structure, dead branches, small live crown	retain
3011	deciduous	unknown	5x5	16	P	poor structure, ivy, dead and broken branches, decay	retain
3012	bigleaf maple	*Acer macrophyllum*	28	28	F	moderate structure, codominant stems with included bark with partially open seam	retain
3013	bigleaf maple	*Acer macrophyllum*	10,12,20	26	F	basal and trunk decay, dead and broken branches, crown decay	retain
3014	bigleaf maple	*Acer macrophyllum*	10,12	15	P	codominant stems, 10" dead with decay, 12" has one-sided small live crown	retain
3015	bigleaf maple	*Acer macrophyllum*	16	20	F	one-sided crown, dead and broken branches, crown decay	retain
3016	bigleaf maple	*Acer macrophyllum*	36	30	F	codominant stems, one-sided crown, dead and broken branches, crown decay	retain
3017	bigleaf maple	*Acer macrophyllum*	18	16	P	advanced trunk decay at point of previous failure 0-6', crown decay, crown entangled in 3018	retain

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Treatment
3018	bigleaf maple	*Acer macrophyllum*	2x16, 2x18	28	F	trunk and crown decay; surveyed as points 3018-3020	retain
3074	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	15	16	G	codominant leaders, minor lean, camera or something attached to trunk	retain
3075	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	13	16	G		retain
3076	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	5	8	G		retain
3077	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	15	20	G		retain
3078	beech	*Fagus* spp.	2.5	4	G		retain
3079	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	16	20	F	codominant leaders with included bark and seam, minor lean	retain
3080	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	11.5	16	G	codominant leaders, self-correcting lean	retain
3081	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	15.5	18	G	codominant leaders, few small broken branches hanging in crown	retain
3249	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	15	20	G	codominant leaders with included bark, few broken branches	retain
3250	beech	*Fagus* spp.	3	4	G		retain
3251	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	4	6	G	minor lean	retain
3252	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	10	12	G	rubbing leaders	retain
3253	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	5	6	G		retain
3254	beech	*Fagus* spp.	3	4	G		retain
3255	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	5	8	G		retain
3256	beech	*Fagus* spp.	2	3	G		retain
3257	beech	*Fagus* spp.	2	4	G		retain
3258	beech	*Fagus* spp.	3	4	G		retain
3259	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	5	6	G		retain
3261	Raywood ash	*Fraxinus oxycarpa* 'Raywood'	13	16	G		retain
3314	vine maple	*Acer circinatum*	2,2x3	10	F	wound on south trunk	retain

No.	Common Name	Species Name	DBH[1]	C-Rad[2]	Cond[3]	Comments	Treatment
3315	vine maple	*Acer circinatum*	7x2	10	G	multiple stems	retain
3317	European white birch	*Betula pendula*	8	16	F	one-sided crown, missing bark, sapsuckers girdling trunk, top dieback	retain
3318	European white birch	*Betula pendula*	8	13	F	one-sided crown, sapsuckers girdling trunk, top dieback	retain
3319	European white birch	*Betula pendula*	8	15	F	broken leader, sapsuckers girdling trunk, top dieback	retain
3320	European white birch	*Betula pendula*	6.5	11	D	dead	remove
3321	European white birch	*Betula pendula*	6	7	D	dead	remove
3322	European white birch	*Betula pendula*	6	6	D	dead	remove
3323	European white birch	*Betula pendula*	7	12	D	dead	remove
3562	incense cedar	*Calocedrus decurrens*	12	8	G	incense cedar rust infection	retain
7001	Port-Orford-cedar	*Chamaecyparis lawsoniana*	34	15	F	old broken stem now with multiple leaders - several broken from previous failures, poor structure	retain
7002	bigleaf maple	*Acer macrophyllum*	10,12, 14,15, 2x18,24	25	F	multiple codominant leaders	retain
7003	deciduous	unknown	2x10	20	F	codominant leaders, dead branches, some trunk decay	retain
7004	bigleaf maple	*Acer macrophyllum*	2x18	24	F	lower trunk sweep, codominant leaders, failed branch hanging in crown	retain

[1]**DBH** is tree diameter measured at 4.5-feet above the ground level, in inches. Trees with multiple stems splitting below DBH are measured individually and separated by a comma or recorded as quantity x size.

[2]**C-Rad** is the average crown radius measured in feet.

[3]**Cond** is an arborist assigned rating to generally describe the condition of individual trees as **D**ead, **P**oor, **F**air or **G**ood.

SECTION 4

Arborist Report

Morgan Holen & Associates, LLC
Consulting Arborists and Urban Forest Management
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Lake Oswego, Oregon 97035
morgan.holen@comcast.net

Memorial Park Pump Station – Wilsonville, Oregon
Tree Maintenance and Protection Plan
May 29, 2019

MHA18018

Purpose

This Tree Maintenance and Protection Plan for the Memorial Park Pump Station project located in Wilsonville, Oregon, is provided pursuant to City of Wilsonville Development Code, Section 4.610.40. This arborist report describes the existing trees located on and adjacent to the project site, as well as the proposed plan for tree removal and protection. This report is based on observations made by International Society of Arboriculture Board Certified Master Arborist (PN-6145B) and Qualified Tree Risk Assessor Morgan Holen during site visits conducted on March 9, 2018, April 26, 2019 and May 13, 2019.

Scope of Work and Limitations

Morgan Holen & Associates, LLC (MHA), was contracted by the City of Wilsonville to visually assess existing trees in terms of general condition and suitability for preservation with development, and to develop a tree plan for the project in collaboration with Murraysmith. A site survey was provided by Murraysmith illustrating the location of trees subject to this evaluation, tree point numbers and potential construction impacts.

Visual Tree Assessment (VTA[1]) was performed on individual trees located on and directly adjacent to the project work area. Trees were evaluated in terms species, size, general condition and potential construction impacts, and treatment recommendations include remove or retain. Following the inventory fieldwork, we coordinated with Murraysmith and the City's Parks Lead Maintenance Specialist to discuss and finalize treatment recommendations and prescribed protection measures as shown on the tree protection and erosion control plans.

The client may choose to accept or disregard the recommendations contained herein, or seek additional advice. Neither this author nor MHA have assumed any responsibility for liability associated with the trees on or adjacent to this site.

General Description

The City of Wilsonville is replacing its wastewater-systems pump station in Memorial Park to increase capacity and reliability. In all, 71 trees measuring 2- to 36-inches in diameter were inventoried including 10 tree species. Table 1 provides a summary of the count of trees by species and location. A complete description of individual trees is provided in the enclosed tree data.

[1] Visual Tree Assessment (VTA): The standard process of visual tree inspection whereby the inspector visually assesses the tree from a distance and up close, looking for defect symptoms and evaluating overall condition and vitality.

Table 1. Count of Trees by Species – Memorial Park Pump Station, Wilsonville, OR.

Common Name	Species Name	Total	Percent*
bigleaf maple	*Acer macrophyllum*	29	41%
European white birch^	*Betula pendula*	7	10%
beech	*Fagus* spp.	7	10%
Raywood ash	*Fraxinus oxycarpa* 'Raywood'	19	27%
sweet cherry^	*Prunus avium*	1	1%
dogwood	*Cornus* spp.	1	1%
deciduous	unknown	3	4%
vine maple	*Acer circinatum*	2	3%
incense cedar	*Calocedrus decurrens*	1	1%
Port-Orford-cedar	*Chamaecyparis lawsoniana*	1	1%
Total		**71**	**100%**

*Percent total may not sum to 100 due to rounding. ^Species commonly accepted as being invasive in our region.

No Oregon white oaks (*Quercus garryana*), native yews (*Taxus brevifolia*) or any species listed by either the state or federal government as rare or endangered were found on the site.

Tree Plan Recommendations

As described in the enclosed tree inventory data, individual trees were assigned a general condition rating as follows:

D: Dead
P: Poor Condition
F: Fair Condition
G: Good Condition

Of the 71 inventoried trees, six are planned for removal, including: four dead European white birches (*Betula pendula*) in the vicinity of proposed staging; and, two bigleaf maples (*Acer macrophyllum*) in poor condition with small live crowns that are very one-sided and leaning to the proposed pump station where pruning for clearance would result in the removal of the entire live crown. The other 65 trees are planned for retention with protection during construction. Table 2 provides a summary of the count of trees by general condition rating and treatment recommendation.

Table 2. Count of Trees by Treatment Recommendation and General Condition Rating.

	General Condition Rating					
Treatment Recommendation	**D**	**P**	**F**	**G**	**Total**	**Percent**
Remove	4	2	0	0	**6**	8%
Retain	1	9	26	29	**65**	92%
Total	**5**	**11**	**26**	**29**	**71**	**100%**
Percent	7%	15%	37%	41%		

Protection fencing is recommended along the edge of the existing asphalt driveway from the lower entrance to the park down past the barn. Protection fencing will need to be adjusted to the limits of work adjacent to the proposed pump station. Crown pruning that will be needed to provide overhead clearance should be performed in coordination with Park's Maintenance staff prior to construction. Excavation proposed beneath the dripline of protected trees should be supervised and documented by the project arborist, as indicated on the tree protection plans.

Mitigation Requirements

The six trees planned for removal each measure at least 6-inches in diameter and therefore require mitigation per Section 4.620.00; removed trees shall be replaced on a basis of one tree planted for each tree removed. Consequently, six trees measuring at least 2-inch in diameter shall be planted as mitigation for tree removal.

Tree Protection Standards

Trees designated for retention will need special consideration to assure their protection during construction. The following tree protection measures have been copied onto tree protection and erosion control plan sheet ESC-2 as direction for the contractor:

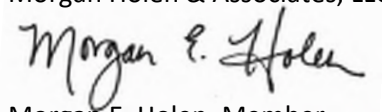
1. **Preconstruction Conference.** The contractor shall coordinate with the project arborist in a timely manner to review tree protection measures and address questions on-site prior to the start of construction activity.
2. **Protection Fencing.** Trees to remain on site shall be protected by installation of tree protection fencing as depicted on the Tree Protection and Erosion Control Plan in order to prevent injury to tree trunks or roots, or soil compaction within the root protection zone. Fences shall be a minimum 6-foot high 2-inch chain link mesh secured to a minimum 1.5-inch steel or aluminum posts steel on concrete blocks or driven into the ground, except where minimum 4-foot high orange plastic mesh fencing on metal stakes is specified on the Plan. The contractor is responsible for coordinating with the project arborist prior to opening, adjusting or removing tree protection fencing.
3. **Tree Protection Zone.** Without authorization from the Project Arborist, none of the following shall occur beneath the dripline of any protected tree:
    a. Grade change or cut and fill;
    b. New impervious surfaces;
    c. Utility or drainage field placement;
    d. Staging or storage of materials and equipment; or
    e. Vehicle maneuvering.

    Root protection zones may be entered for tasks like surveying, measuring, and, sampling. Fences must be closed upon completion of these tasks.
4. **Erosion Control.** Silt fencing required to be installed beneath the dripline of protected trees shall not be trenched in per manufacturer specifications to avoid root damage. Instead, use a straw wattle or roll the base of the silt fence around a straw wattle and stake the wattle securely into the ground.

5. **Tree and Stump Removal.** Trees to be removed shall be clearly identified with tree-marking paint or other methods approved in advanced by the project arborist. Stumps from removed trees located within tree protection zones shall remain in the ground where feasible. Otherwise, stumps may be removed by stump grinding or extracted from the ground under arborist supervision.
6. **Pruning.** Pruning will be needed to provide for overhead clearance and to remove dead and defective branches for safety. The City's Parks Maintenance Crew shall be responsible for all pruning. The City's Project Manager shall coordinator with the Park's Department in a timely manner to arrange the necessary pruning prior to construction.
7. **Excavation.** The project arborist shall provide on-site consultation during all excavation activities beneath the dripline of protected trees. Excavation immediately adjacent to roots larger than 2-inches in diameter within the root protection zone of retained trees shall be by hand or other non-invasive techniques to ensure that roots are not damaged. Where feasible, major roots shall be protected by tunneling or other means to avoid destruction or damage. Exceptions can be made if, in the opinion of the project arborist, unacceptable damage will not occur to the tree.
8. **Landscaping.** Following construction and where landscaping is desired, apply approximately 3-inches of mulch beneath the dripline of protected trees, but not directly against tree trunks. Shrubs and ground covers may be planted within tree protection areas. If irrigation is used, use drip irrigation or low flow emitters installed at native grade (no trenching) only beneath the driplines of protected trees. Landscaping shall be performed by hand and with hand tools only beneath protected tree driplines; adjust the location of plants to avoid tree root impacts.
9. **Quality Assurance.** The project arborist should supervise proper execution of this plan during construction activities that could encroach on retained trees. Tree protection site inspection monitoring reports should be provided to the Client and City on a regular basis throughout construction.

Thank you for choosing Morgan Holen & Associates, LLC, to provide consulting arborist services for the Memorial Park Pump Station project. Please contact us if you have questions or need any additional information or assistance.

Thank you,
Morgan Holen & Associates, LLC



Morgan E. Holen, Member
ISA Board Certified Master Arborist, PN-6145B
ISA Tree Risk Assessment Qualified
Forest Biologist

Enclosures: MHA18018 Memorial Park Pump Station – Tree Data 3-9-18