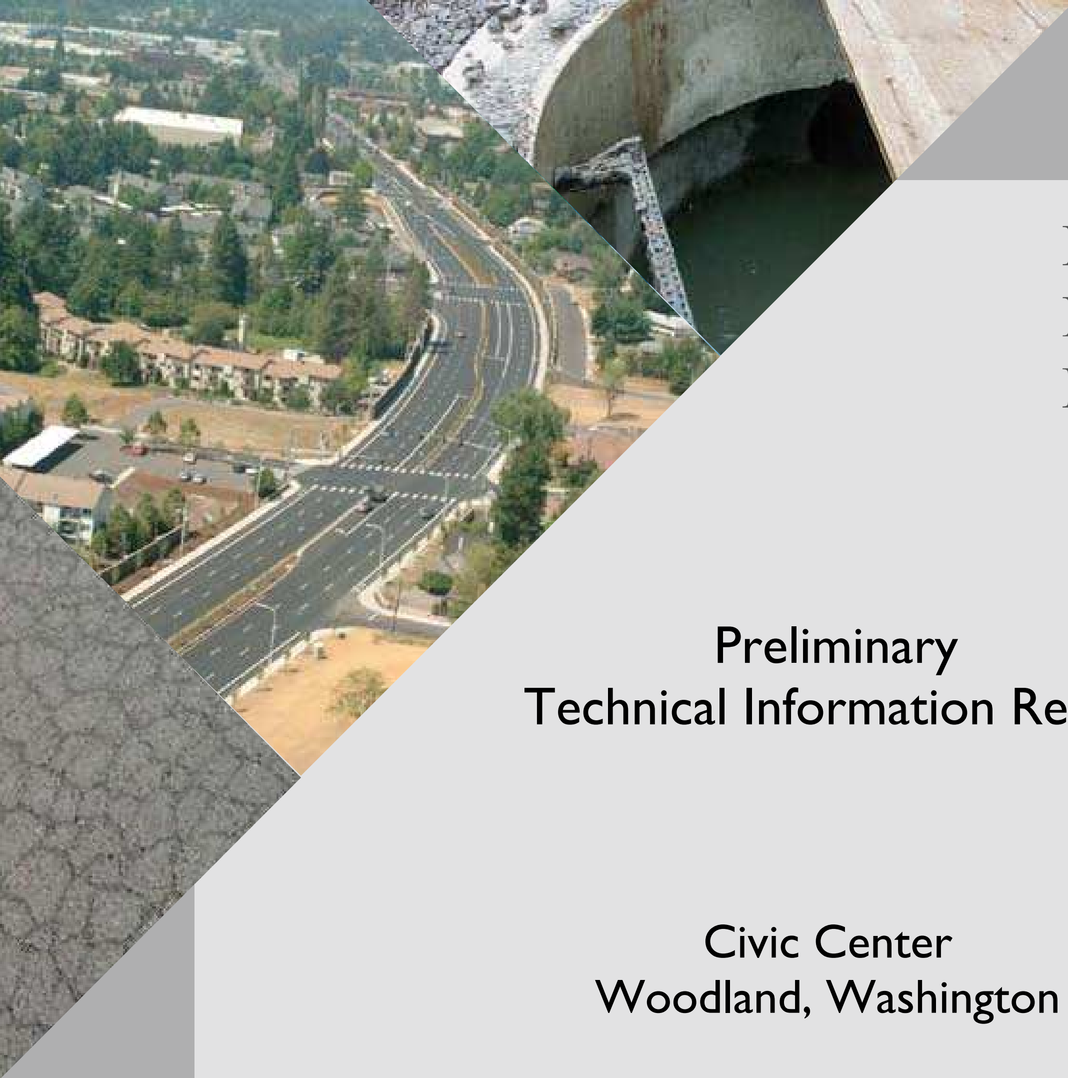

Harper
Houf Peterson
Righellis Inc.

Preliminary
Technical Information Report

Civic Center
Woodland, Washington

February 24, 2023

Prepared For:

City of Woodland
230 Davidson Avenue
PO Box 9
Woodland, WA 98674

WLD-21

Prepared By:

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Bruce Haunreiter, PE

HHPR

ENGINEERS ◆ PLANNERS
LANDSCAPE ARCHITECTS ◆ SURVEYORS

TABLE OF CONTENTS

TECHNICAL APPENDICES

REFERENCES

1. Department of Ecology Stormwater Management Manual for the Puget Sound Basin, 1992.
2. United States Department of Agriculture - Natural Resource Conservation Service, Custom Soil Resource Report for Cowlitz County, Washington 2023
3. Draft Preliminary Geotechnical Information – Columbia West Engineering, Inc. May 19, 2022.
4. Cowlitz County Environmental Planning Internet Clearance, Cowlitz County GIS Department, 2023

SECTION A – PROJECT OVERVIEW

Site Location and Description

This project will create the new 1,200 square foot Civic Center for the City of Woodland, located at 828 Goerig Street, Woodland, WA. The project site is defined as the 0.48-acre western portion of Parcel #50480, located southeast of the intersection of Lakeshore Drive and Goerig Street. (Section 48 Township 5 North, Range 1 West).
Runoff from the proposed impervious surface, including the welcome center, pedestrian walkways and maintenance access pad, will be collected and discharged via an infiltration trench.

Vehicular access to the site will be provided from Lakeshore Drive, an Urban Collector Roadway, via the proposed Fort Vancouver Regional Library parking area. The temporary stabilized construction entrance will be accessed from Goerig Street, an Urban Collector Roadway.

The site was formerly occupied by the Woodland Funeral Home, which was recently demolished.

Existing Stormwater System

Stormwater appears to infiltrate on-site, as there does not appear to be an existing storm system.

Topography and Surrounding Area

The 0.48-acre site is relatively flat. The site is zoned Highway Commercial (C-2). The adjacent area from Goerig Street to Park Road is zoned Highway Commercial (C-2). The area to the west of Goerig Street is zoned High Density Residential (HDR). The site is west of Interstate 5 and north of Horseshoe Lake Park, with a mix of High Density Residential housing and commercial areas to the north.

Critical Areas

The entire project site is located within the Flood Zone classified *X Protected by Levee or Dike* (Cowlitz County EPIC, 2023).

Site Soils

The Natural Resources Conservation Service (NRCS) map depicts one soil unit within the project area: Clato silt loam, 0 to 3% slopes (32). There are no surface indications or history that identify the site as a severe erosion hazard or landslide hazard area, and no potentially unstable slopes are recorded on or near the site.

The project site is suitable for infiltration. Based on the favorable infiltration test rates, the proposed storm system is designed to fully infiltrate 100% of the stormwater.

(See attached Preliminary Geotechnical Information and Custom Soil Resource Report in Appendix 4.)

Drainage to and from Adjacent Properties

No stormwater flows onto the site from adjacent parcels.

Compliance with Standards

This project is designed to meet the requirements of the City of Woodland, the

Department of Ecology's 1992 Stormwater Management Manual for the Puget Sound Basin (portions adopted by the City of Woodland), and the Uniform Plumbing Code.

All storm systems will be designed per the City of Woodland design and construction standards.

SECTION B – APPROVAL CONDITIONS

A summary of the project's surface impacts to the site is provided in the table below.

TABLE B-1. PROJECT IMPACT AREA VALUES

Existing Impervious (acres)	Replaced Impervious (acres)	New Impervious (acres)	Total Land-Disturbing Activity (acres)
0.18	0.04	0.07	0.48

Upon completion of the project, approximately 23% of the total site will be covered with impervious surface including the welcome center, access roadway and pedestrian walkways. The existing asphalt pavement and concrete surface on-site will be removed and replaced with grass and landscaping.

The proposed improvements are less than 5000 square feet, with less than 1 acre of land disturbing activity. The project qualifies as a Redevelopment (Small Project). Minimum Requirements 1-11 apply to the portion of the site being redeveloped.

A summary of how the project meets each of the minimum requirements is described below. See additional sections of this report for more detailed information. See the project plans in Appendix 2 for grading, stormwater and erosion control information.

MR#1 – Erosion and Sediment Control
See the project plans in Appendix 2 for temporary erosion control information. The contractor is responsible for conforming to the City of Woodland and Department of Ecology (DOE) erosion control standards. A Construction Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction.

MR#2 – Preservation of Natural Drainage Systems
Runoff from the site appears to flow overland and infiltrate into the surrounding soil. No stormwater flows onto the site from adjacent parcels. Roof runoff will be discharged into a gravel infiltration trench on-site. Runoff from the maintenance access pad will flow to a sumped catch basin, discharging to the on-site infiltration trench.

MR#3 – Source Control of Pollution
The primary source of pollutants for this project will be from occasional maintenance vehicles on-site. The main permanent structural BMPs incorporated on this project will be:

1. Sumped catch basins

The operational BMP will be the continual maintenance of the storm system by the City of Woodland.

MR#4 – Runoff Treatment BMPs
Roof runoff will be discharged into a gravel infiltration trench on-site. Runoff from the maintenance access pad will flow to a sumped catch basin prior to discharging to the on-site

infiltration trench.

MR#5 – Streambank Erosion Control
Stormwater runoff from the roof drains will be discharged into a gravel infiltration trench on-site and the runoff from the maintenance access pad will flow to a sumped catch basin prior to discharge into the infiltration trench. A portion of the runoff from the pedestrian walkways will sheet flow into surrounding vegetation.

MR#6 – Wetlands
There are no wetlands in the project vicinity, and no stormwater will discharge directly or indirectly in to a wetland.

MR#7 – Water Quality Sensitive Areas
There are no environmentally sensitive areas within or adjacent to the project vicinity.

MR#8 – Off-Site Analysis and Mitigation
All stormwater runoff will be 100% infiltrated on-site through the proposed gravel infiltration trench. There are no negative water quality impacts anticipated downstream of the project site. The project will not alter or affect drainage patterns within the vicinity of the site.

MR#9 – Basin Planning
There are no impacts to any regional drainage basins or watersheds associated with this development, nor are there any regional plans that would affect the minimum requirements for this project.

MR#10 – Operation and Maintenance
The new stormwater facilities associated with this project will be maintained by the City of Woodland.

MR#11 – Financial Liability
These facilities will be constructed by the City of Woodland, and financial guarantee is not necessary.

SECTION C – DOWNSTREAM ANALYSIS

Stormwater runoff will be discharged to the proposed gravel infiltration trench. Runoff from the maintenance access pad will flow to a sumped catch basin prior to discharge into the infiltration trench. There are no negative water quality impacts anticipated downstream of the project site.

See Appendix 2 for project plans and Appendix 3 for all stormwater calculations.

SECTION D – QUANTITY CONTROL ANALYSIS AND DESIGN

As part of this project, stormwater runoff from the roof drains will be discharged into a gravel infiltration trench on-site and the runoff from the maintenance access pad will flow to a sumped catch basin prior to discharge into the infiltration trench. A portion of the runoff from the pedestrian walkways will sheet flow into surrounding vegetation.

Due to the favorable tested infiltration rates of 50 in/hour, a gravel infiltration trench has been selected to infiltrate runoff from the project site. The infiltration trench was designed with a safety factor of 4 (12.5 in/hour), using Hydraflow modeling software and a 100-year 24-hour storm event. The trench will consist of a 12” perforated drain pipe surrounded by drain rock.

One infiltration trench is proposed:

Infiltration Trench

Contributing area: 0.11 acres
Trench dimensions: 3 feet deep x 3 feet wide x 86 feet long

The infiltration trench is designed to infiltrate 100% of the runoff.

See the Stormwater Plans and Calculations, Appendix 2 and 3.

SECTION E – SOILS EVALUATION

1. The Natural Resources Conservation Service (NRCS) map depicts one soil unit within the project area: Clato silt loam, 0 to 3% slopes (32).
   Clato silt loam is very deep, well-drained soil formed in mixed alluvium, with moderate permeability, slow runoff, and high available water capacity.
   Clato silt loam, 0 to 3% slopes (32) is considered prime farmland, but the project area is not within zoned agricultural land. (See attached Custom Soil Resource Report in Appendix 4.)

2. The proposed infiltration trench is located within an area of well-draining soils in the southeast portion of the site which is comprised of Clato silt loam. Per the NRCS data, Clato soils are well-drained and classified as Hydrologic Soil Group B. The infiltration rates will be confirmed during construction. (See attached Custom Soil Resource Report in Appendix 4.)
3. The soil parameters that affected the stormwater design are the satisfactory infiltration rates. There are no surface indications or history that identify the site as a severe erosion hazard or landslide hazard area. No potentially unstable slopes are recorded on or near the site.
4. The project site is suitable for infiltration. The Geotechnical Engineer tested the infiltration in a location approximately 200 feet east of the proposed infiltration trench, which yielded results of 50 in/hour. The infiltration rates will all be confirmed during construction. (See attached Preliminary Geotechnical evaluation and Custom Soil Resource Report in Appendix 4)

SECTION F – TECHNICAL APPENDIX

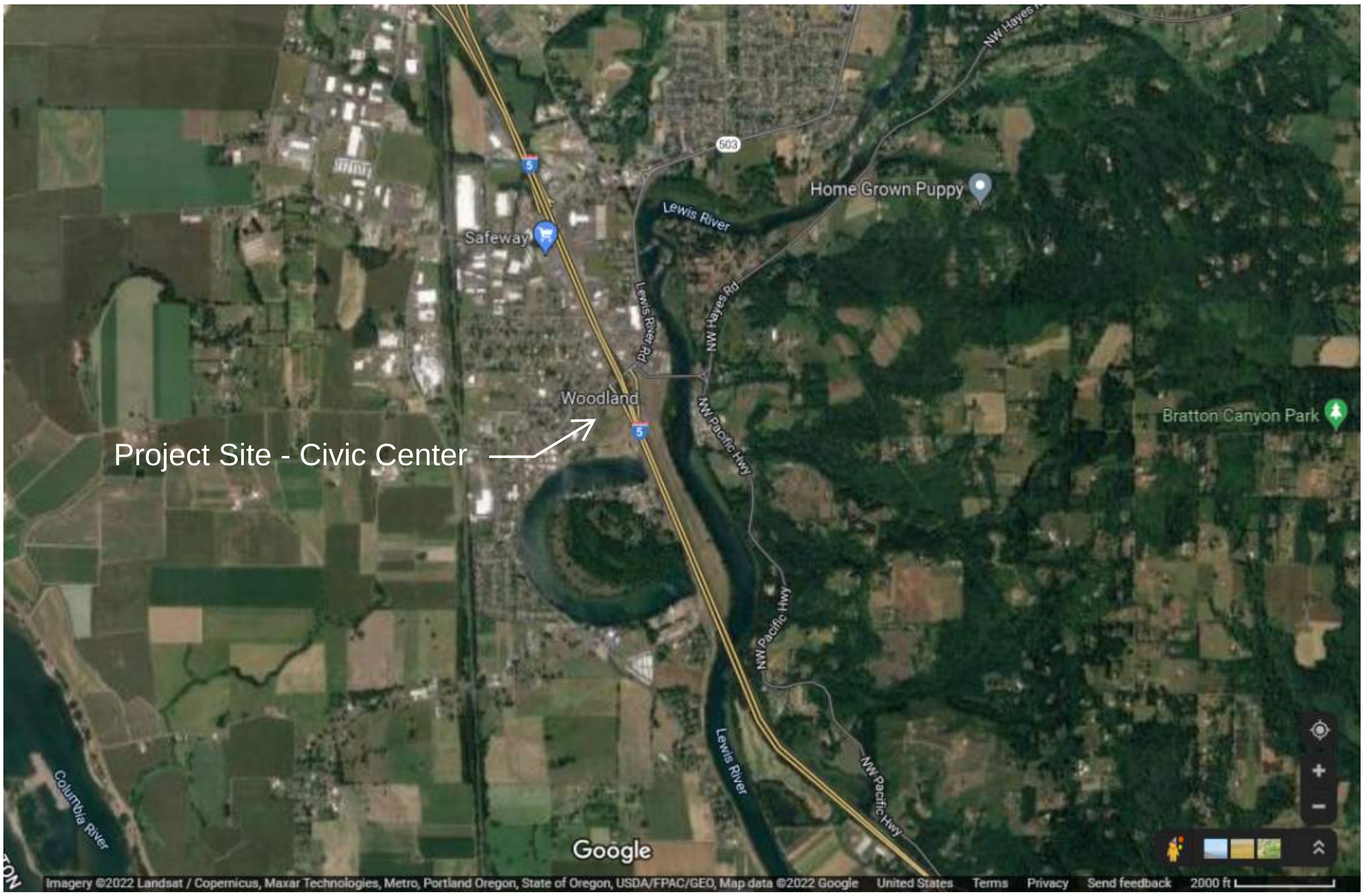
The Technical Appendices include all computations, drawings, maps, referenced data, software printouts, specials studies, and all other information used in the preparation of this report.

1. Maps
2. Project Plans
3. Stormwater Calculations and Design Information
4. Custom Soil Resource Report / Preliminary Geotechnical Information

APPENDIX 1 – Maps

Woodland Civic Center

Woodland, Washington



VICINITY MAP

N.T.S.

<u>APPENDIX 2</u> – Project Plans

WOODLAND CIVIC CENTER

WOODLAND, WASHINGTON

FEBRUARY 2023

LAND USE SUBMITTAL

GENERAL NOTES:

ALL CONSTRUCTION, MATERIALS, AND WORKMANSHIP SHALL CONFORM TO THE CITY OF WOODLAND ENGINEERING STANDARDS AND THE LATEST EDITION OF "STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION" AS PREPARED BY WSDOT AND APWA.

ALL MATERIALS AND WORK ARE SUBJECT TO INSPECTION AND APPROVAL BY THE CITY OF WOODLAND'S DEPARTMENT OF PUBLIC WORKS (360) 225-7999.

THE CONTRACTOR SHALL NOTIFY THE PUBLIC WORKS DEPARTMENT AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION.

THE CONTRACTOR SHALL COORDINATE AND ATTEND A PRE-CONSTRUCTION CONFERENCE WITH THE CITY OF WOODLAND PUBLIC WORKS DEPARTMENT PRIOR TO COMMENCING CONSTRUCTION.

ANY DEVIATIONS FROM THE PLANS WILL REQUIRE A WRITTEN REQUEST FROM THE CONTRACTOR AND APPROVAL BY THE PUBLIC WORKS DIRECTOR.

THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND LICENSES BEFORE STARTING CONSTRUCTION.

LOCATION OF EXISTING UNDERGROUND UTILITIES AS SHOWN ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. ADDITIONAL UNDERGROUND UTILITIES MAY EXIST.

THE CONTRACTOR SHALL HAVE ALL EXISTING UTILITIES PROPERLY LOCATED PRIOR TO COMMENCING EXCAVATIONS. THE CONTRACTOR SHALL, AT A MINIMUM, CALL THE UTILITIES COORDINATING COUNCIL 48 HOURS BEFORE BEGINNING EXCAVATIONS. UTILITIES COORDINATING COUNCIL CAN BE REACHED AT 1-800-424-5555.

CONTRACTOR SHALL KEEP AN APPROVED SET OF PLANS ON THE PROJECT SITE AT ALL TIMES.

ALL PIPE BEDDING MATERIAL SHALL MEET THE APPLICABLE SPECIFICATIONS IN THE CITY OF WOODLAND STANDARDS. BEFORE ANY NATIVE MATERIAL IS USED, LABORATORY TEST RESULTS SHALL BE PROVIDED TO THE CITY INSPECTOR INDICATING THAT THE MATERIAL MEETS THE SPECIFICATIONS.

PIPE BEDDING AND BACKFILL SHALL BE PER CITY OF WOODLAND STANDARDS. BACKFILL MATERIAL SHALL BE COMPACTED TO 95% MAXIMUM RELATIVE DENSITY.

SHOULD ANY ITEM OF ARCHAEOLOGICAL INTEREST BE FOUND DURING DEVELOPMENT, YOU ARE REQUIRED TO STOP WORK AND NOTIFY THE CITY INSPECTOR AND THE WASHINGTON STATE OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION AT (360) 753-4011 IMMEDIATELY. FAILURE TO DO SO COULD RESULT IN A FELONY CONVICTION.

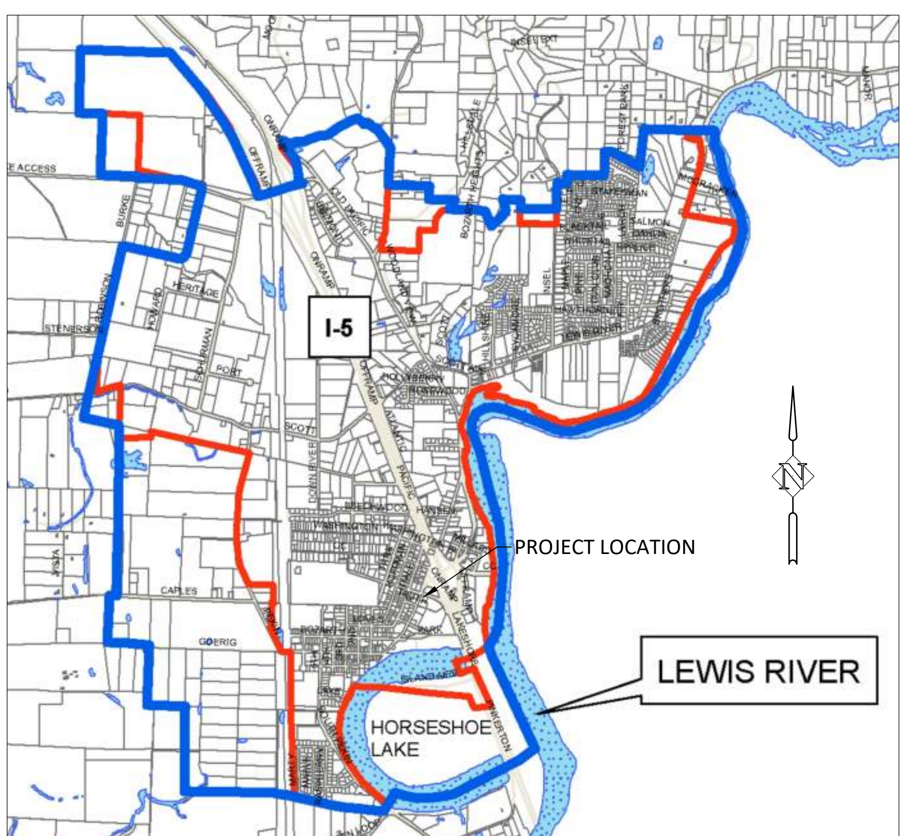
AT THE END OF EACH WORK DAY THE CONTRACTOR SHALL CLEAN UP THE PROJECT AREA AND LEAVE IT IN A NEAT AND SECURED MANNER. UPON COMPLETION, THE CONTRACTOR SHALL LEAVE THE PROJECT AREA FREE OF DEBRIS AND UNUSED MATERIAL.

THE CONTRACTOR SHALL PRUNE ALL VEGETATION, AS NECESSARY, AWAY AND UP FROM THE WORK AS WELL AS ANY ROOT PRUNING AS DETERMINED BY THE ENGINEER. THE CONTRACTOR SHALL PROTECT ALL EXISTING LANDSCAPING THAT IS TO REMAIN.

THE CONTRACTOR SHALL MAKE EVERY REASONABLE EFFORT TO PROTECT ANY EXISTING CONCRETE CURBS AND SIDEWALKS TO REMAIN AND SHALL REPLACE DAMAGED CURBS AND SIDEWALKS AT NO ADDITIONAL COST.

THE CONTRACTOR SHALL PROTECT EXISTING UTILITIES. ALL DISTURBED UTILITIES SHALL BE REPAIRED AS DIRECTED. ALL RELOCATED UTILITIES WILL BE RESET IN ACCORDANCE WITH THE APPROPRIATE AGENCY OR OWNER'S STANDARDS AND SPECIFICATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OF EXISTING UTILITY LINES DAMAGED OR DESTROYED THROUGH NEGLIGENCE AND/OR INATTENTION.

CONTRACTOR SHALL REPORT ALL DAMAGES IMMEDIATELY TO THE PUBLIC WORKS DIRECTOR'S OFFICE OR CONTACT THE INSPECTOR ON THE JOB.



SITE MAP
N.T.S.

MAYOR: WILLIAM FINN

COUNCIL:
- POS. #1: JOHN "JJ" BURKE
- POS. #2: CAROL ROUNDS
- POS. #3: MELISSA DOUGHTY
- POS. #4: KARL CHAPMAN
- POS. #5: DEEANNA HOLLAND
- POS. #6: JENNIFER ROWLAND
- POS #7: MONTE SMITH

PUBLIC WORKS DIRECTOR: TRACY COLEMAN

OWNER

CITY OF WOODLAND
CONTACT: TRACY COLEMAN
230 DAVIDSON AVE
WOODLAND, WA 98674
PH: 360-225-7999
FAX: 360-225-7467
E-MAIL: COLEMANT@CI.WOODLAND.WA.US

CIVIL ENGINEER

HARPER HOUF PETERSON RIGHELLIS INC.
CONTACT: BRUCE HAUNREITER, P.E.
1220 MAIN STREET, SUITE 150
VANCOUVER, WA 98660
PH: (360) 750-1131
FAX: (360) 750-1141
E-MAIL: BRUCE@HHPR.COM

SHEET INDEX

LEGEND

FOUND MONUMENT AS NOTED
CALCULATED MONUMENT POSITION
SURVEY CONTROL POINT
SANITARY SEWER MANHOLE
STORM CATCH BASIN
STORM CULVERT
WATER VALVE
WATER METER
FIRE HYDRANT
IRRIGATION CONTROL VALVE
DECIDUOUS TREE
UTILITY POLE
GUY ANCHOR
LIGHT POLE
JUNCTION BOX
TELECOMM RISER
TELECOMM CABINET
UTILITY VAULT
SIGN
TELECOMM CABINET
MAILBOX
POWER METER
BOUNDARY LINE
LOT LINE
DLC LINE OR SECTION LINE
ROAD CENTERLINE
STORM DRAIN LINE
SANITARY SEWER LINE
BURIED WATER LINE
BURIED POWER LINE
BURIED TELECOMMUNICATIONS LINE
OVERHEAD POWER LINE
CHAIN LINK FENCE
WOOD FENCE
WIRE FENCE
ASPHALT SURFACE
CONCRETE SURFACE
GRAVEL SURFACE

HORIZONTAL DATUM

WASHINGTON STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, NAD 83/2011
BASED ON GPS OBSERVATION UTILIZING THE WASHINGTON STATE REFERENCE NETWORK (WSRN)
MEASURED SOUTH 71°27'02" EAST BETWEEN FOUND MONUMENTS ALONG BUCKEYE STREET AT THE INTERSECTIONS WITH DALE ST. & HOFFMAN ST.

VERTICAL DATUM

NAVD 88
BASED ON GPS OBSERVATION UTILIZING THE WSRN WITH NGS GEOID2012B LOADED

TEMPORARY BENCHMARK ELEVATION = 31.68
DESCRIPTION: REBAR WITH CONTROL CAP #4
SET ON THE NORTH SIDE OF LAKESHORE DRIVE

COVER SHEET
CIVIC CENTER
WOODLAND, WASHINGTON

HHPR Harper Houf Peterson Righellis Inc.
ENGINEERS ◆ PLANNERS
LANDSCAPE ARCHITECTS ◆ SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

DESIGNED: DJW
DRAWN: DJW
CHECKED: BMH
DATE: 02/21/2023

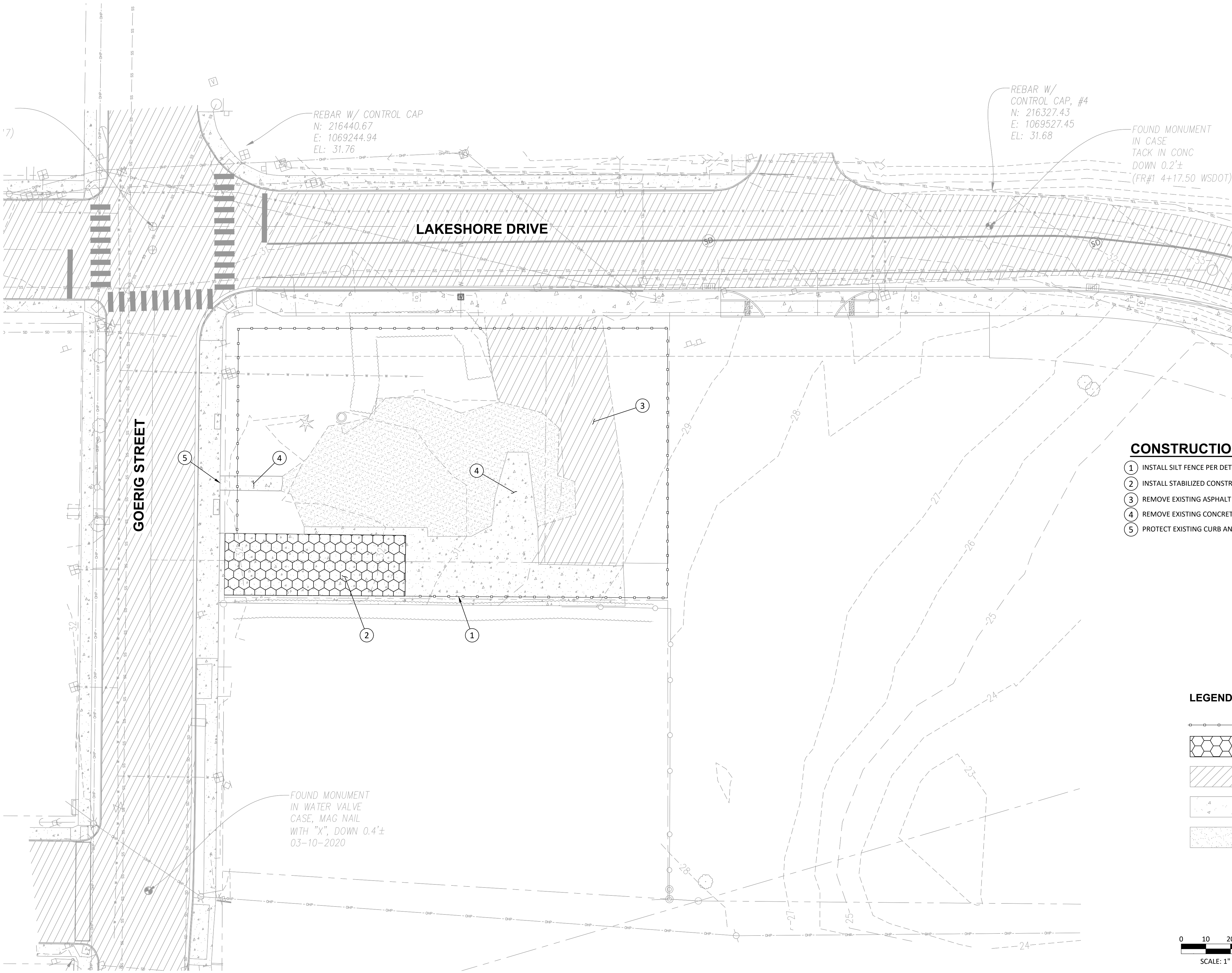
REVISIONS

DATE	NO.	DESCRIPTION

SHEET NO. **C1.0**

JOB NO. WLD-21

P:\02-Vancouver\WLD (City of Woodland)\WLD-21 (Welcome Center)\WLD21-DWGS\Sheets\ C1.0 - COVER SHEET.dwg



CONSTRUCTION NOTES:

1. INSTALL SILT FENCE PER DETAIL E-20, SHEET C5.0.
2. INSTALL STABILIZED CONSTRUCTION ENTRANCE PER DETAIL E-05, SHEET C5.0.
3. REMOVE EXISTING ASPHALT PAVEMENT.
4. REMOVE EXISTING CONCRETE WALK OR DRIVEWAY.
5. PROTECT EXISTING CURB AND SIDEWALK.

LEGEND

- SEDIMENT FENCE
- CONSTRUCTION ENTRANCE
- EXISTING ASPHALT PAVEMENT
- EXISTING CEMENT CONCRETE
- EXISTING GRAVEL SURFACE

0 10 20 40
SCALE: 1" = 20'

EROSION CONTROL PLAN
CIVIC CENTER
WOODLAND, WASHINGTON

HHPR
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LANDSCAPE ARCHITECTS • SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

DESIGNED:	DJW
DRAWN:	DJW
CHECKED:	BMH
DATE:	02/21/2023

REVISIONS

DATE	NO.	DESCRIPTION

SHEET NO.
C2.0

JOB NO. WLD-21

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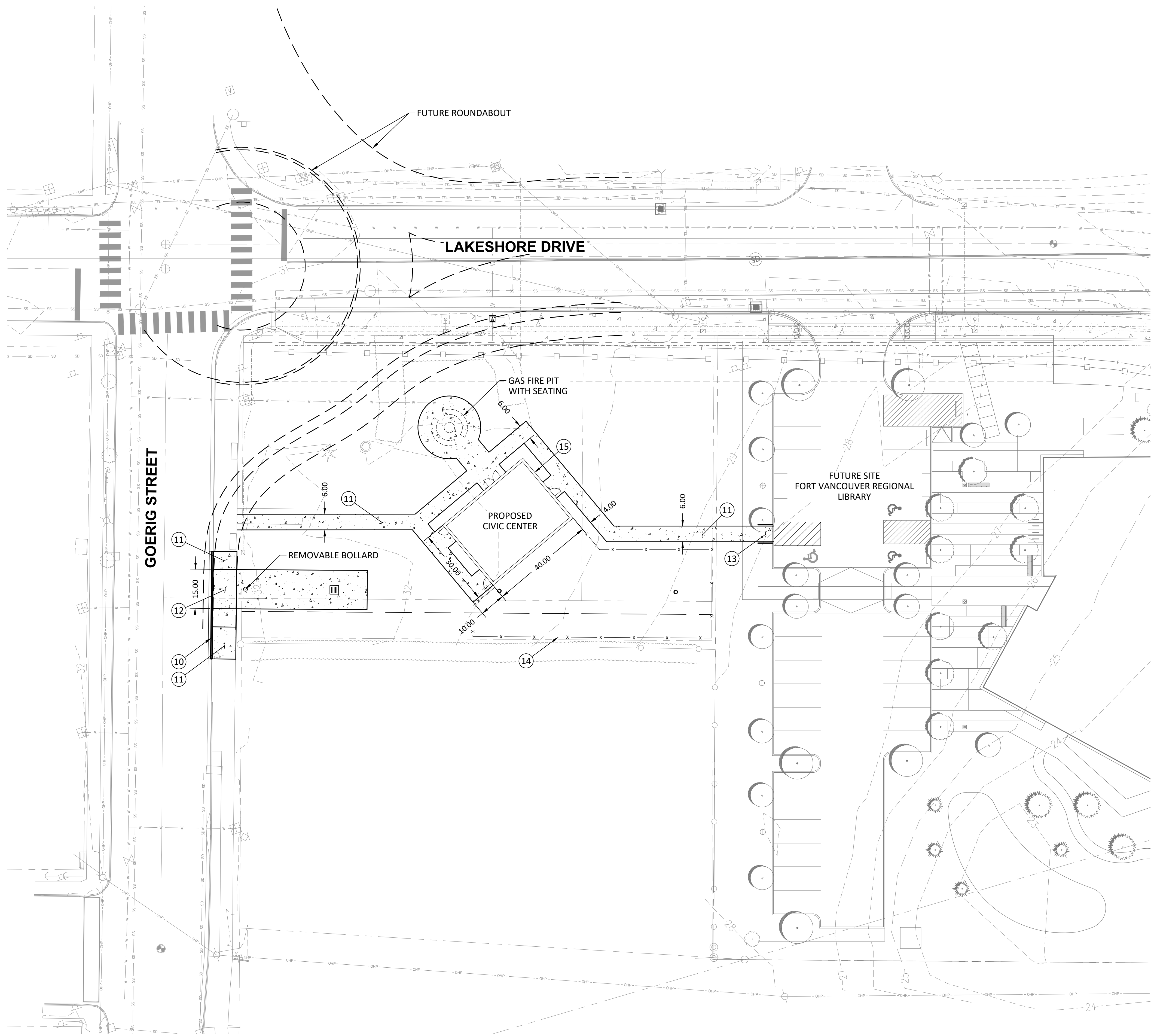


CONSTRUCTION NOTES:

(10) CONSTRUCT TRAFFIC CURB AND GUTTER PER DETAIL T-01, SHEET C5.1.

(11) CONSTRUCT SIDEWALK PER DETAIL T-07, SHEET C5.1.

(12) CONSTRUCT DRIVEWAY PER DETAIL T-05, SHEET C5.1.

(13) CONSTRUCT PERPENDICULAR RAMP PER DETAIL T-17, SHEET C5.1.

(14) INSTALL 4 FT. CHAIN LINK FENCE.

(15) FOR BUILDING DETAILS SEE SHEETS A1 - A6.

LEGEND

—x—x— CHAIN LINK FENCE

CEMENT CONCRETE

0 10 20 40

SCALE: 1" = 20'

SITE PLAN

CIVIC CENTER

WOODLAND, WASHINGTON

HHPR Harper Houf Peterson Righellis Inc.
ENGINEERS • PLANNERS
LANDSCAPE ARCHITECTS • SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

DESIGNED: DJW

DRAWN: DJW

CHECKED: BMH

DATE: 02/21/2023

DATE	NO.	DESCRIPTION

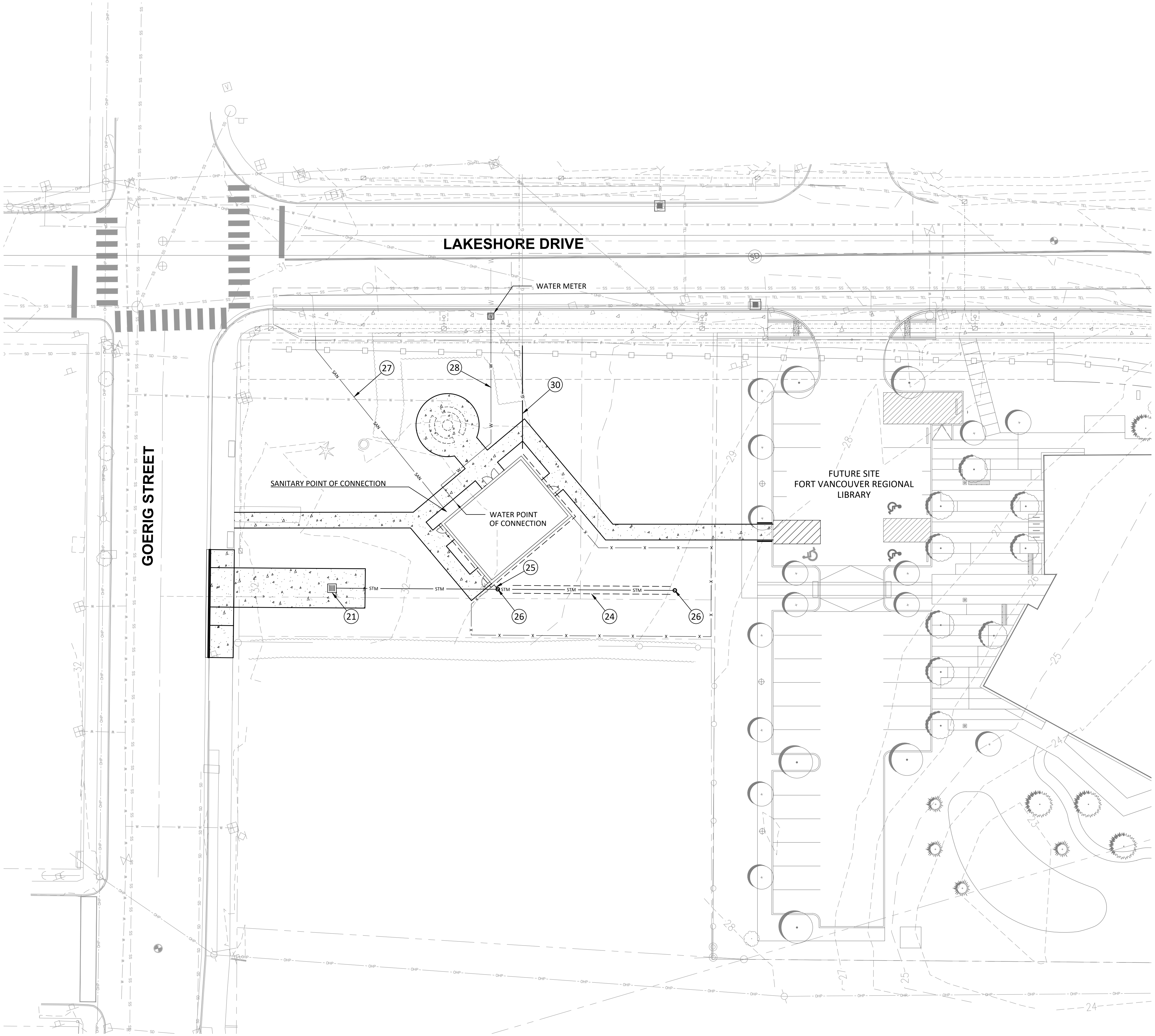
REVISIONS

SHEET NO.

C3.0

JOB NO. WLD-21

P:\02-Vancouver\WLD (City of Woodland)\WLD-21 (Welcome Center)\WLD21-DWGS\Sheets\ C3.0 - SITE PLAN.dwg



CONSTRUCTION NOTES:

21 INSTALL AREA DRAIN PER DETAIL ON SHEET C5.1.
24 CONSTRUCT INFILTRATION TRENCH, SEE DETAIL ON SHEET C5.1.
25 CONNECT ROOF DRAIN.
26 CONSTRUCT STORMWATER CLEANOUT PER DETAIL D-13, SHEET C5.1.
27 INSTALL 6 IN. DIAM SANITARY SEWER PIPE.
28 INSTALL 1 IN. WATER LINE.
30 PROPOSED GAS SERVICE, COORDINATE WITH CASCADE NATURAL GAS.

LEGEND

GAS LINE
WATER LINE
SANITARY SEWER LINE
CHAIN LINK FENCE
CONCRETE WALK

0 10 20 40
SCALE: 1" = 20'

UTILITY PLAN
CIVIC CENTER
WOODLAND, WASHINGTON

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phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

DESIGNED: DJW
DRAWN: DJW
CHECKED: BMH
DATE: 02/21/2023

DATE	NO.	DESCRIPTION

R E V I S I O N S

SHEET NO.
C4.0

JOB NO. WLD-21

P:\02-Vancouver\WLD (City of Woodland)\WLD-21 (Welcome Center)\WLD21-DWGS\Sheets\ C4.0 - UTILITY PLAN.dwg

GENERAL EROSION PREVENTION & SEDIMENT CONTROL NOTES

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE AND IN WORKING CONDITION PRIOR TO ANY LAND DISTURBING ACTIVITY CAUSED BY CLEARING OR GRADING. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE APPROVED BY THE CITY EROSION CONTROL SPECIALIST PRIOR TO THE COMMENCEMENT OF WORK. THE CONTRACTOR SHALL CALL FOR AN ON-SITE INSPECTION WHEN EROSION AND SEDIMENT CONTROL MEASURES ARE IN PLACE AND PRIOR TO COMMENCEMENT OF WORK.
2. THE EROSION AND SEDIMENT CONTROL MEASURES SHALL BE SITED, DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS IN THE CITY OF WOODLAND'S LATEST STANDARD DETAILS AND THE WASHINGTON STATE DEPARTMENT OF ECOLOGY STORMWATER MANUAL FOR WESTERN WASHINGTON, WHERE THE CITY OF WOODLAND GENERAL REQUIREMENTS SHALL TAKE PRECEDENCE.
3. THE DEVELOPER IS RESPONSIBLE FOR MAINTAINING EROSION PREVENTION AND SEDIMENT CONTROL MEASURES DURING AND AFTER INSTALLATION OF ALL UTILITY WORK ASSOCIATED WITH UTILITY TRENCHES.
4. PRIOR TO ANY SITE EXCAVATION, ALL STORM DRAINAGE INLETS SHALL BE PROTECTED DOWN SLOPE FROM ANY DISTURBED OR CONSTRUCTION AREAS PER THE STANDARD DETAILS TO PREVENT SEDIMENT FROM ENTERING THE STORM DRAINAGE SYSTEM PRIOR TO PERMANENT STABILIZATION OF THE DISTURBED AREAS. CLEAN THE FILTER FABRIC AS NECESSARY TO MAINTAIN DRAINAGE. REMOVE FILTER AND CLEAN CATCH BASINS FOLLOWING COMPLETION OF SITEWORK.
5. THE CONTRACTOR SHALL NOT ALLOW SEDIMENT OR DEBRIS TO ENTER NEW OR EXISTING PIPES, CATCH BASINS OR INFILTRATION SYSTEMS.
6. NEWLY CONSTRUCTED OR MODIFIED INLETS AND CATCH BASINS ARE TO BE PROTECTED IMMEDIATELY UPON INSTALLATION.
7. TEMPORARY SEEDING AND MULCHING OF FILL SLOPES AND DIVERSION DIKES SHALL BE COMPLETED WITHIN ONE WEEK AFTER ROUGH GRADING.
8. ALL EXPOSED AND UNWORKED SOILS SHALL BE STABILIZED BY THE APPROPRIATE BEST MANAGEMENT PRACTICES (BMPs). DURING THE PERIOD FROM OCTOBER 1 TO APRIL 30 NO SOIL SHALL BE EXPOSED FOR MORE THAN TWO (2) DAYS. FROM MAY 1 TO SEPTEMBER 30 NO SOIL SHALL BE EXPOSED FOR MORE THAN SEVEN (7) DAYS.
9. MATERIAL STOCKPILES ARE TO BE PROTECTED BY THE FOLLOWING MEANS:
   TEMPORARY: COVER PILES WITH TARPS OR PLASTIC SHEETING WEIGHTED WITH CONCRETE BLOCKS, LUMBER OR TIRES.
   PERMANENT: COVER PILES WITH TARPS OR PLASTIC, OR RESEED. PERIMETER AREAS AROUND PILES ARE TO BE SURROUNDED WITH EROSION CONTROL FILTER FABRIC FENCES UNTIL SOIL SURFACE IS STABILIZED WITH RESEEDING.
10. THE CONTRACTOR SHALL MAINTAIN ON SITE A WRITTEN DAILY LOG OF EROSION CONTROL BMP MAINTENANCE.
11. IF THE CITY INSPECTOR OR ENGINEER(S) HAS EVIDENCE OF POOR CONSTRUCTION PRACTICES OR IMPROPER EROSION PREVENTION BMPs, CITATIONS AND/OR A STOP WORK ORDER SHALL BE ISSUED UNTIL PROPER MEASURES HAVE BEEN TAKEN AND APPROVED BY THE CITY OF WOODLAND. IF THE BMPs APPLIED TO A SITE ARE INSUFFICIENT TO PREVENT SEDIMENT FROM REACHING WATER BODIES, ADJACENT PROPERTIES, OR PUBLIC RIGHT-OF-WAY, THEN THE PUBLIC WORKS DIRECTOR SHALL REQUIRE ADDITIONAL BMPs.

PROTECTION OF ADJACENT PROPERTIES, ROADS AND STREETS

12. PROVIDE A 12-INCH DEEP PAD OF CRUSHED ROCK FOR A DISTANCE OF 100 FEET INTO THE SITE FOR ALL ACCESS POINTS UTILIZED BY CONSTRUCTION EQUIPMENT AND TRUCKS. WIDTH OF THE PAD SHALL BE A MINIMUM OF 20 FEET. ALL TRUCKS LEAVING THE SITE SHALL EGRESS ACROSS THE PAD. ACCUMULATED SOIL SHALL BE PERIODICALLY REMOVED, OR ADDITIONAL ROCK SHALL BE PLACED UPON THE PAD SURFACE. ROCK SHALL BE CLEAN 4 INCH TO 8 INCH QUARRY SPALLS. ALL MATERIALS SPILLED, DROPPED, WASHED OR TRACKED FROM VEHICLES ONTO ROADWAYS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.
13. PAVEMENT SWEEPING AND SHOVELING IS REQUIRED. WASHING THE PAVEMENT INTO THE STORM SYSTEM IS NOT PERMITTED.
14. AT SITES WITH LESS THAN 1 ACRE OF EXPOSED SOIL, PAD LENGTH MAY BE REDUCED TO 50-FEET. SINGLE FAMILY LOT ENTRANCES MAY HAVE THE PAD LENGTH REDUCED TO 20-FEET. IF CONSTRUCTION OCCURS SIMULTANEOUSLY ON ADJACENT LOTS WITH THE SAME OWNER DURING CONSTRUCTION, ONE LOT ENTRANCE MAY BE USED FOR THE ADJACENT LOTS.
15. INSTALL SEDIMENT FENCE IN ACCORDANCE WITH THIS DETAIL SHEET PRIOR TO BUILDING CONSTRUCTION AND/OR EXCAVATION TO PREVENT SILT INTRUSION UPON ADJACENT LOTS. IF CONSTRUCTION OCCURS SIMULTANEOUSLY ON ADJACENT LOTS AND THE LOTS HAVE THE SAME OWNER DURING CONSTRUCTION, THE SILT FENCE ALONG THE COMMON LOT LINE MAY BE ELIMINATED.
16. CONSTRUCTION ROADS AND PARKING AREAS SHALL BE STABILIZED WHEREVER THEY ARE CONSTRUCTED, WHETHER PERMANENT OR TEMPORARY, FOR THE USE OF CONSTRUCTION TRAFFIC.

MAINTENANCE OF SEDIMENT CONTROL BMPs

17. MAINTAIN AND REMOVE ALL SEDIMENT CONTROLS AS SPECIFIED IN THE STANDARD DETAILS. THE CONTRACTOR SHALL REMOVE ALL ACCUMULATED SEDIMENT FROM THE CATCH BASINS, DRYWELLS, UTILITY TRENCHES AND STORM PIPES PRIOR TO ACCEPTANCE BY THE CITY.
18. SEDIMENT CONTROL BMPs SHALL BE INSPECTED WEEKLY AND AFTER ANY STORM EVENT PRODUCING RUNOFF. THE INSPECTION FREQUENCY FOR STABILIZED, INACTIVE SITES SHALL BE ONCE EVERY TWO WEEKS OR MORE FREQUENTLY AS DETERMINED BY THE LOCAL PERMITTING AUTHORITY BASED ON THE LEVEL OF SOIL STABILITY AND POTENTIAL FOR ADVERSE ENVIRONMENTAL IMPACTS.
19. ALL TEMPORARY EROSION PREVENTION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER SITE STABILIZATION IS ACHIEVED OR AFTER TEMPORARY BMPs ARE NO LONGER NEEDED. TRAPPED SEDIMENT SHALL BE REMOVED OR STABILIZED ON SITE. DISTURBED SOIL AREAS RESULTING FROM REMOVAL SHALL BE PERMANENTLY STABILIZED.

DUST CONTROL

20. IN AREAS SUBJECT TO SURFACE AND AIR MOVEMENT OF DUST ONE OR MORE OF THE FOLLOWING PREVENTATIVE MEASURES SHALL BE TAKEN FOR DUST CONTROL:
   A. MINIMIZE THE PERIOD OF SOIL EXPOSURE THROUGH THE USE OF TEMPORARY GROUND COVER AND OTHER TEMPORARY STABILIZATION PRACTICES.
   B. SPRINKLE THE SITE WITH WATER UNTIL THE SURFACE IS WET.
   C. SPRAY EXPOSED SOIL AREAS WITH A DUST PALLIATIVE. NOTE: USE OF PETROLEUM PRODUCTS OR POTENTIALLY HAZARDOUS MATERIALS ARE PROHIBITED

TEMPORARY SEEDING

21. EXPOSED SURFACES THAT WILL NOT BE BROUGHT TO FINAL GRADE OR GIVEN A PERMANENT COVER TREATMENT WITHIN 30 DAYS OF THE EXPOSURE SHALL HAVE SEED MIX AND MULCH PLACED TO STABILIZE THE SOIL AND REDUCE EROSION SEDIMENTATION. SEEDED AREAS SHALL BE CHECKED REGULARLY TO ASSURE A GOOD STAND OF GRASS IS BEING MAINTAINED. AREAS THAT FAIL TO ESTABLISH VEGETATION COVER ADEQUATE TO PREVENT EROSION WILL BE RESEEDED AS SOON AS SUCH AREAS ARE IDENTIFIED.
22. APPLY AN APPROVED TEMPORARY SEEDING MIXTURE TO THE PREPARED SEED BED AT A RATE OF 120 LBS/ACRE. NOTE: "HYDROSEEDING" APPLICATIONS WITH APPROVED SEED-MULCH-FERTILIZER MIXTURES MAY ALSO BE USED.

WOODLAND PUBLIC WORKS	EROSION PREVENTION AND SEDIMENT CONTROL				E-03
	APPROVED 3/14/23	REVISIONS	DATE	DRAWN	DESIGNED
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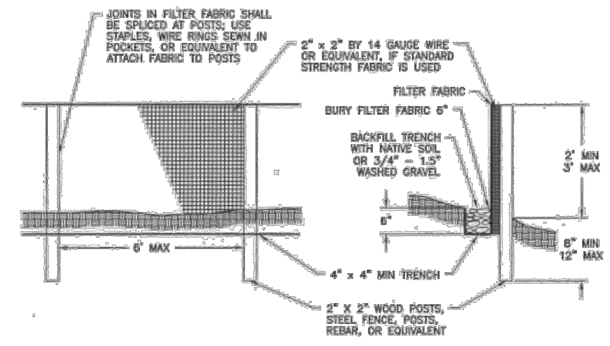

NOTES:

1. FILTER FABRIC FENCES SHALL BE INSTALLED ALONG CONTOUR WHENEVER POSSIBLE.
2. POST SPACING MAY BE INCREASED TO 8' IF WIRE BACKING IS USED.

MAINTENANCE STANDARDS:

1. SILT FENCES AND FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.
2. IF CONCENTRATED FLOWS ARE EVIDENT UPHILL OF THE FENCE, THEY MUST BE INTERCEPTED AND CONVEYED TO A SEDIMENT POND.
3. IT IS IMPORTANT TO CHECK THE UPHILL SIDE OF THE FENCE FOR SIGNS OF THE FENCE CLOGGING AND ACTING AS A BARRIER TO FLOW AND THEN CAUSING CHANNELIZATION OF FLOWS PARALLEL TO THE FENCE. IF THIS OCCURS, REPLACE THE FENCE OR REMOVE THE TRAPPED SEDIMENT.
4. SEDIMENT DEPOSITS SHALL EITHER BE REMOVED WHEN THE DEPOSIT REACHES APPROXIMATELY ONE-THIRD THE HEIGHT OF THE SILT FENCE, OR A SECOND SILT FENCE SHALL BE INSTALLED.
5. IF THE FILTER FABRIC (GEOTEXTILE) HAS DETERIORATED DUE TO ULTRAVIOLET BREAKDOWN, IT SHALL BE REPLACED.

WOODLAND PUBLIC WORKS	SILT FENCE				E-20
	APPROVED 3/14/23	REVISIONS	DATE	DRAWN	DESIGNED
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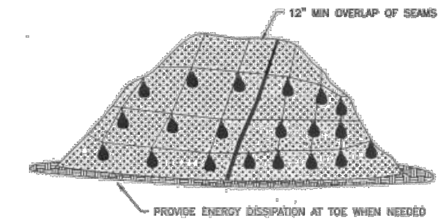

PLASTIC SHEETING

NOTES:

1. PLASTIC SHEETING IS USED TO PROVIDE IMMEDIATE PROTECTION TO SLOPES AND STOCKPILES.
2. DO NOT USE PLASTIC COVERING UPSLOPE OF AREAS SUCH AS STEEP AND/OR UNSTABLE SLOPES THAT MIGHT BE ADVERSELY AFFECTED BY CONCENTRATED RUNOFF.
3. WHEN POSSIBLE, INSTALL AN INTERCEPTOR DIKE AT THE TOP OF THE PLASTIC TO DIVERT FLOWS AWAY FROM THE PLASTIC.
4. TOE-IN THE TOP OF THE SHEETING IN A 6"x6" TRENCH BACKFILLED WITH COMPACTED NATIVE MATERIAL.
5. INSTALL A GRAVEL BERM, RIPRAP, OR OTHER SUITABLE PROTECTION AT THE TOP OF THE SLOPE IN ORDER TO DISSIPATE RUNOFF VELOCITY.
6. ANCHOR THE PLASTIC USING SANDBAGS OR OTHER SUITABLE TETHERED ANCHOR SYSTEM SPACED ON A 10' GRID SPACING IN ALL DIRECTIONS.
7. OVERLAP SEAMS 1-2', TAPE, ROLL AND STAKE THE SEAMS AND THEN WEIGH DOWN THE ENTIRE LENGTH.
8. PROVIDE ENERGY DISSIPATION AT TOE WHEN NEEDED.
9. REPLACE TORN SHEETS AND REPAIR OPEN SEAMS; COMPLETELY REMOVE AND REPLACE PLASTIC WHEN IT BEGINS TO DETERIORATE.

WOODLAND PUBLIC WORKS	PLASTIC COVERING				E-08
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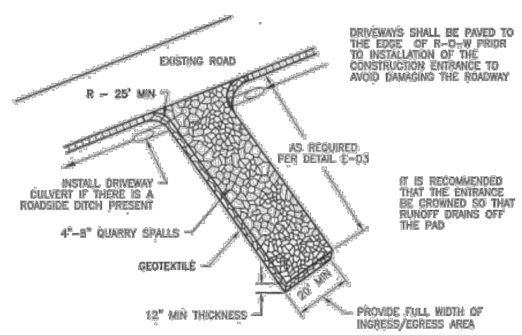

NOTES:

1. IF THE ENTRANCE SITS ON A SLOPE, PLACE A FILTER FABRIC FENCE DOWN GRADIENT.
2. TOP DRESS THE PAD WITH CLEAN 3" MINUS ROCK WHEN THE CONSTRUCTION ENTRANCE BECOMES CLOGGED WITH SEDIMENTS.
3. ANY SEDIMENT CARRIED FROM THE SITE ONTO THE STREET SHALL BE CLEANED UP IMMEDIATELY.
4. IF EQUIPMENT TRAVELS EXTENSIVELY ON UNSTABILIZED ROADS ON THE SITE, A TIRE AND VEHICLE UNDERCARRIAGE WASH NEAR THE ENTRANCE WILL BE NEEDED. PERFORM WASHING ON CRUSHED ROCK. WASH WATER WILL REQUIRE TREATMENT IN A SEDIMENT POND OR TRAP.

WOODLAND PUBLIC WORKS	STABILIZED CONSTRUCTION ENTRANCE				E-05
	APPROVED 3/14/23	REVISIONS	DATE	DRAWN	DESIGNED
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phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

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CHECKED:	BMH
DATE:	02/21/2023

REVISIONS

DATE	NO.	DESCRIPTION

SHEET NO.
C5.0

JOB NO. WLD-21

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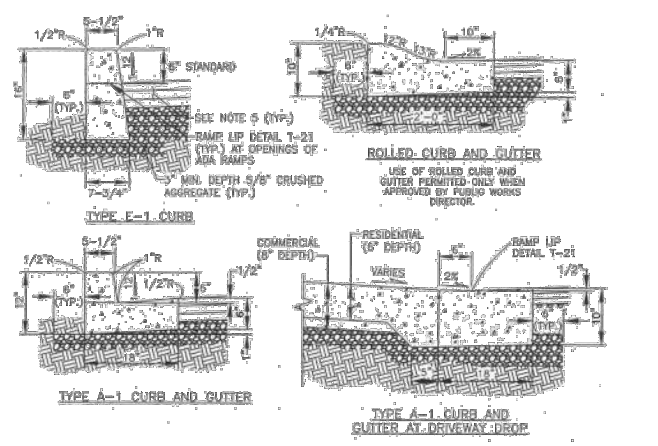

NOTES:

1. CONCRETE SHALL BE 3000 PSI MIN. (CL 3000), 3-1/2" SLUMP (MAX.).
2. CURBS ADJACENT TO PAVEMENT OR SIDEWALK SHALL HAVE CONSTRUCTION JOINTS TO MATCH EXISTING PATTERNS. 3/8" EXPANSION JOINTS SHALL BE PLACED ON BOTH SIDES OF CATCH BASINS, AT TOPS OF DRIVEWAYS, ALL CHANGES IN DIRECTION, AND AS DIRECTED BY THE INSPECTOR. CONTRACTION JOINTS TO BE PLACED AT 15' MAXIMUM SPACING.
3. FOR CURB DROPS AT ADA RAMPS, SEE RAMP LIP DETAIL T-21.
4. COMPACT SUBGRADE AND AGGREGATE TO 95% MAXIMUM DRY DENSITY (3" MIN. DEPTH).
5. SEE PAVEMENT RESTORATION/WIDENING AT CURBS DETAIL T-30.
6. CURB TO BE MEDIUM BROOM FINISHED, PARALLEL TO GUTTER LINE.
7. WHERE MATCHING EXISTING CURBS, ALL EXISTING EDGES SHALL BE SAWCUT.
8. WHEN ATTACHED SIDEWALKS ARE USED WITH ROLLED CURB AND GUTTER, THICKENED SIDEWALKS (6" MIN.) SHALL BE CONSTRUCTED UNDER THE SAME CONSTRUCTION CONTRACT.

CONCRETE CURBS — T-01

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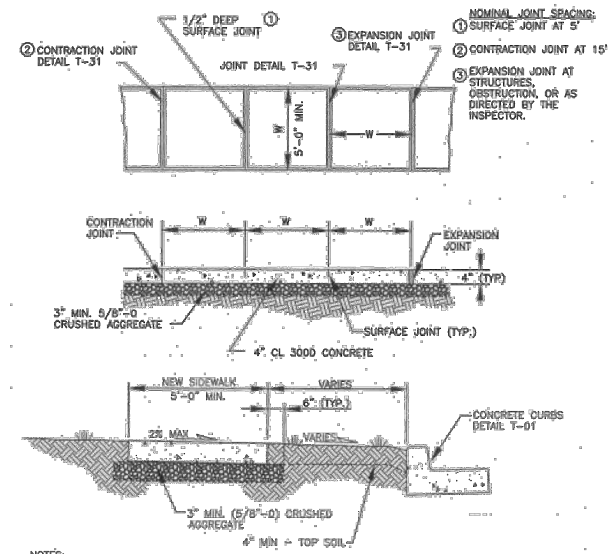
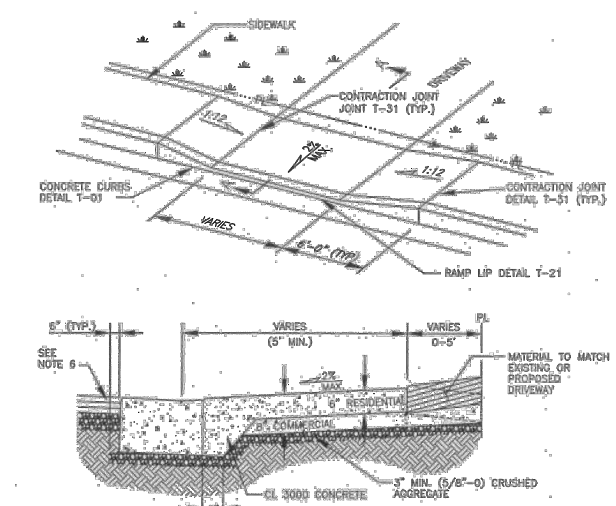


NOTES:

1. CONCRETE SHALL BE 3000 PSI MIN. (CL 3000), 3 1/2" SLUMP (MAX.).
2. COMPACT SUBGRADE AND AGGREGATE TO 95% OF MAXIMUM DRY DENSITY (3" MIN.).
3. FINISH SHALL BE MEDIUM BROOM PERPENDICULAR TO PEDESTRIAN TRAFFIC UNLESS OTHERWISE DIRECTED.
4. MATCH EXISTING BORDER.
5. SEE CONCRETE JOINTS DETAIL T-31 FOR SURFACE, CONTRACTION, AND EXPANSION JOINTS.
6. ALL EXISTING EDGES SHALL BE SAWCUT.
7. CROSS SLOPE OF PLANTER STRIP SHALL BE 2% (TYP.) AND 4:1 (MAX.).

SIDEWALK DETAIL — T-07

WOODLAND PUBLIC WORKS | APPROVED PUBLIC WORKS DIRECTOR DATE | REVISIONS | DATE | DRAWN | DESIGNED



NOTES:

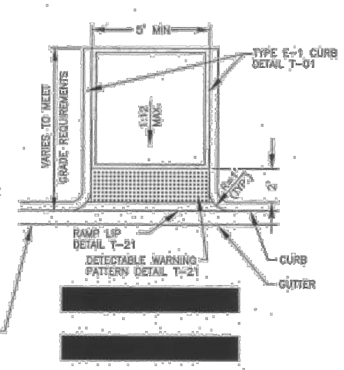
1. CONCRETE SHALL BE 3000 PSI MIN. (CL 3000), 3-1/2" SLUMP (MAX.), MEDIUM BROOM FINISH PARALLEL TO DRIVEWAY CENTERLINE.
2. COMMERCIAL DRIVEWAYS REQUIRE REINFORCING STEEL (6x6 - W2.9xW2.9 WWF, MIN.), MIN. 1 1/2" COVER FROM BOTTOM OF SLAB.
3. COMPACT SUBGRADE AND AGGREGATE TO 95% OF MAXIMUM DRY DENSITY (3" MIN. DEPTH).
4. DRIVEWAYS EXCEEDING 15' IN TOTAL WIDTH SHALL HAVE ADDITIONAL LONGITUDINAL JOINTS AS DIRECTED. JOINT SPACING SHALL NOT EXCEED 15'. SEE CONCRETE JOINTS DETAIL T-31.
5. EXISTING CURB SHALL BE REMOVED TO EXISTING JOINT OR SAWCUT SUCH THAT 3' MIN. OF NEW CURB IS CONSTRUCTED ADJACENT TO NEW DRIVEWAY.
6. SEE PAVEMENT RESTORATION/WIDENING AT CURBS DETAIL T-30 WHEN CUTTING EXISTING CURB.
7. ALL EXISTING EDGES SHALL BE SAWCUT.
8. SET ALL POLES AND SIGNS BEHIND SIDEWALK.
9. NO WATER METERS IN DRIVEWAY APPROACH OR WINGS.

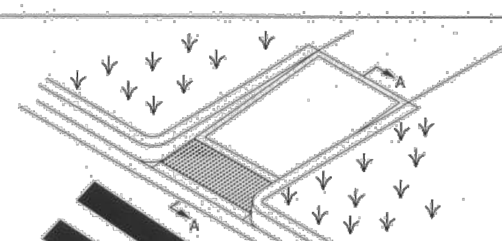
DRIVEWAY WITH ATTACHED SIDEWALK - OPTION B — T-05

WOODLAND PUBLIC WORKS | APPROVED 2/10/23 PUBLIC WORKS DIRECTOR DATE | REVISIONS | DATE | DRAWN | DESIGNED

NOTES:

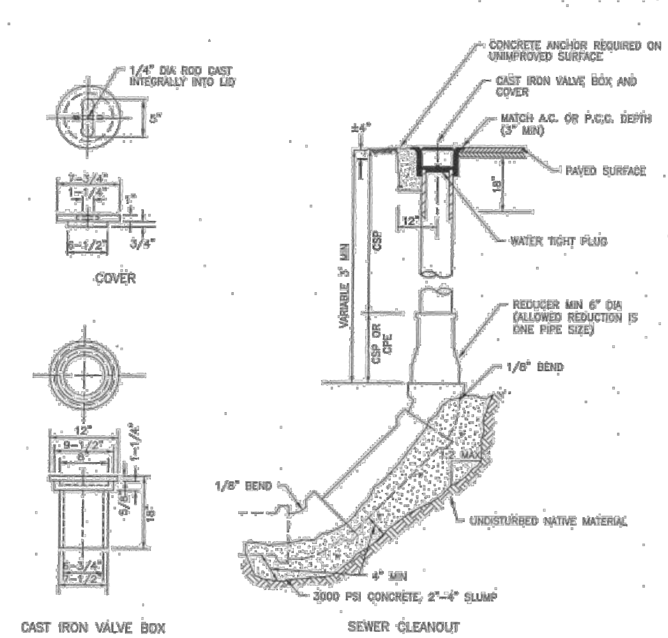
1. EXISTING CURB AND SIDEWALK TO BE SAWCUT AND REMOVED FOR INSTALLATION OF NEW RAMP.
2. RAMP MAY BE USED MID BLOCK OR ON INTERSECTION RADIUS.
3. RAMP TO BE CENTERED IN CROSSWALK.
4. RAMPS TO BE CONSTRUCTED SEPARATELY FROM SIDEWALK AND ISOLATED BY EXPANSION JOINT MATERIAL.
5. FOR SECTIONS A-A, SEE STANDARD LANDING CROSS SECTION A-A, T-19.
6. IF THE MAXIMUM SLOPE OF 1:12 CANNOT BE ACHIEVED DUE TO THE SLOPE OF THE EXISTING SIDEWALK, THE LENGTH OF THE CURB RAMP SHALL NOT BE REQUIRED TO BE LONGER THAN 15 FEET REGARDLESS OF THE RESULTING RAMP SLOPE.





PERPENDICULAR RAMP — T-17

WOODLAND PUBLIC WORKS | APPROVED 2/10/23 PUBLIC WORKS DIRECTOR DATE | REVISIONS | DATE | DRAWN | DESIGNED



NOTES:

1. VALVE BOX SHALL BE FORT VANCOUVER PATTERN NO. 910 CAST IRON OR APPROVED EQUAL.
2. MATERIAL TO BE GRAY CAST IRON CONFORMING TO ASTM A-48 CLASS 30.
3. LID TO HAVE "S" CAST IN OR STAMPED ON. "W" CASTING NOT ALLOWED.
4. TOLERANCE = 1/8".
5. SEWER CLEANOUT TO BE 8" DIAMETER.

STORM SEWER CLEANOUT — D-13

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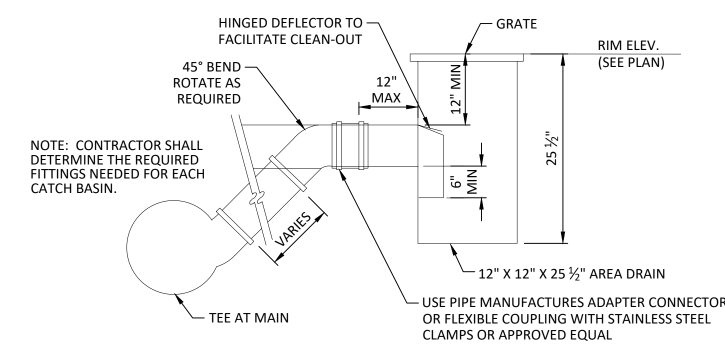
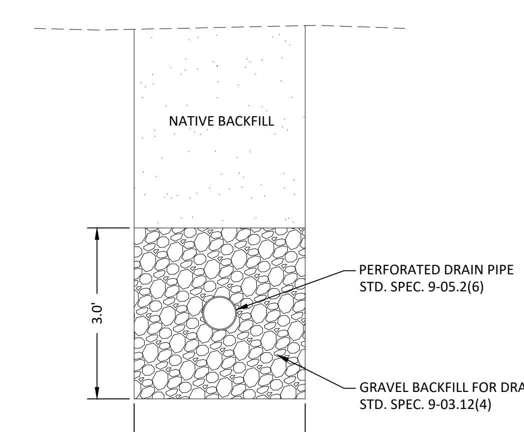


AREA DRAIN

NTS



INFILTRATION TRENCH

NTS

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DRAWN: DJW
CHECKED: BMH
DATE: 02/21/2023

REVISIONS

DATE	NO.	DESCRIPTION

SHEET NO. **C5.1**

JOB NO. WLD-21

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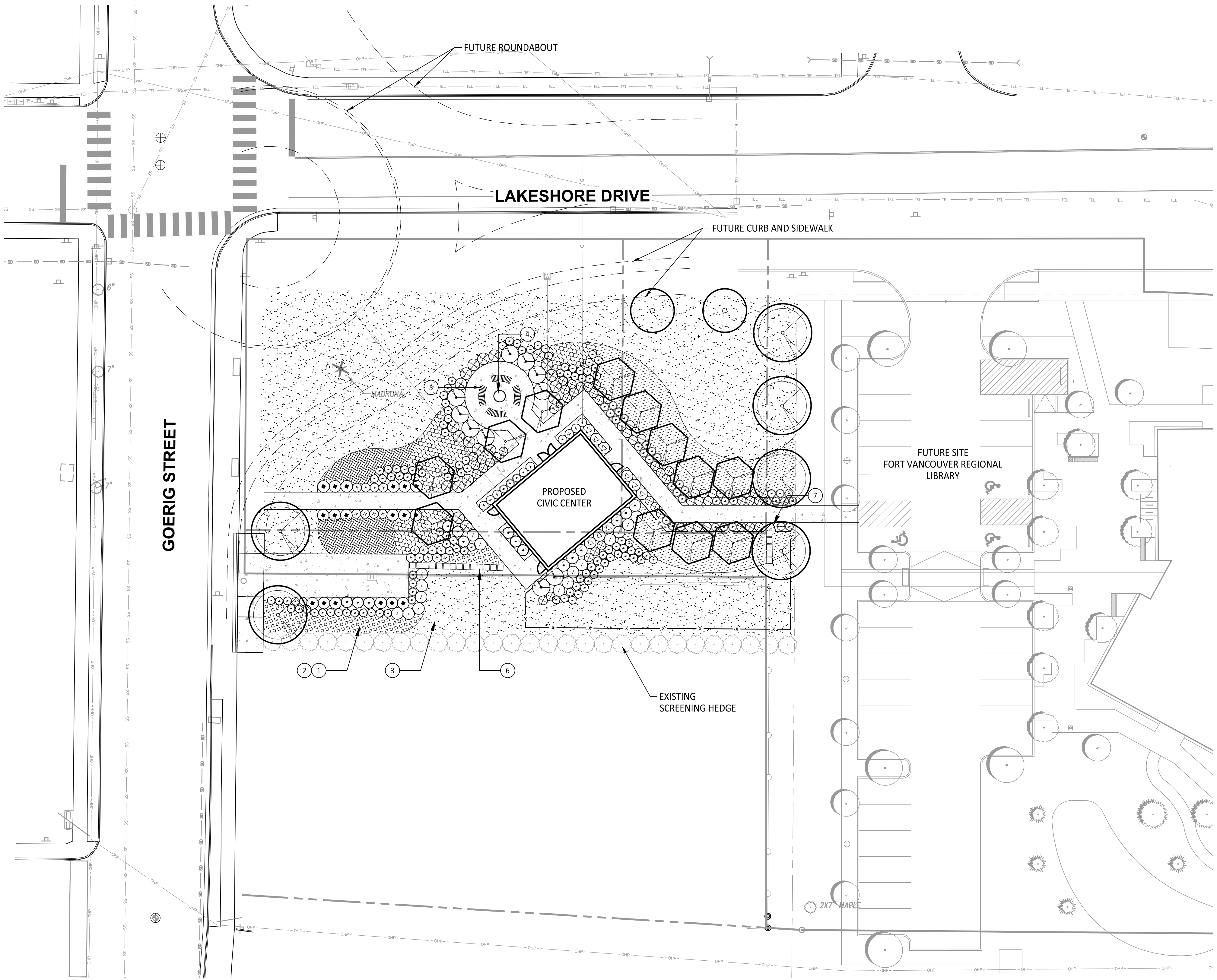

0 10 20 40
SCALE: 1" = 20'

PLANT SCHEDULE:

1	TREE TO BE REMOVED
6 2" CAL.	Acer buergerianum - Trident Maple B&B, WELL BRANCHED, LIMBED TO 6' MATURE SIZE: 20-30'H x 20'W
2 2" CAL.	Gingko biloba 'Saratoga' - Saratoga Gingko B&B, WELL BRANCHED, LIMBED TO 6' MATURE SIZE: 15-20'H x 15'W
12 2" CAL.	Cercis occidentalis 'Forest Pansy' - Forest Pansy Redbud B&B, WELL BRANCHED, LIMBED TO 6' MATURE SIZE: 20'H x 15'W

SHRUBS

10 5 GAL	Choisya ternata 'Sundance' - Sundance Mexican Orange Blossom CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 5-6'H x 6'W
6 5 GAL	Viburnum davidii - David Viburnum CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 2-3'H x 4'W
9 5 GAL	Abelia x grandiflora 'Little Richard' - Little Richard Abelia CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 2-3'H x 4'W
18 5 GAL	Buxus 'Glencoe' - Chicagoland Green Boxwood CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 3-4'H x 4'W
9 5 GAL	Hydrangea 4aniculate - Little Lime Hydrangea CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 3-5'H x 4'W
26 5 GAL	Nandina domestica 'Gulf Stream' - Gulf Stream Nandina CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 3'H x 3'W
46 5 GAL	Pinus mugo 'Sherwood Compact' - Compact Mugo Pine CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 2'H x 3'W
19 5 GAL	Berberis thunbergii 'Crimson Pygmy' - Dwarf Japanese Barberry CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 2'H x 3'W
40 5 GAL	Spiraea japonicum 'Goldmound' - Goldmound Spirea CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 2'H x 3'W
16 5 GAL	Spiraea x bumalda 'Anthony Waterer' - Anthony Waterer Spirea CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 3'H x 4'W
22 5 GAL	Pennisetum alopecuroides - Fountain Grass CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 3-5'H x 4'W
108 5 GAL	Deschampsia cespitosa 'Pixie Fountain' - Dwarf Tufted Hair Grass CONT., FULL PLANTS, SPACING AS SHOWN MATURE SIZE: 2'H x 3'W

GROUNDCOVER

161 1 GAL	Rubus pentalobus 'Emerald Carpet' - Creeping Raspberry CONT., FULL PLANTS, 24" O.C.
533 1 GAL	Juniperus squamata 'Blue Star' - Blue Star Juniper CONT., FULL PLANTS, 24" O.C.
630 1 GAL	Festuca glauca 'Elijah Blue' - Blue Fescue CONT., FULL PLANTS, 12" O.C.
113 1 GAL	Calluna vulgaris 'Spring Torch' - Flowering Heather CONT., FULL PLANTS, 24" O.C.

SEED MIXES

10,588 SF	TURF SEEDING	% PLS	LBS OF PLA/ 1000 SF
	Festuca rubra 'Gibraltar'	10	0.364
	Festuca rubra 'Silhouette'	10	0.364
	Lolium perenee 'Delaware Dwarf'	40	5.563
	Lolium perenee 'Amazing'	40	2.696
		TOTAL	8.987

CONSTRUCTION NOTES:

1. PLACE 12" AMENDED TOPSOIL IN SHRUB AREAS, TYP. - 245 CY
2. PLACE 3" BARK MULCH IN SHRUBS AREAS, TYP. - 61 CY
3. PLACE 4" AMENDED TOPSOIL IN SEEDED LAWN AREAS, TYP. - 131 CY
4. GAS FIRE PIT
5. LANDSCAPE FORMS 'LINK' OUTDOOR BENCH
   PIANO KEY - 96" RADII; BACKED; NO ARMS; METAL LEGS
   SEE DETAIL 1, SHEET L1.2 FOR DETAILS
6. STEPPING PAVERS, TYP.
7. GATE - ACCESS TO BACKYARD AREA

STATE OF WASHINGTON
REGISTERED
LANDSCAPE ARCHITECT
PRELIMINARY
JEFFERY P. CREEL
CERTIFICATE NO. 1356

PLANTING PLAN
CIVIC CENTER
WOODLAND, WASHINGTON

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REVISIONS

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SHEET NO.
L1.0

JOB NO.
WLD-21

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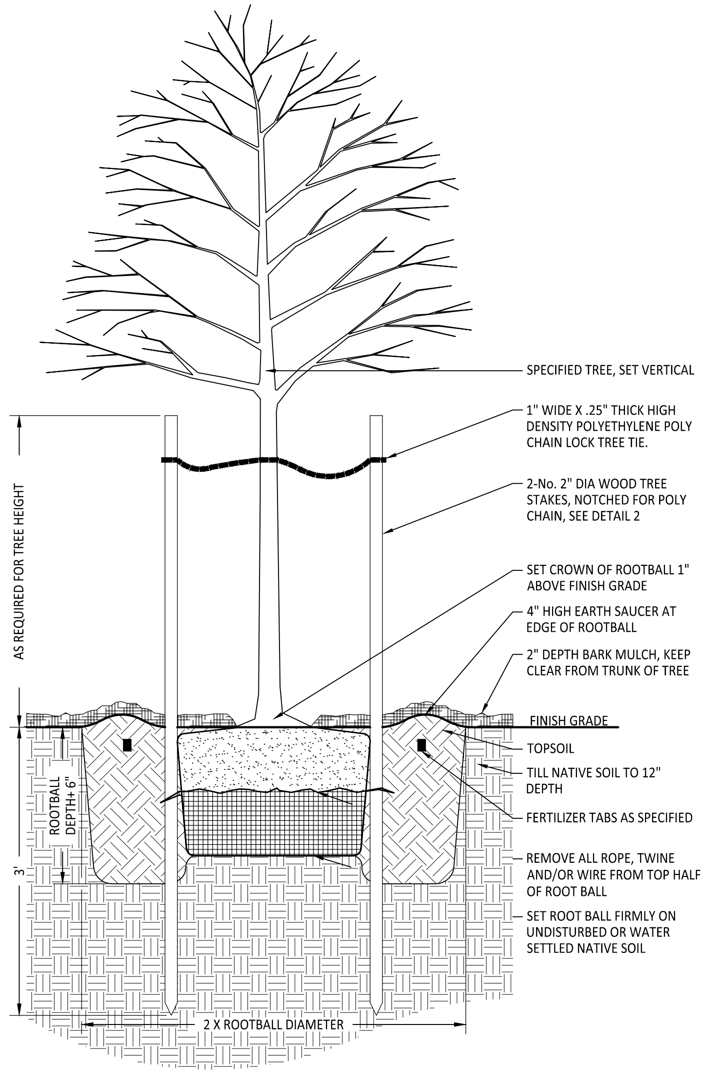
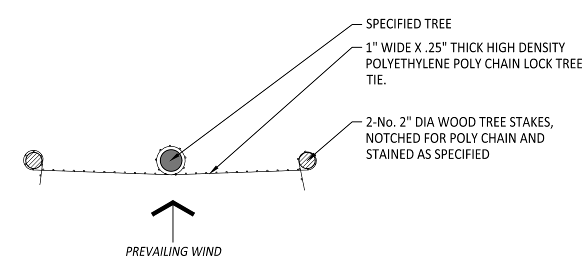


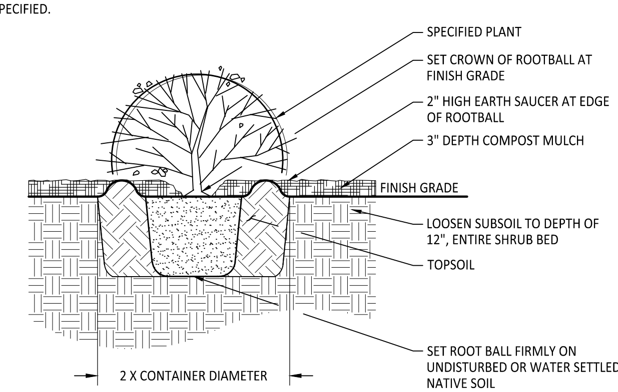
1 DECIDUOUS TREE PLANTING
Section
NOT TO SCALE

NOTE:
WRAP POLY CHAIN AROUND NOTCHED STAKE AND LOCK TO SECURE. WRAP CENTER OF POLY CHAIN AROUND TREE TRUNK TO MOVE 3" IN ALL DIRECTIONS.

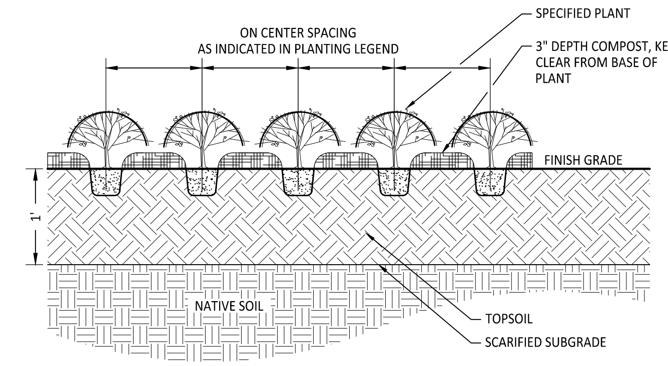


2 TREE STAKING
Plan
NOT TO SCALE

NOTE:
PROVIDE 36" DIAMETER MULCH OR COMPOST RING, AS SPECIFIED.

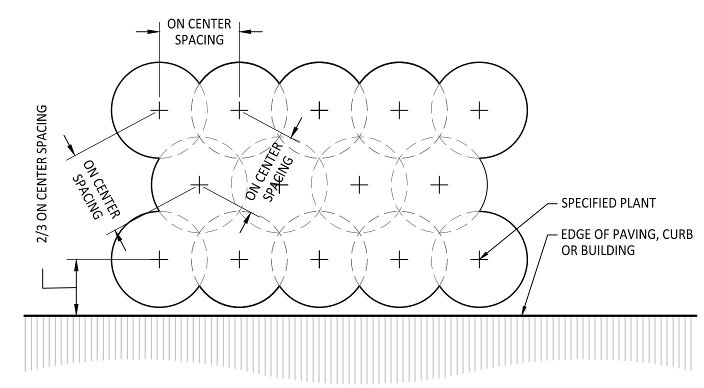


3 SHRUB PLANTING
Section
NOT TO SCALE



4 GROUNDCOVER PLANTING
Section
NOT TO SCALE

NOTE:
ON CENTER SPACING SHALL BE AS INDICATED IN PLANTING LEGEND.



5 TRIANGULAR SPACING
Plan
NOT TO SCALE

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STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT
PRELIMINARY
JEFFERY P. CREEL
CERTIFICATE NO. 1356

PLANTING DETAILS
CIVIC CENTER
WOODLAND, WASHINGTON

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DATE:	02/21/2023

REVISIONS

DATE	NO.	DESCRIPTION

SHEET NO.
L1.1

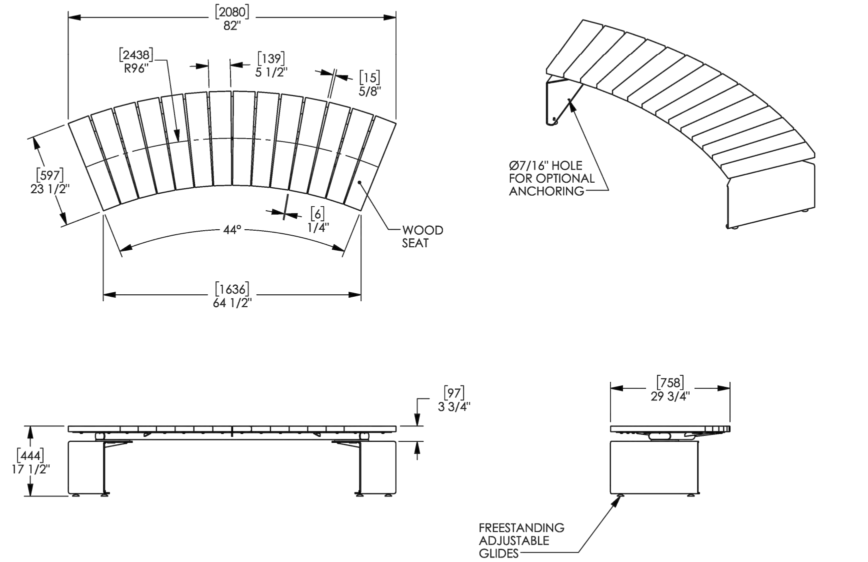
JOB NO.
WLD-21

Link bench, piano key, 96in centerline radius, backless, no arms, metal legs

Date: 01/16/2023

Product Drawing

www.landscapeforms.com Ph: 800.521.2546



landscapeforms

Drawing: BQ0085

Dimensions are in inches [mm]

1 LANDSCAPE FORMS LINK BENCH

PLAN AND SECTION NTS

LANDSCAPE DETAILS

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JOB NO. WLD-21

N:\WLD (City of Woodland)\WLD-21 (Welcome Center)\DWGS\SHEETS\ WLD21-L1.0 - PLANTING PLAN.dwg

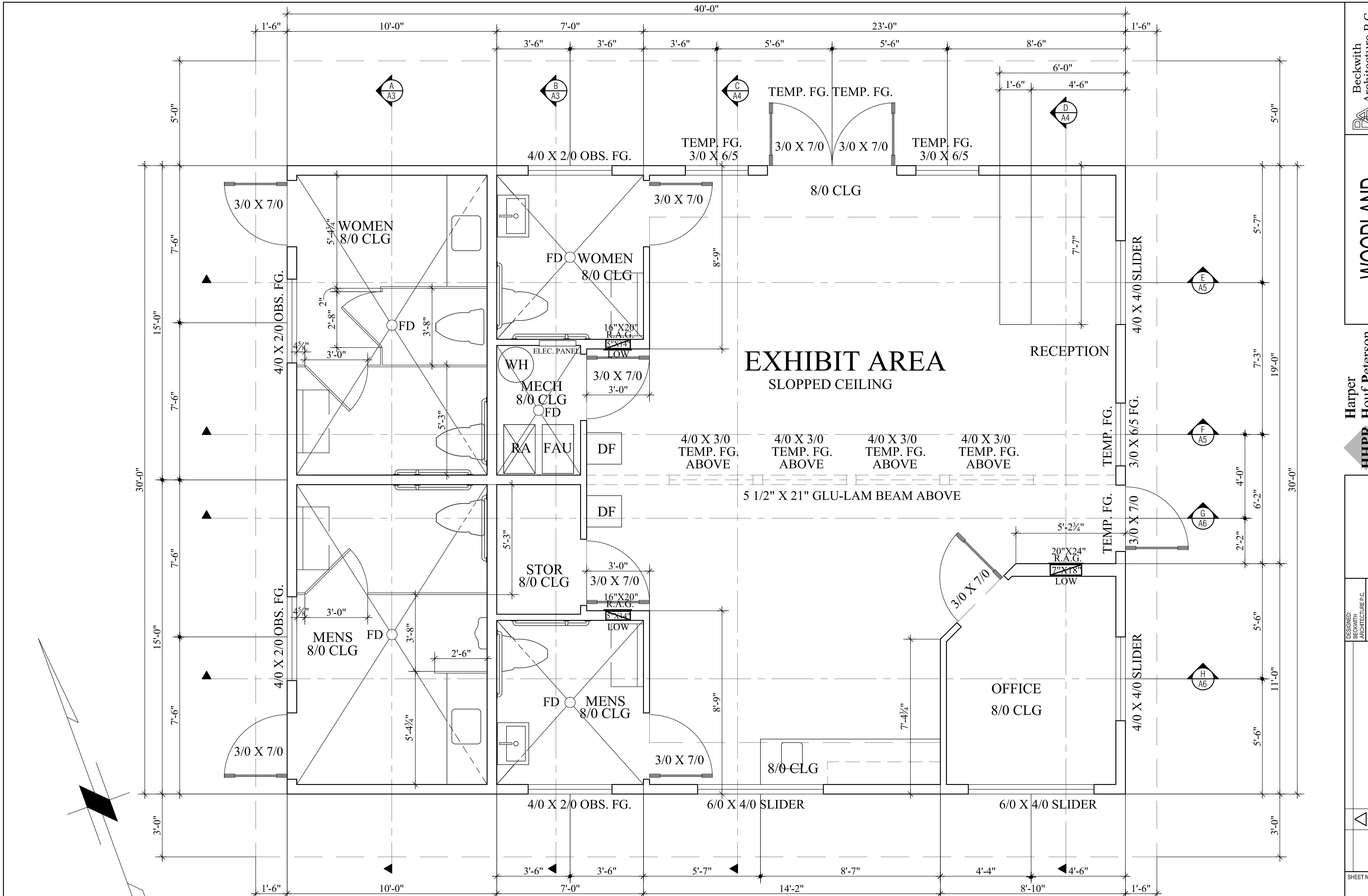
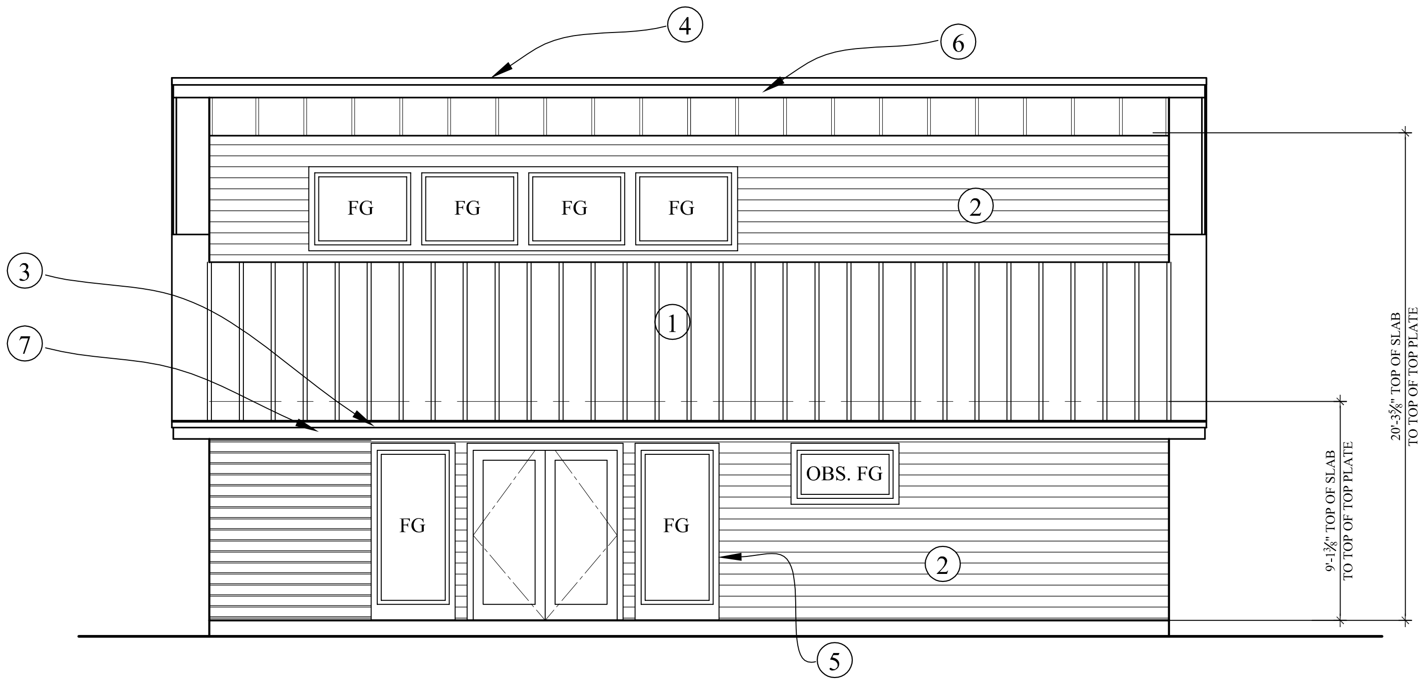
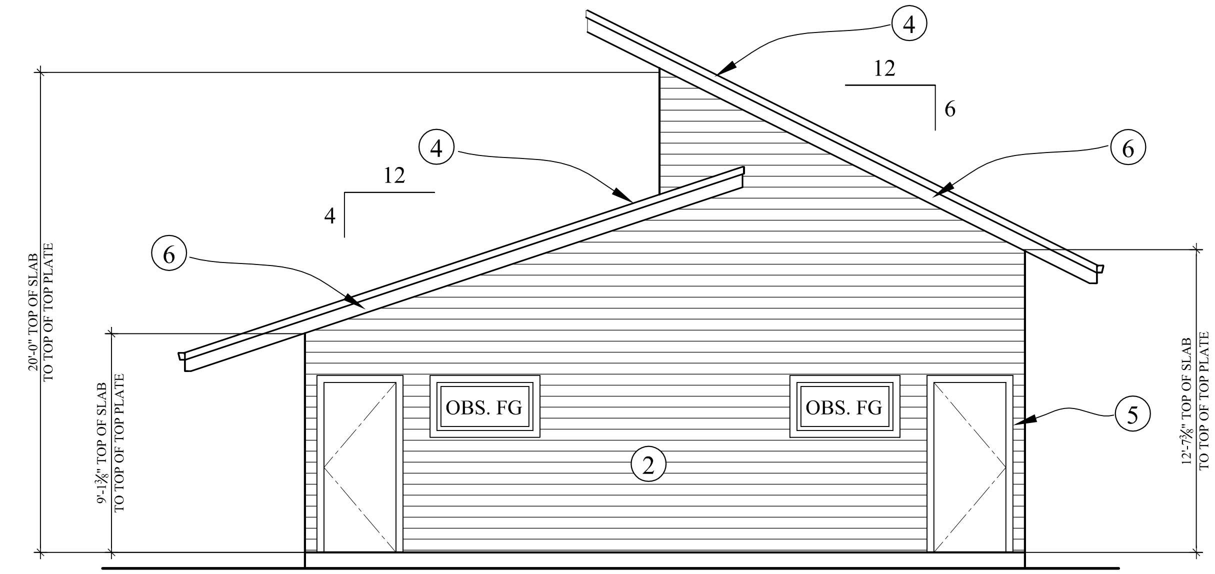


EXHIBIT AREA
SLOPPED CEILING
8/0 CLG
RECEPTION
WOMEN 8/0 CLG
MENS 8/0 CLG
MECH 8/0 CLG
STOR 8/0 CLG
OFFICE 8/0 CLG
WH
RA
FAU
DF
FD
ELEC. PANEL
5 1/2" X 21" GLU-LAM BEAM ABOVE
4/0 X 3/0 TEMP. FG. ABOVE
TEMP. FG. TEMP. FG.
3/0 X 7/0
TEMP. FG. 3/0 X 6/5
4/0 X 2/0 OBS. FG.
6/0 X 4/0 SLIDER
4/0 X 4/0 SLIDER
TEMP. FG. 3/0 X 6/5 FG.
16"X20" R.A.G.
5"X14" LOW
20"X24" R.A.G.
7"X18" LOW
40'-0"
23'-0"
30'-0"
19'-0"
Beckwith Architecture P.C.
WOODLAND
Harper Houf Peterson
HHPR
DESIGNED: BECKWITH ARCHITECTURE P.C.



NORTH EAST EXTERIOR ELEVATION

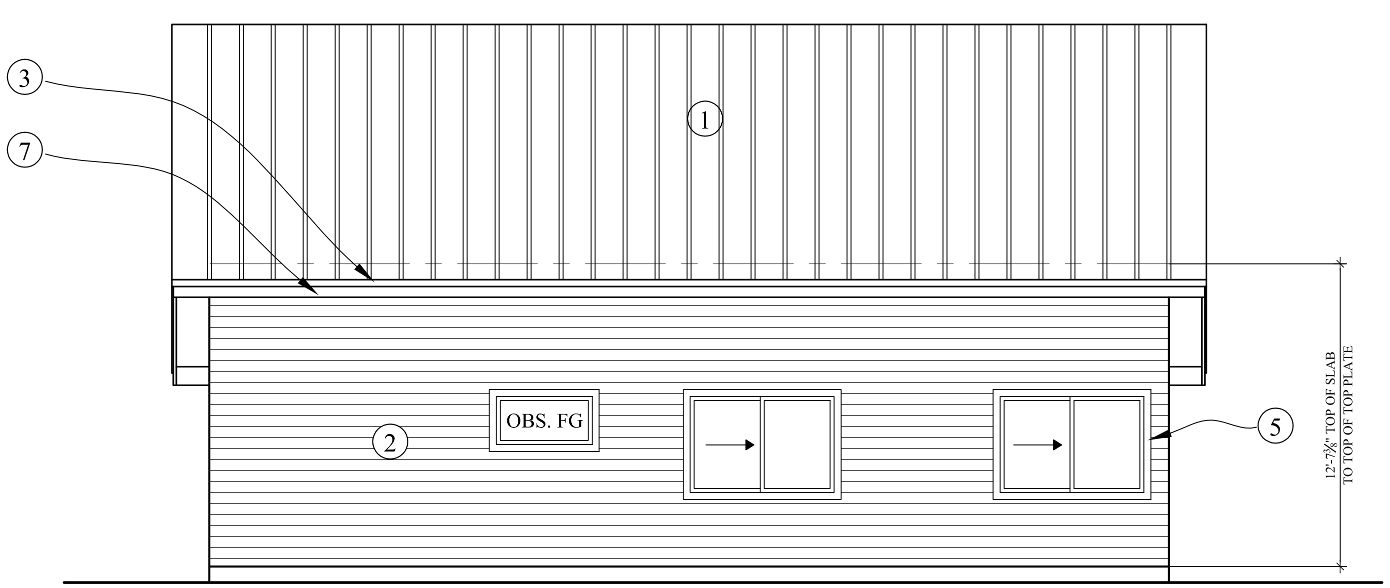
SCALE: 1/4" = 1'-0"



NORTH WEST EXTERIOR ELEVATION

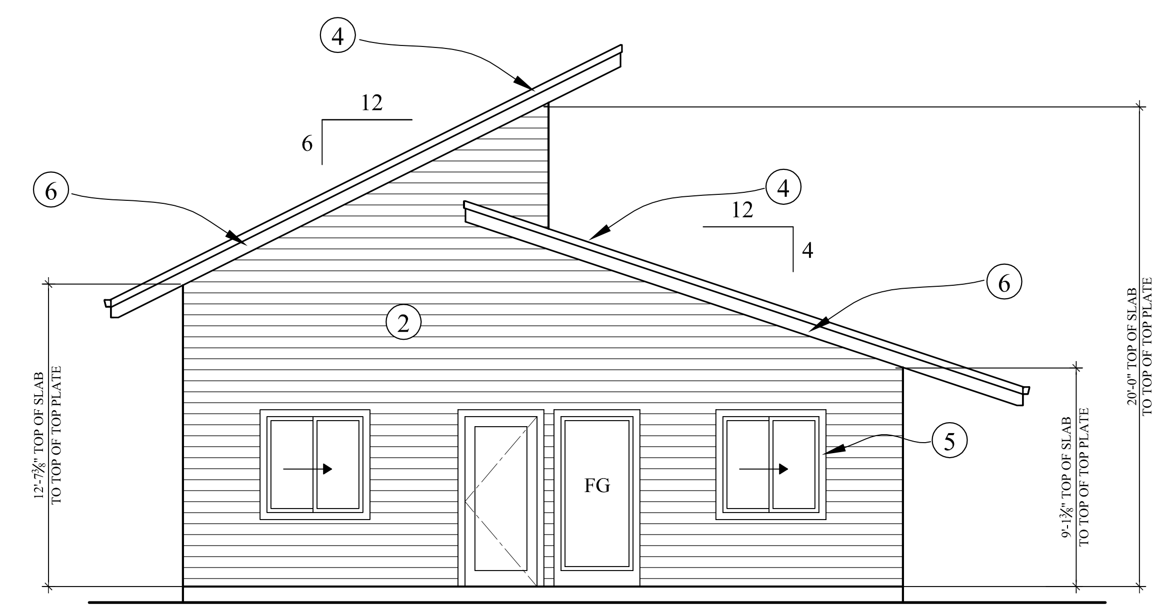
SCALE: 1/4" = 1'-0"

1. STANDING SEAM METAL ROOFING
2. HORIZONTAL LAP SIDING WITH +/- 5 1/2 " EXPOSURE
3. ALLUMINIM GUTTERS & DOWN SPOUTS
4. 1X4 BARGE BOARD TRIM
5. 1X4 DOOR & WINDOW TRIM
6. 2X10 BARGE BOARD
7. 2X10 FASCIA



SOUTH EAST EXTERIOR ELEVATION

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



SOUTE EAST EXTERIOR ELEVATION

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

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HHPR

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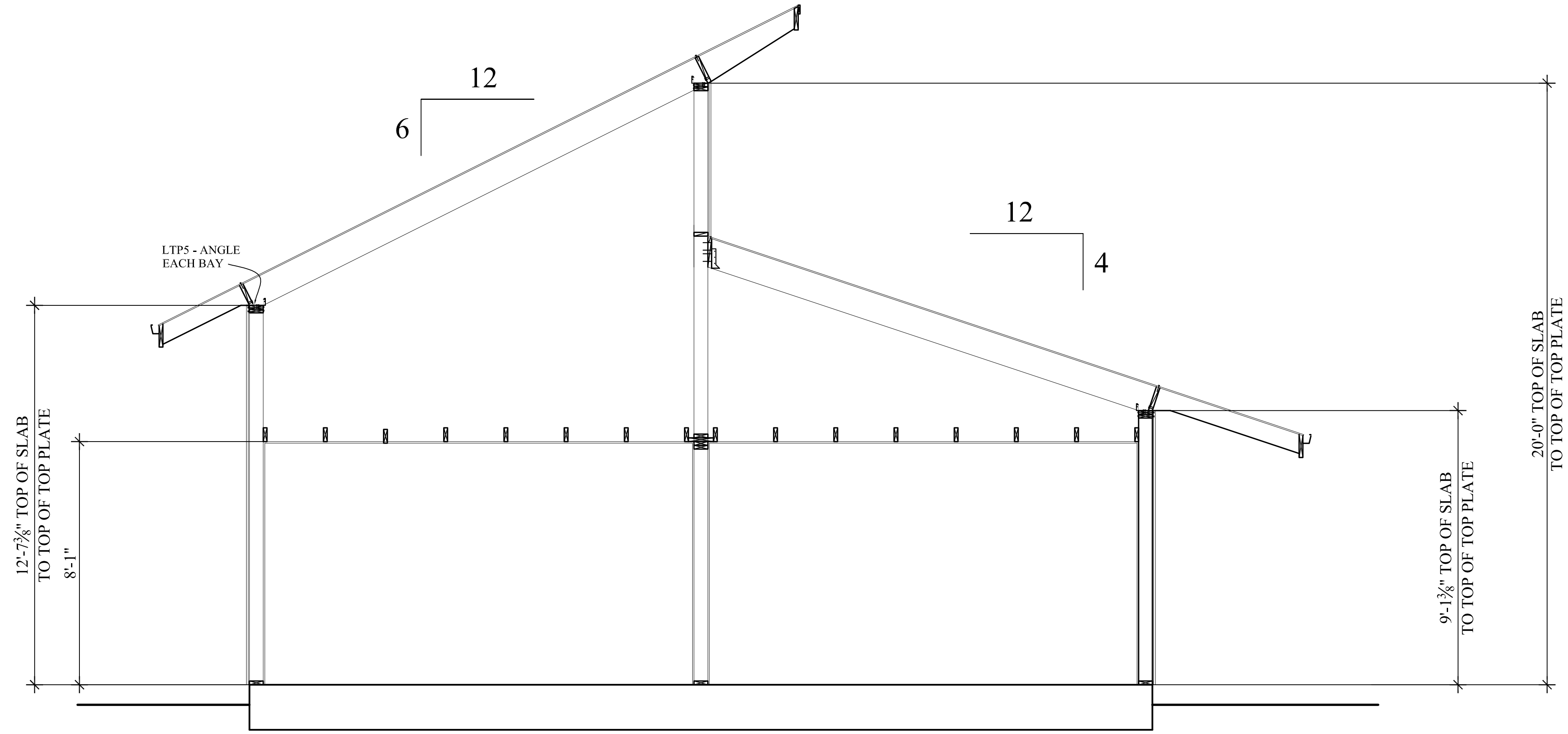
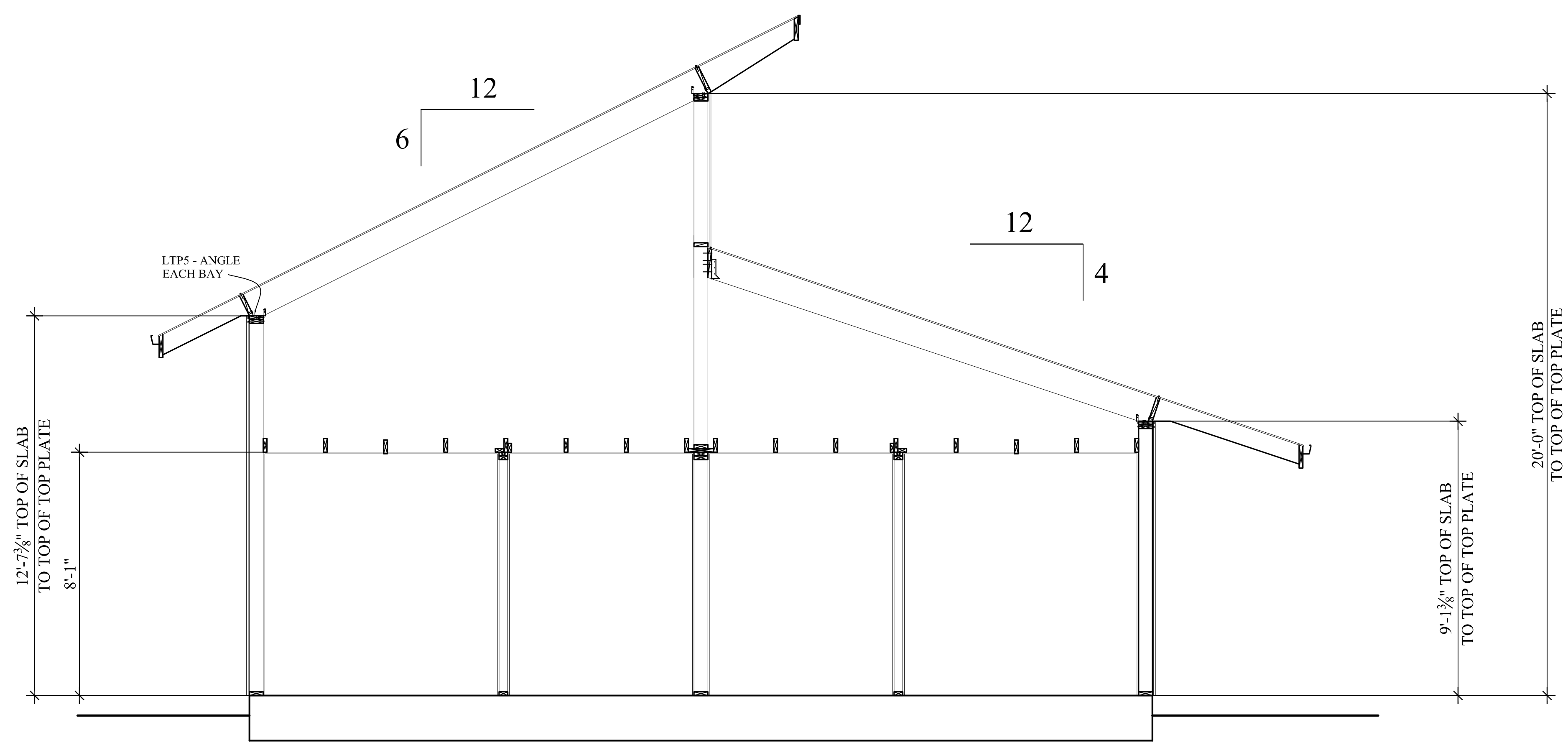
SHEET N



A
A3
BUILDING CROSS SECTION

SCALE: 3/8" = 1'-0"



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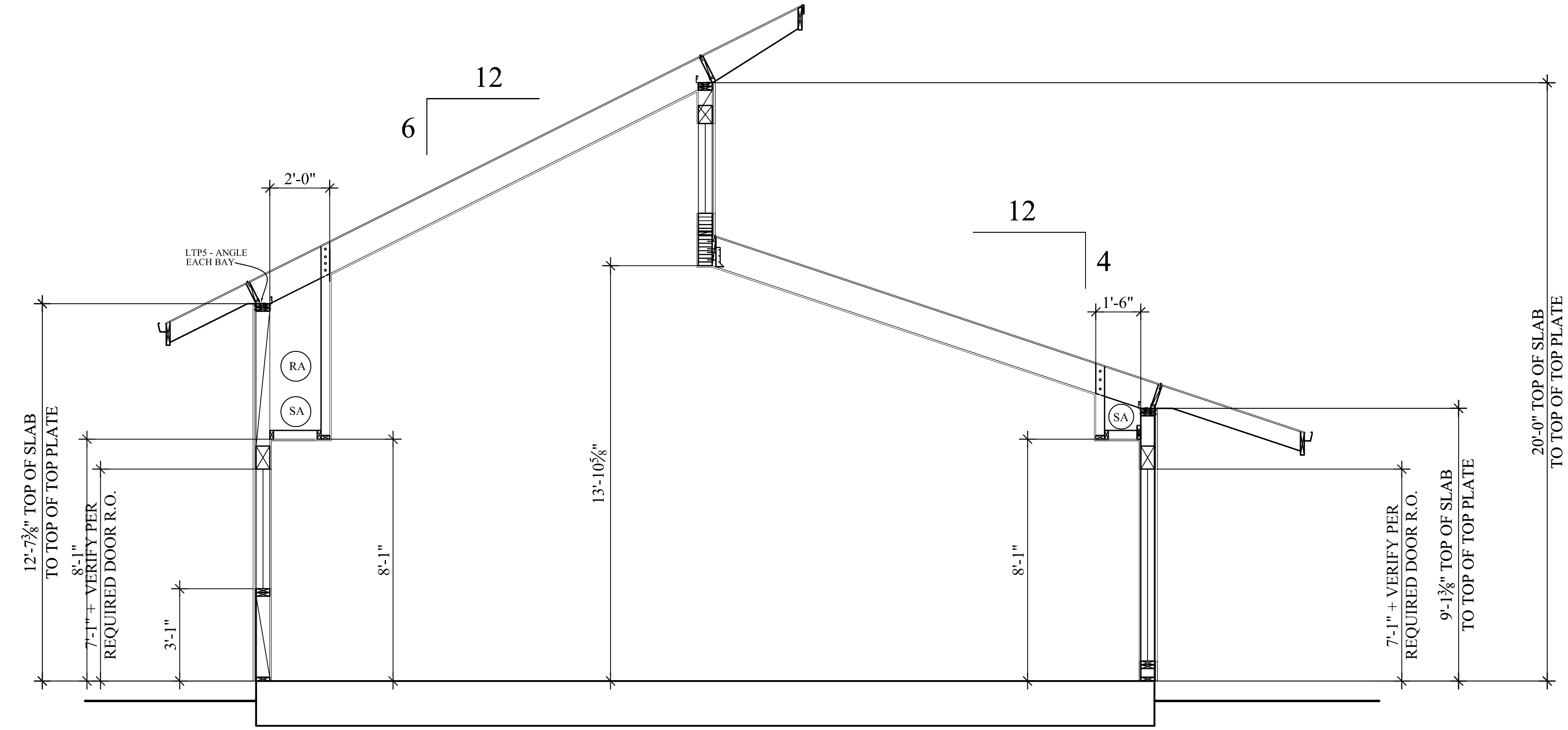
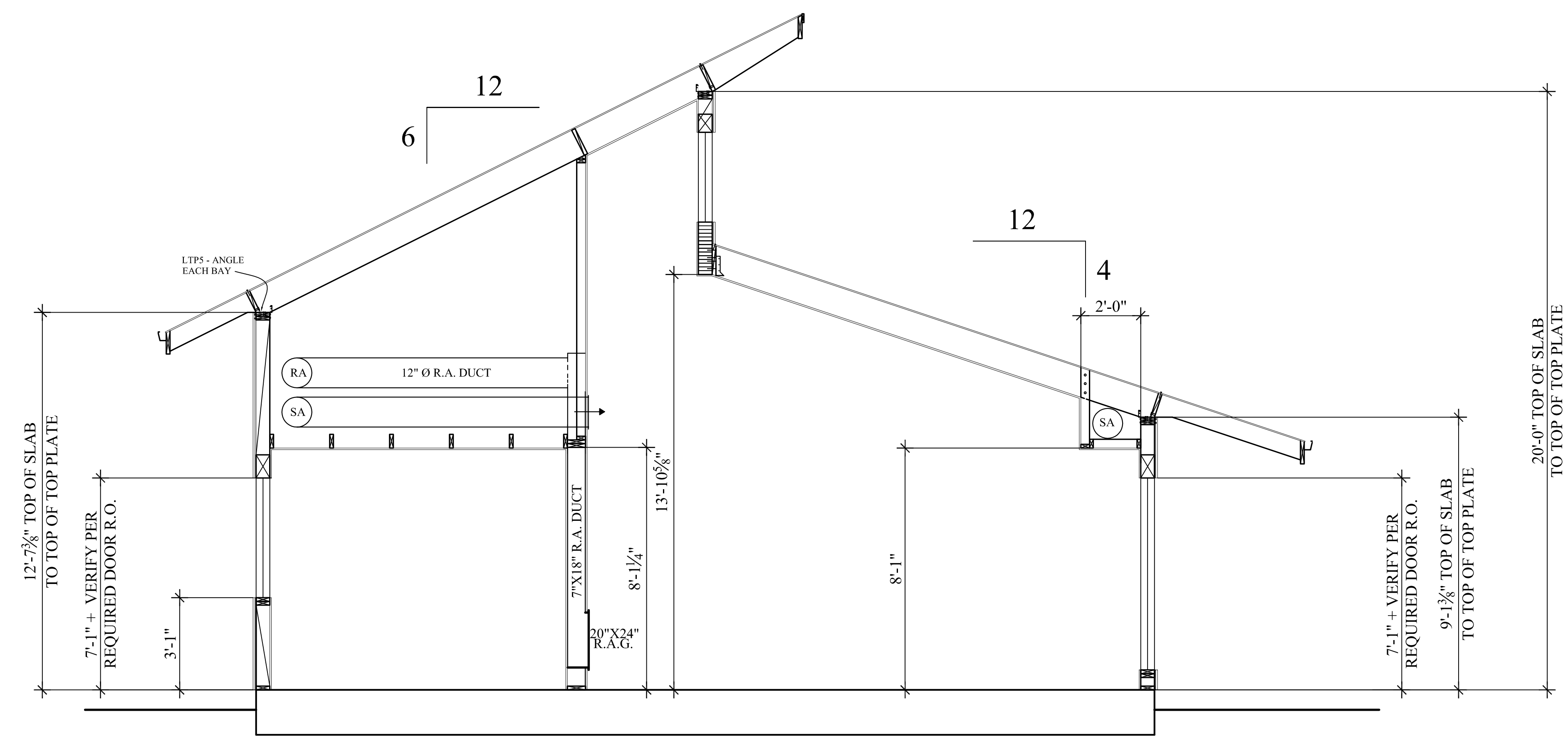


C
A4
BUILDING CROSS SECTION

SCALE: 3/8" = 1'-0"



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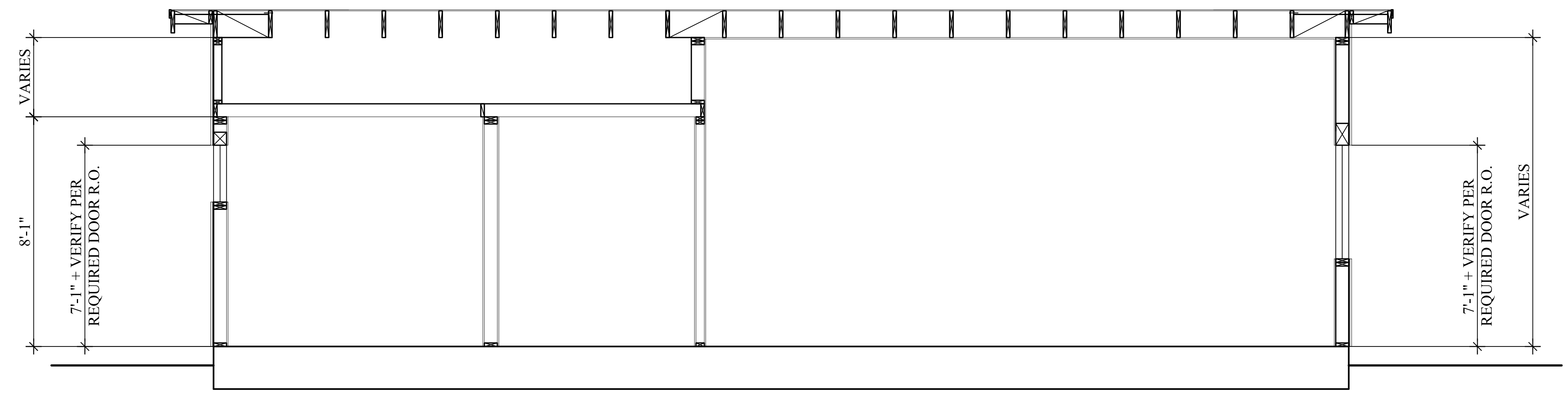
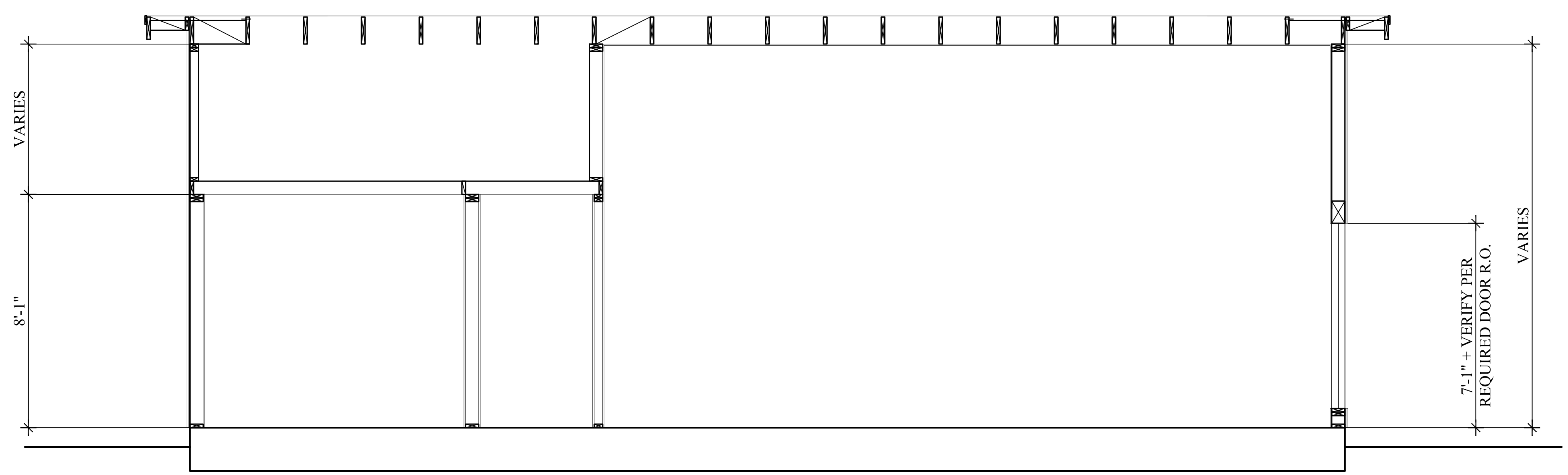
SHEET N



E
A5
BUILDING CROSS SECTION

SCALE: 3/8" = 1'-0"



F
A5
BUILDING CROSS SECTION

SCALE: 3/8" = 1'-0"

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Harper

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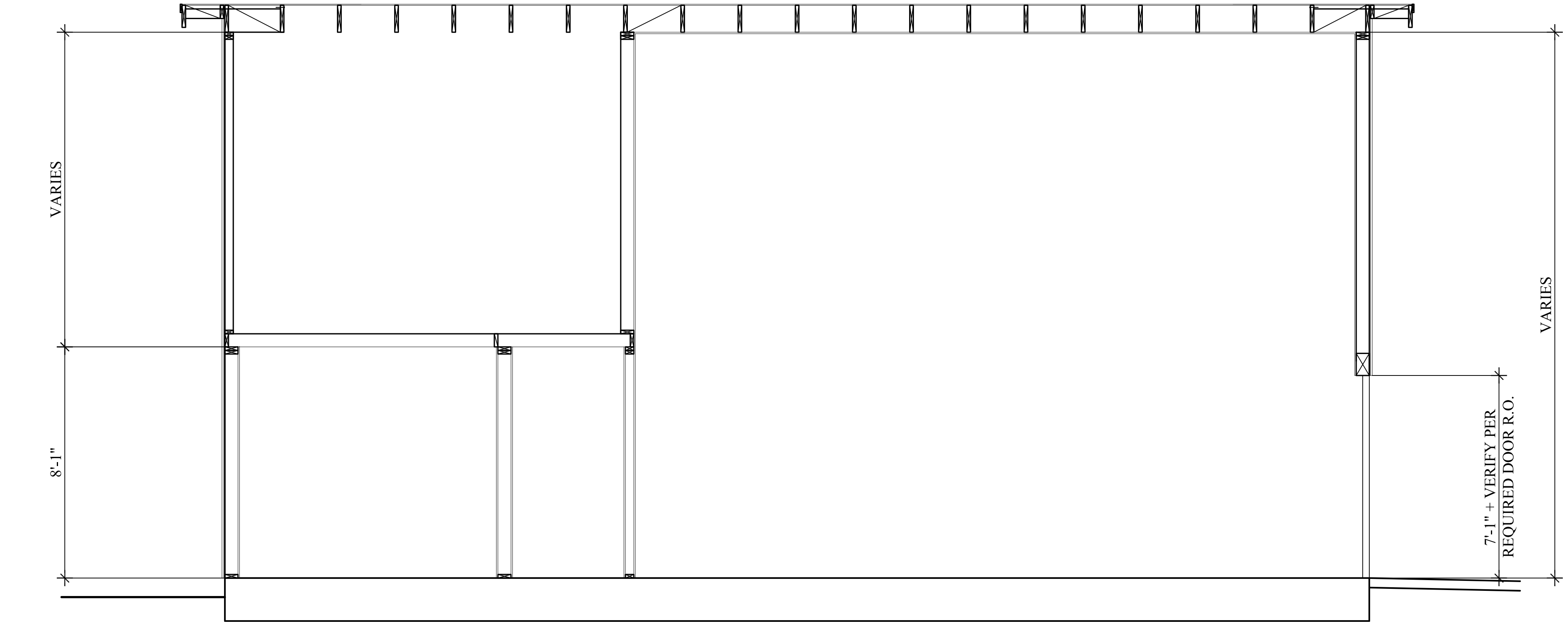
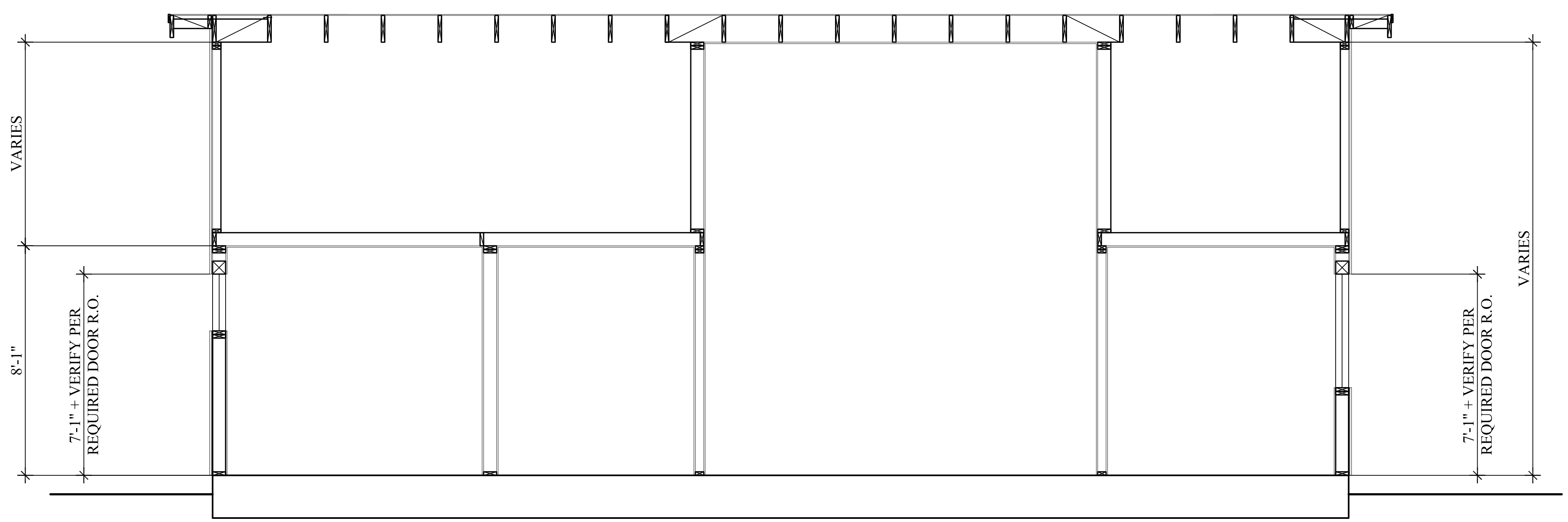
ARCHITECTURE P.C.



G
A6
BUILDING CROSS SECTION

SCALE: 3/8" = 1'-0"



BUILDING CROSS SECTION

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Harper
Houf Peterson

DESIGNED:
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ARCHITECTURE P.C.

SHEET N

APPENDIX 3 – Stormwater Calculations and Design Information

WLD-21 BASIN MAP

LEGEND

BASIN AREA = 20,904 SF

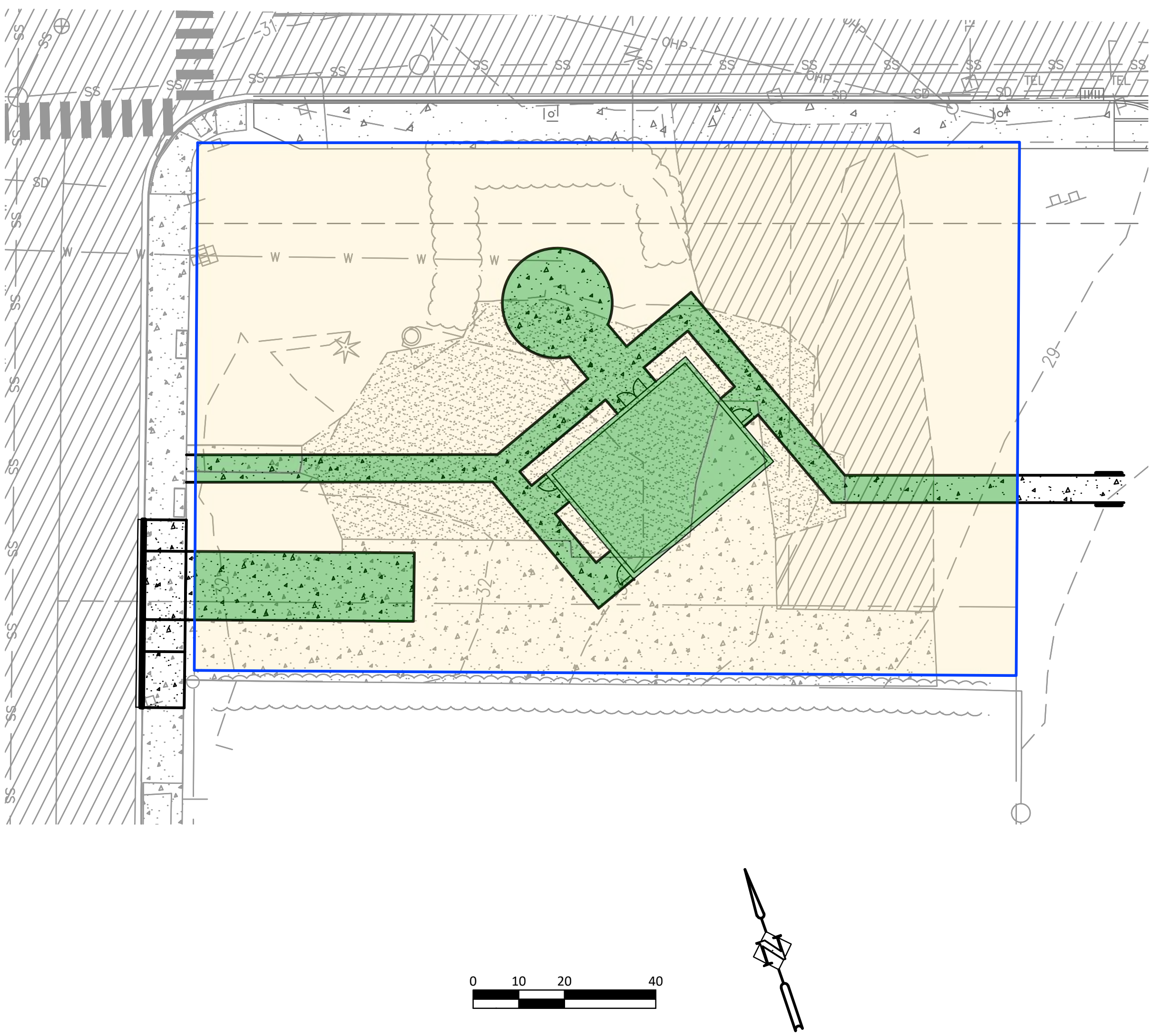
GRASS/LANDSCAPE = 16,309 SF

IMPERVIOUS = 4,594 SF

EXISTING ASPHALT PAVEMENT

EXISTING CEMENT CONCRETE

EXISTING GRAVEL SURFACE



Civic Center
WLD-21
Infiltration Calculations

Trench 1

Q_2 (25-year peak flow)	0.224	cfs		
Design Infiltration Rate	12.5	in/hr		
Trench Design	Depth (ft)		Width (ft)	Wetted Area (sf)
	3		3	9
Q_{inf} (Maximum infiltration rate per lineal foot of trench)	0.00260	cfs/lf		
Required length of trench (Q_{100} / Q_{inf})	86.0	lf		
Design length of Trench	0	lf		

Hydrograph Report

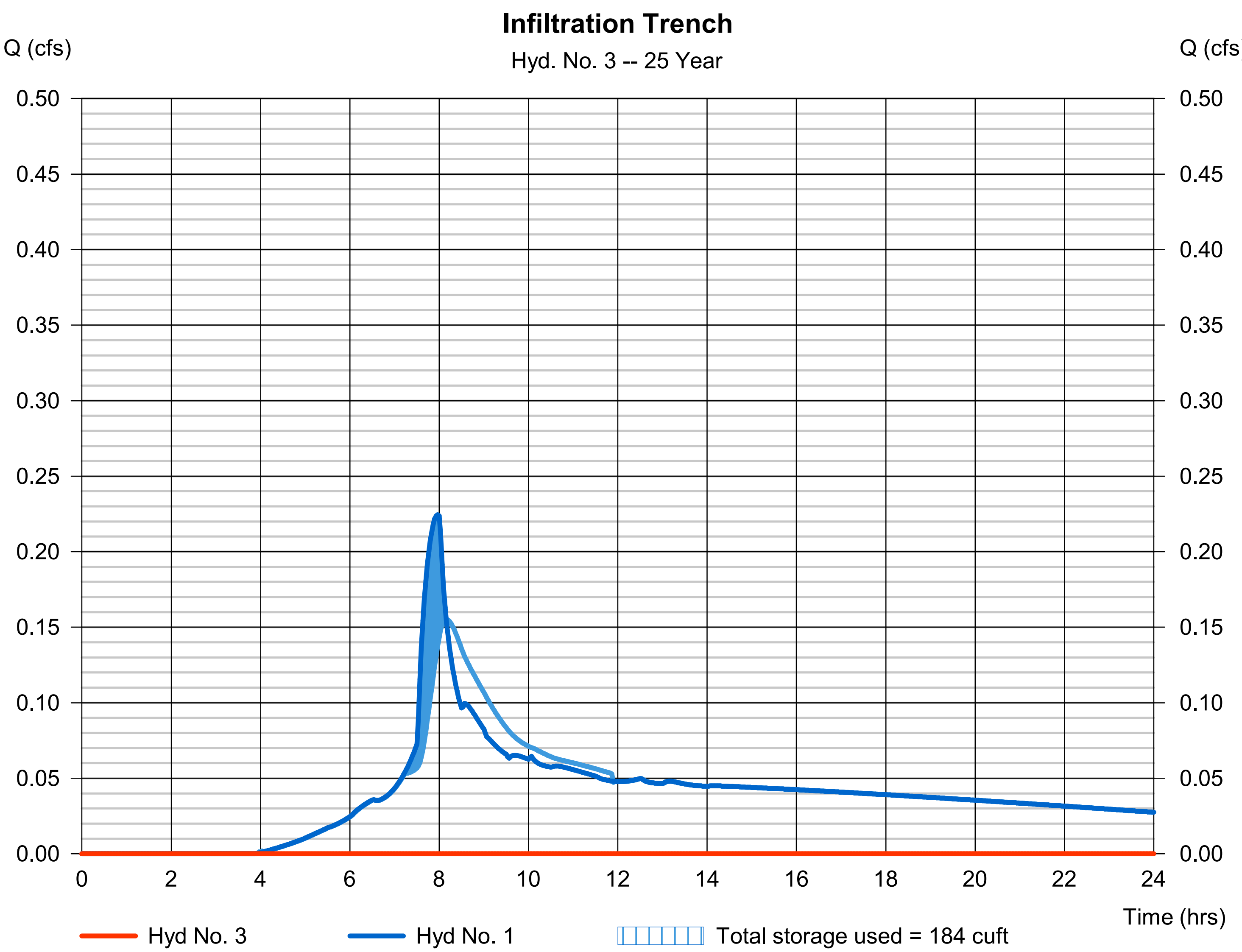
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Friday, 02 / 17 / 2023

Hyd. No. 3

Infiltration Trench

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 6.17 hrs
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 1 - Infiltration Trench - Civic Center	Max. Elevation	= 10.97 ft
Reservoir name	= Infiltration Trench #1	Max. Storage	= 184 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

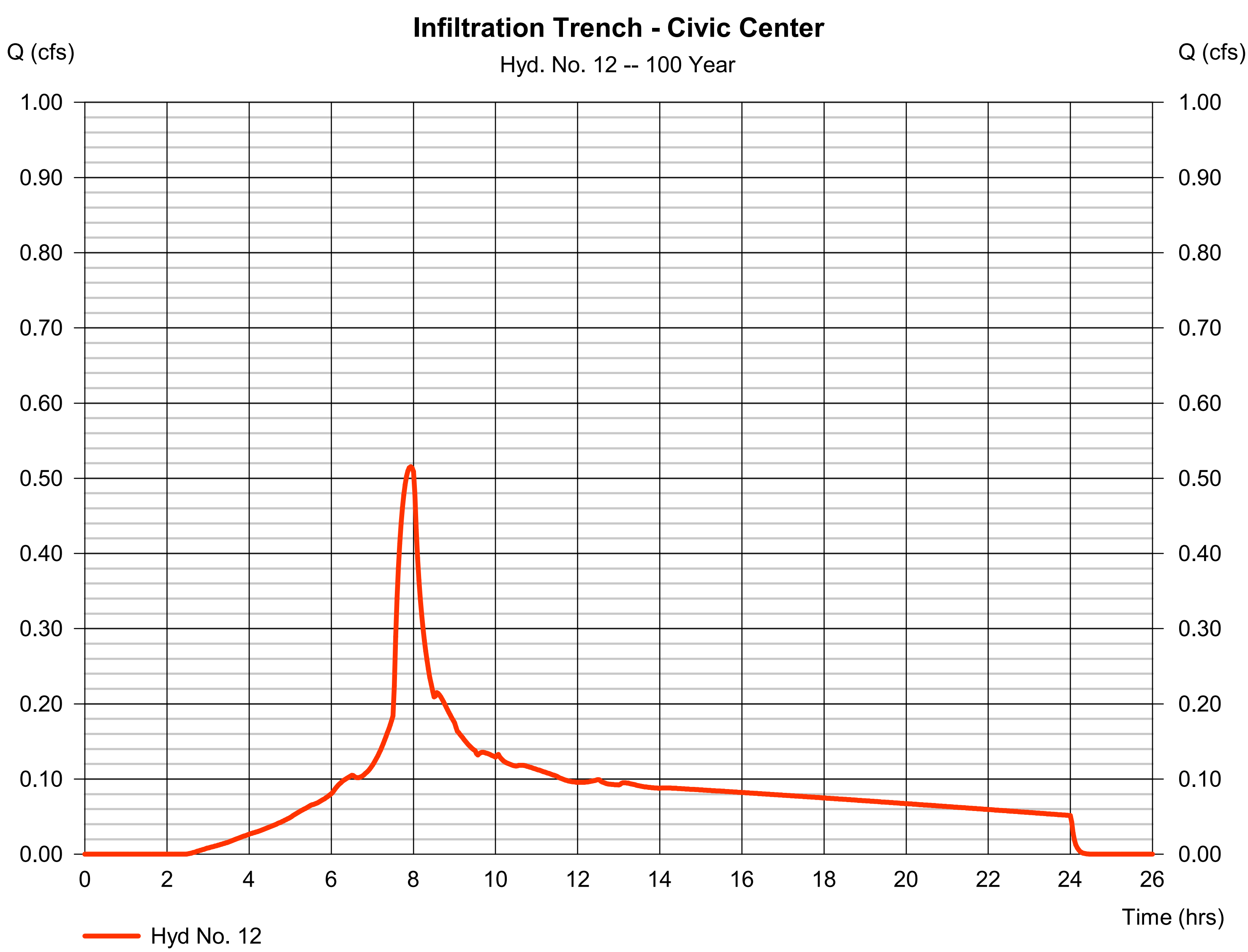
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Friday, 02 / 17 / 2023

Hyd. No. 12

Infiltration Trench - Civic Center

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.515 cfs
Storm frequency	= 100 yrs	Time to peak	= 7.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,312 cuft
Drainage area	= 0.480 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.105 x 98) + (0.374 x 80)] / 0.480



APPENDIX 4 – Custom Soil Resource Report/Preliminary Geotechnical Information

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Cowlitz County, Washington

February 16, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

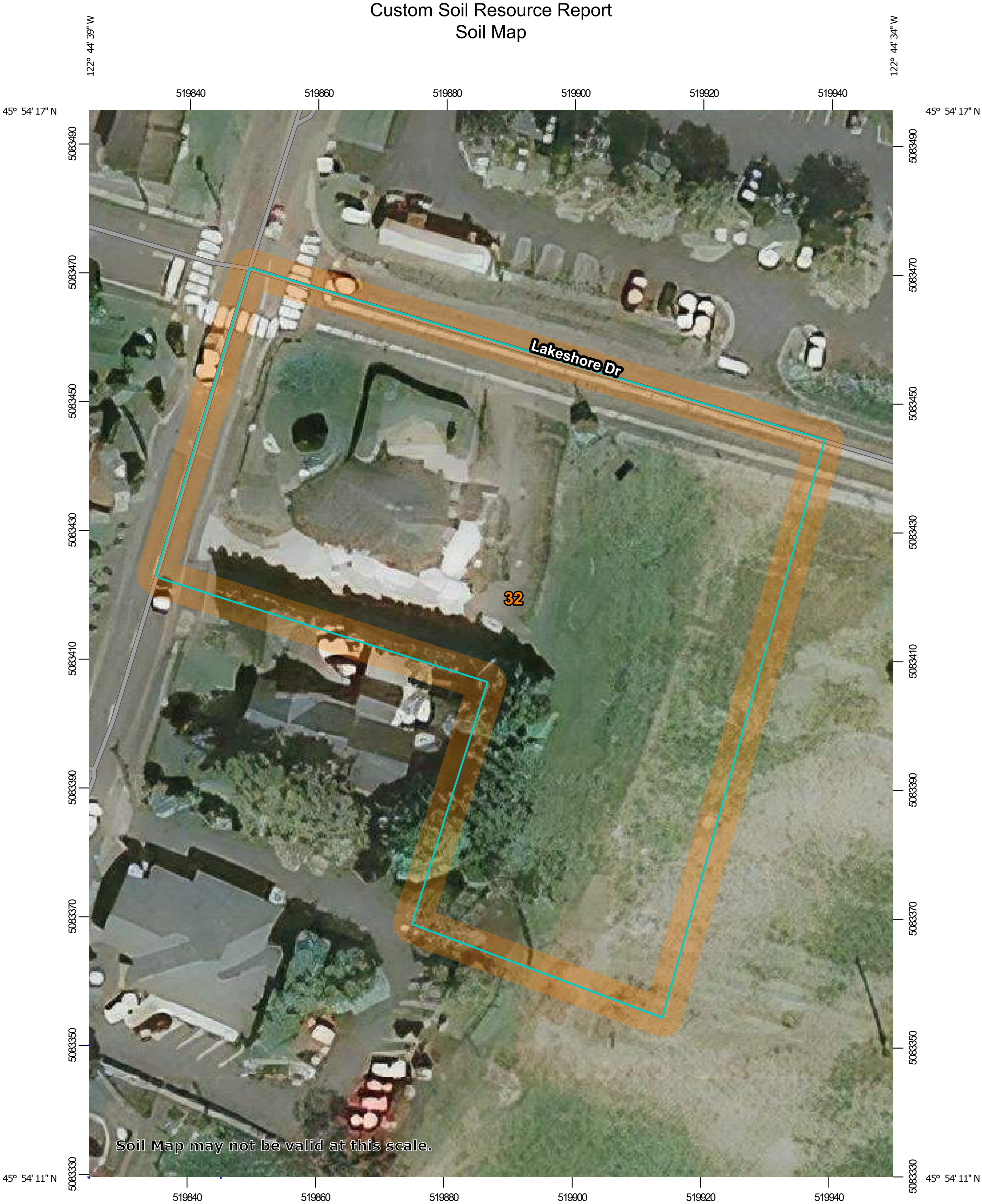
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:807 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 10, 20, 40, 60

Feet: 0, 35, 70, 140, 210

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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

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

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

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Cowlitz County, Washington
Survey Area Data: Version 23, Aug 31, 2022

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

Date(s) aerial images were photographed: Apr 26, 2019—Jun 11, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
32	Clato silt loam, 0 to 3 percent slopes	1.6	100.0%
Totals for Area of Interest		**1.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Cowlitz County, Washington

32—Clato silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2fch
Elevation: 30 to 300 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 160 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Clato and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Clato

Setting

Landform: Flood plains
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F002XB004WA - Portland Basin Forest
Forage suitability group: Soils with Few Limitations (G002XV502WA)
Other vegetative classification: Soils with Few Limitations (G002XV502WA)
Hydric soil rating: No

Minor Components

Newberg

Percent of map unit: 5 percent
Landform: Alluvial cones
Hydric soil rating: No

References

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Geotechnical Site Investigation

Lakeshore Drive Pavement and Pedestrian Improvements

Woodland, Washington

June 9, 2022

Geotechnical ▪ Environmental ▪ Special Inspections

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GEOTECHNICAL SITE INVESTIGATION
LAKESHORE DRIVE PAVEMENT AND PEDESTRIAN IMPROVEMENTS
WOODLAND, WASHINGTON

Prepared For:	**Harper Houf Person Righellis Inc.** **Attn: Bruce Haunreiter, PE** **1220 Main Street #150** **Vancouver, Washington 98660**
Site Location:	**Lakeshore Drive** **Goerig Street to Horseshoe Lake** **Woodland, Washington**
Prepared By:	**Columbia West Engineering, Inc.** **11917 NE 95th Street** **Vancouver, Washington 98682** **Phone: 360-823-2900** **W.O. No. 22086**
Date Prepared:	**June 9, 2022**

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1.0 INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) was retained by Harper Houf Peterson Righellis, Inc. (HHPR) to conduct a geotechnical site investigation for the proposed Lakeshore Drive Pavement and Pedestrian Improvements project located in Woodland, Washington. The purpose of the investigation was to observe and assess subsurface soil conditions at specific locations and provide geotechnical engineering analyses, planning, and design recommendations for proposed development. The specific scope of services was outlined in an Agreement for Subconsultant Services executed April 14, 2022. This report summarizes the investigation and provides field assessment documentation. This report is subject to the limitations expressed in Section 6.0, *Conclusion and Limitations*, and Appendix E.

1.1 General Site Information

As indicated on Figures 1 and 2, the subject site is located in the right-of-way along Lakeshore Drive between Goerig Street and Horseshoe Lake in Woodland, Washington. The approximate latitude and longitude are N 45° 54' 9" and W 122° 44' 29", and the legal description is a portion of the SE ¼ of Section 48, T5N, R1W and SW ¼ of Section 41, T5N, R1E, Willamette Meridian. The regulatory jurisdictional agency is the City of Woodland, Washington.

1.2 Proposed Development

Correspondence with the design team indicate that proposed development will consist of road and sidewalk improvements along the southbound lane of Lakeshore Drive including construction of a sidewalk and infiltration facilities. Columbia West has not reviewed preliminary grading plans but understands that cut and fill will likely be proposed at the property. This report is based upon proposed development as described above and may not be applicable if modified.

2.0 REGIONAL GEOLOGY AND SOIL CONDITIONS

The subject site lies within the Willamette Valley/Puget Sound Lowland, a wide physiographic depression flanked by the mountainous Coast Range on the west and the Cascade Range on the east. Inclined or uplifted structural zones within the Willamette Valley/Puget Sound Lowland constitute highland areas and depressed structural zones form sediment-filled basins. The site is located in the northern portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

According to the *Geologic Map of the Woodland Quadrangle, Clark and Cowlitz Counties, Washington* (Russell C. Evarts, USGS Geological Survey, 2004), near-surface soils are expected to primarily consist of Holocene and Pleistocene-aged, unconsolidated, sorted to well-sorted, sand, silt, and minor gravel of the Columbia River floodplain (Qa). Minor Holocene-aged, unconsolidated, soil, sand, gravel, and rock artificial fill and modified land deposits (Af) are mapped on the east side of Lakeshore Drive.

The *Web Soil Survey* (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2022 Website) identifies surface soils as Clato silt loam, Newberg fine sandy loam, and Pilchuck loamy fine sand. Clato, Newberg, and Pilchuck series soils are generally fine-textured sands, silts, and clays with very low to low permeability, moderate to high water capacity, and low shear strength. They are generally moisture sensitive, somewhat compressible, and described as having low to moderate shrink-swell potential while exhibiting a slight erosion hazard based primarily upon slope grade.

3.0 REGIONAL SEISMOLOGY

Recent research and subsurface mapping investigations within the Pacific Northwest appear to suggest the historic potential risk for a large earthquake event with strong localized ground movement may be underestimated. Past earthquakes in the Pacific Northwest appear to have caused landslides and ground subsidence, in addition to severe flooding near coastal areas. Earthquakes may also induce soil liquefaction, which occurs when elevated horizontal ground acceleration and velocity cause soil particles to interact as a fluid as opposed to a solid. Liquefaction of soil can result in lateral spreading and temporary loss of bearing capacity and shear strength. Liquefaction is discussed later in Section 5.8, *Soil Liquefaction and Dynamic Settlement*.

There are at least four major known fault zones in the vicinity of the site that may be capable of generating potentially destructive horizontal accelerations. These fault zones are described briefly in the following text.

Portland Hills Fault Zone

The Portland Hills Fault Zone consists of several northwest-trending faults located along the northeastern margin of the Tualatin Mountains, also known as the Portland Hills, and the southwest margin of the Portland Basin. The fault zone is approximately 25 to 30 miles in length and is located approximately 20 miles south of the site. According to *Seismic Design Mapping, State of Oregon* (Geomatrix Consultants, 1995), there is no definitive consensus among geologists as to the zone fault type. Several alternate interpretations have been suggested.

According to the *USGS Earthquake Hazards Program*, the fault was originally mapped as a down-to-the-northeast normal fault but has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults, and as a steep escarpment caused by asymmetrical folding above a south-west dipping, blind thrust fault. The Portland Hills fault offsets Miocene Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene-aged Missoula flood deposits.

However, evidence suggests that fault movement has impacted shallow Holocene deposits and deeper Pleistocene sediments. Seismologists recorded a M3.2 earthquake thought to be associated with the fault zone near Kelly Point Park in November 2012, a M3.9 earthquake thought to be associated with the fault zone near Kelly Point Park in April 2003, and a M3.5 earthquake possibly associated with the fault zone approximately 1.3 miles east of the fault in 1991. Therefore, the Portland Hills Fault Zone is generally thought to be potentially active and capable of producing possible damaging earthquakes.

<u>Gales Creek-Newberg-Mt. Angel Fault Zone</u>

Located approximately 31 miles southwest of the site, the northwest-striking, approximately 50-mile long Gales Creek-Newberg-Mt. Angel Structural Zone forms the northwestern boundary between the Oregon Coast Range and the Willamette Valley, and consists of a series of discontinuous northwest-trending faults. The southern end of the fault zone forms the southwest margin of the Tualatin basin. Possible late-Quaternary geomorphic surface deformation may exist along the structural zone (Geomatrix Consultants, 1995).

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

Although no definitive evidence of impacts to Holocene sediments have clearly been identified, the Mount Angel fault appears to have been the location of minor earthquake swarms in 1990 near Woodburn, Oregon, and a M5.6 earthquake in March 1993 near Scotts Mills, approximately four miles south of the mapped extent of the Mt. Angel fault. It is unclear if the earthquake occurred along the fault zone or a parallel structure. Therefore, the Gales Creek-Newberg-Mt. Angel Structural Zone is considered potentially active.

<u>Lacamas Lake-Sandy River Fault Zone</u>

The northwest-trending Lacamas Lake Fault and northeast-trending Sandy River Fault intersect north of Camas, Washington approximately 26 miles southeast of the site, and form part of the northeastern margin of the Portland basin. According to *Geology and Groundwater Conditions of Clark County Washington* (USGS Water Supply Paper 1600, Mundorff, 1964) and the *Geologic Map of the Lake Oswego Quadrangle* (Oregon DOGAMI Series GMS-59, 1989), the Lacamas Lake fault zone consists of shear contact between the Troutdale Formation and underlying Oligocene andesite-basalt bedrock. Secondary shear contact associated with the fault zone may have produced a series of prominent northwest-southeast geomorphic lineaments in proximity to the site.

According to the *USGS Earthquake Hazards Program* the fault has been mapped as a normal fault with down-to-the-southwest displacement and has also been described as a steeply northeast or southwest-dipping, oblique, right-lateral, slip-fault. The trace of the Lacamas Lake fault is marked by the very linear lower reach of Lacamas Creek. No fault scarps on Quaternary surficial deposits have been described. The Lacamas Lake fault offsets Pliocene-aged sedimentary conglomerates generally identified as the Troutdale formation, and Pliocene- to Pleistocene-aged basalts generally identified as the Boring Lava formation.

Recent seismic reflection data across the probable trace of the fault under the Columbia River yielded no unequivocal evidence of displacement underlying the Missoula flood deposits, however, recorded mild seismic activity during the recent past indicates this area may be potentially seismogenic.

Cascadia Subduction Zone

The Cascadia Subduction Zone has recently been recognized as a potential source of strong earthquake activity in the Portland/Vancouver Basin. This phenomenon is the result of the earth's large tectonic plate movement. Geologic evidence indicates that volcanic ocean floor activity along the Juan de Fuca ridge in the Pacific Ocean causes the Juan de Fuca Plate to perpetually move east and subduct under the North American Continental Plate. The subduction zone results in historic volcanic and potential earthquake activity in proximity to the plate interface, believed to lie approximately 20 to 50 miles west of the general location of the Oregon and Washington coast (Geomatrix Consultants, 1995).

4.0 GEOTECHNICAL AND GEOLOGIC FIELD INVESTIGATION

A geotechnical field investigation consisting of visual reconnaissance, four test pits (TP-1 through TP-4), and four infiltration tests was conducted at the site on May 19, 2022. Test pit exploration was performed with a track-mounted excavator. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) specifications. Disturbed soil samples were collected from relevant soil horizons and submitted for laboratory analysis. Laboratory test results are presented in Appendix A. Subsurface exploration locations are indicated on Figure 2. Test pit exploration logs are presented in Appendix B. Soil descriptions and classification information are provided in Appendix C. A photo log is presented in Appendix D.

4.1 Surface Investigation and Site Description

The subject site is located in the right-of-way of Lakeshore Drive between Goerig Street and Horseshoe Lake in Woodland, Washington. The site is bounded by Lakeshore Drive to the east, Horseshoe Lake Park and Rolling Freedom Skate Park in the southwest, and undeveloped grassy fields in the northwest.

The site is currently the southbound lane of Lakeshore Drive and the embankment slope to the west. Site vegetation generally consists of open, grassy areas with intermittent mature tree growth primarily concentrated in the central site area. Field reconnaissance indicate relatively flat to gently rolling terrain with grades generally ranging from 0 to 5 percent with minor steeper slopes comprising the embankment fill for Lakeshore Drive. Site elevations of approximately 18 to 30 feet above mean sea level (amsl).

4.2 Subsurface Exploration and Investigation

Test pits were explored to a maximum depth of 10 feet bgs. Exploration locations were selected to observe subsurface soil characteristics in proximity to proposed development areas and are indicated on Figure 2.

4.2.1 Soil Description

The field investigation indicated the presence of approximately 6 to 20 inches of sod and topsoil in the observed locations. Underlying the topsoil layer, subsurface soils resembling geographically mapped sand, silt, and clay deposits (Qa), artificial fill (Af), and native USDA Clato, Newberg, and Pilchuck soil series descriptions were generally encountered. Subsurface lithology may generally be described by soil types identified in the following text. Field logs and observed stratigraphy for the encountered materials are presented in Appendix B, *Subsurface Exploration Logs*.

Soil Type 1 - Existing FILL

Soil Type 1 was observed to primarily consist of brown, moist, medium stiff, low plasticity, silty to clayey sand with minor gravel. Soil Type 1 was observed underlying the topsoil layer in test pit TP-1 and extended to a depth of 3 feet bgs where it was underlain by Soil Type 2. Additional discussion and recommendations pertaining to existing fill are discussed in Section 5.1.1, *Existing Fill.* The fill material encountered was used as backfill around the skate park structure.

Soil Type 2 – Poorly-graded SAND with Silt / Poorly-graded SAND

Soil Type 2 was observed to primarily consist of gray, damp to wet, loose to medium dense, poorly-graded SAND with silt and poorly-graded SAND. Soil Type 2 was observed underlying Soil Type 1 in test pit TP-1, underlying the topsoil layer in test pits TP-2 and TP-3, and underlying Soil Type 3 in test pit TP-4. Soil Type 2 extended to maximum explored depths. In test pit TP-3 there was a layer of Soil Type 3 between layers of Soil Type 2.

Soil Type 3 - SILT

Soil Type 3 was observed to primarily consist of brown to gray, damp to moist, medium stiff, low plasticity SILT to silty fine sand. Soil Type 3 was observed underlying the topsoil layer in test pit TP-4 and between layers of Soil Type 2 in test pit TP-3 at a depth of 2 to 7.5 feet. In test pit TP-4, Soil Type 3 extended to a depth of 5 feet bgs where it was underlain by Soil Type 2.

4.2.2 Groundwater

Groundwater was observed in test pit TP-2 at a depth of approximately 4.5 feet below ground surface and appeared to coincide with the surface elevation of adjacent Horeshoe Lake. Mitigation of shallow groundwater within proposed development areas is discussed in greater detail in Sections 5.5, *Dewatering* and 5.10, *Drainage*.

Note that groundwater levels are often subject to seasonal variance and may rise during extended periods of increased precipitation. Perched groundwater may also be present in localized areas. Seeps and springs may become evident during site grading, primarily along slopes or in areas cut below existing grade. Structures, roads, and drainage design should be planned accordingly.

5.0 DESIGN RECOMMENDATIONS

The geotechnical site investigation suggests the proposed development is generally compatible with surface and subsurface soils, provided the recommendations presented in this report are utilized and incorporated into the design and construction processes. The primary geotechnical concerns associated with the site are existing fill, liquefiable soils, and shallow groundwater. Design recommendations are presented in the following text sections.

5.1 Site Preparation and Grading

Vegetation, organic material, unsuitable fill, and deleterious material that may be encountered should be cleared from areas identified for structures and site grading. Vegetation, other organic material, and debris should be removed from the site. Stripped topsoil should also be removed or used only as landscape fill in nonstructural areas with slopes less than 25 percent. The stripping depth for sod and highly organic topsoil is anticipated to vary between approximately 6 and 20 inches. The required stripping depth may increase in areas of existing fill, heavy organics, or previously existing structures. Actual stripping depths should be determined based upon visual observations made during construction when soil conditions are exposed. The post-construction maximum depth of landscape fill placed or spread at any location onsite should not exceed one foot.

Previously disturbed soil, debris, or unconsolidated fill encountered during grading or construction activities should be removed completely and thoroughly from structural areas. This includes old remnant foundations, basement walls, utilities, associated soft soils, and debris. These materials and associated disturbed soils should also be completely removed from structural areas. Excavation areas should be backfilled with engineered structural fill.

Test pits excavated during site exploration were backfilled loosely with onsite soils. The test pits should be located and properly backfilled with structural fill during site improvements construction. Trees, stumps, and associated roots should also be removed from structural areas, individually and carefully. Resulting cavities and excavation areas should be backfilled with engineered structural fill.

Site grading activities should be performed in accordance with requirements specified in the *2018 International Building Code* (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, and grading activities should be observed and documented by Columbia West.

5.1.1 Existing Fill

As previously discussed, existing fill and disturbed soils were observed at the subject site in test pit TP-1. Subsurface exploration and field reconnaissance indicate that existing fill, in the areas observed, consisted of brown, moist, medium stiff, low plasticity, silty to clayey sand. Site observations and subsurface exploration indicated that existing fill extended to an observed depth of approximately 3 feet bgs in test pit TP-1. Existing fill may be present at greater depths in embanked areas of the roadway alignment.

Based upon Columbia West's investigation, observed existing fill soils in their current state are not suitable for bearing of additional fill, sidewalks, structures, or pavements, and should be removed thoroughly and completely from structural areas. However, some observed fill soils appear to be acceptable for reuse as structural fill, provided materials are observed to exhibit index properties similar to those observed during this investigation and that construction adheres to the specifications presented in this report. Portions of existing fill found to contain highly organic soils, debris, or other deleterious material should be removed.

In some areas, existing fill may directly overlie vegetation and the original topsoil layer. This material should also be removed completely from structural areas. Recommendations regarding the suitability of reusing existing fill soils as structural fill material should be provided in the field by Columbia West during construction. It should be noted that the limited scope of exploration conducted for this investigation cannot wholly eliminate uncertainty regarding the presence of unsuitable soils in areas not explored.

5.1.2 Existing Embankment Slopes

Existing roadway embankment fill slopes were observed on the west side (southbound lane) of Lakeshore Drive ranging from approximately 2 to 12 feet in vertical height. The inclination of the embankment slopes generally ranges between approximately 2H to 1V and 3H to 1V. Based upon Columbia West's subsurface investigation and visual reconnaissance, the embankment slopes do not constitute geologically hazardous areas per *Section 15.08.600* of the *City of Woodland Municipal Code*.

5.2 Engineered Structural Fill

Areas proposed for fill placement should be appropriately prepared as described in the preceding text. Surface soils should be scarified and compacted prior to additional fill placement. Engineered structural fill should be placed in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within two percentage points of optimum conditions. A field density at least equal to 95 percent of the maximum dry density, obtained from the modified Proctor moisture-density relationship test (ASTM D1557), is recommended for structural fill placement and scarified and recompacted subgrade.

Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with *ASTM D6938*. Field compaction testing should be performed for each vertical foot of engineered fill placed. Engineered fill placement should be observed by Columbia West.

Engineered structural fill placement activities should be performed during dry summer months if possible. Most clean native soils may be suitable for use as structural fill if adequately dried or moisture-conditioned to achieve recommended compaction specifications. Native soils may require addition of moisture during late summer months or after extended periods of warm dry weather. Compacted fine-textured fill soils should be covered shortly after placement.

Because they are moisture-sensitive, near-surface fine-textured soils are often difficult to excavate and compact during wet weather construction. If adequate compaction is not achievable with clean native soils, import structural fill consisting of granular fill meeting WSDOT specifications for *Gravel Borrow 9-03.14(1)* is recommended.

Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by Columbia West prior to placement. Laboratory analyses should include particle-size gradation and Proctor moisture-density analysis.

5.3 Cut and Fill Slopes

Fill placed on existing grades steeper than 5H:1V should be horizontally benched at least 5 feet into the slope. Fill slopes greater than six feet in height should be vertically keyed into existing subsurface soil. A typical fill slope cross-section is shown in Figure 3. Drainage implementations, including subdrains or perforated drainpipe trenches, may also be necessary in proximity to cut and fill slopes if seeps or springs are encountered. Drainage design may be performed on a case-by-case basis. Extent, depth, and location of drainage may be determined in the field by Columbia West during construction when soil conditions are exposed. Failure to provide adequate drainage may result in soil sloughing, settlement, or erosion.

Final cut or fill slopes at the site should not exceed 2H:1V or 20 feet in height without individual slope stability analysis. The values above assume a minimum horizontal setback for loads of 10 feet from top of cut or fill slope face or overall slope height divided by three (H/3), whichever is greater. A minimum slope setback detail for structures is presented in Figure 4.

Concentrated drainage or water flow over the face of slopes should be prohibited, and adequate protection against erosion is required. Fill slopes should be constructed by placing fill material in maximum 12-inch level lifts, compacting as described in Section 5.2, *Engineered Structural Fill*, and horizontally benching where appropriate. Fill slopes should be overbuilt, compacted, and trimmed at least two feet horizontally to provide adequate compaction of the outer slope face. Proper cut and fill slope construction is critical to overall project stability and should be observed and documented by Columbia West.

5.4 Excavation

Soils at the site were explored to a maximum depth of 10 feet using an excavator. Bedrock was not encountered and blasting or specialized rock-excavation techniques are not anticipated. Groundwater was observed within test pit TP-2 at a depth of 4.5 feet bgs. Perched groundwater layers may exist at shallower depths depending on seasonal fluctuations in the water table.

Based upon laboratory analysis and field testing, near-surface soils may be Washington State Industrial Safety and Health Administration (WISHA) Type C. For temporary open-cut excavations deeper than four feet, but less than 20 feet in soils of these types, the maximum allowable slope is 1.5H:1V. WISHA soil type should be confirmed during field construction activities by the contractor. Soil is often anisotropic and heterogeneous, and it is possible that WISHA soil types determined in the field may differ from those described above.

Site-specific shoring design may be required if open-cut excavations are infeasible or if excavations are proposed adjacent to existing infrastructure. Typical methods for stabilizing excavations consist of soldier piles and timber lagging, sheet pile walls, tiebacks and shotcrete, or pre-fabricated hydraulic shoring. Because lateral earth pressure distributions acting on below-grade structures are dependent upon the type of shoring system used, Columbia West should be contacted to conduct additional analysis when shoring type, excavation depths, and locations are known.

The contractor should be held responsible for site safety, sloping, and shoring. Columbia West is not responsible for contractor activities and in no case should excavation be conducted in excess of all applicable local, state, and federal laws.

5.5 Dewatering

Groundwater elevation and hydrostatic pressure should be carefully considered during design of utilities, retaining walls, or other structures that require below-grade excavation. Utility trenches in shallow groundwater areas or excavations and cuts that remain open for even short periods of time may undermine or collapse due to groundwater effects. Placement of layers of riprap or quarry spalls in localized areas on shallow excavation side slopes may be required to limit instability. Over-excavation and stabilization of pipe trenches or other excavations with imported crushed aggregate or gabion rock may also be necessary to provide adequate subgrade support.

Significant pumping and dewatering may be required to temporarily reduce the groundwater elevation to allow construction of proposed below-grade structures, installation of utilities, or placement of structural fills. Dewatering via a sump within excavation zones may be insufficient to control groundwater and provide excavation side slope stability. Dewatering may be more feasibly conducted by installing a system of temporary well points and pumps around proposed excavation areas or utility trenches. Depending on proposed utility depths, a site-specific dewatering plan may be necessary. Well pumps should remain functioning at all times during the excavation and construction period. Suitable back-up pumps and power supplies should be available to prevent unanticipated shut-down of dewatering equipment. Failure to operate pumps full-time may result in flooding of the excavation zones, resulting in damage to forms, slopes, or equipment.

5.6 Lateral Earth Pressure

Lateral earth pressures should be considered during design of retaining walls and below grade structures. Hydrostatic pressure and additional surcharge loading should also be considered. Retained material may include engineered structural backfill or undisturbed native soil. Structural wall backfill should consist of imported granular material meeting *Section 9-03.12(2)* of *WSDOT Standard Specifications*. Backfill should be prepared and compacted to at least 95 percent of maximum dry density as determined by the modified Proctor test (ASTM D1557). Recommended parameters for lateral earth pressures for retained soils and engineered structural backfill consisting of imported granular fill meeting WSDOT specifications for *Gravel Backfill for Walls 9-03.12(2)* are presented in Table 1.

Table 1. Recommended Lateral Earth Pressure Parameters for Level Backfill

Retained Soil	Equivalent Fluid Pressure for Level Backfill			Wet Density	Drained Internal Angle of Friction
	At-rest	Active	Passive		
Undisturbed native Poorly-graded SAND with Silt and Poorly-graded SAND (Soil Type 2)	54 pcf	35 pcf	374 pcf	115 pcf	32°
Undisturbed native SILT (Soil Type 3)	58 pcf	40 pcf	305 pcf	110 pcf	28°
Approved Structural Backfill Material WSDOT 9-03.12(2) compacted aggregate backfill	56 pcf	35 pcf	520 pcf	135 pcf	36°

**The upper 6 inches of soil should be neglected in passive pressure calculations. If exterior grade from top or toe of retaining wall is sloped, Columbia West should be contacted to provide location-specific lateral earth pressures.*

The design parameters presented in Table 1 are valid for static loading cases only and are based upon in situ undisturbed native soils or compacted granular fill. The recommended earth pressures do not include surcharge loads, dynamic loading, hydrostatic pressure, or seismic design. If sloped backfill conditions are proposed, Columbia West should be contacted for additional analysis and associated recommendations.

If seismic design is required for unrestrained walls, seismic forces may be calculated by superimposing a uniform lateral force of $10H^2$ pounds per lineal foot of wall, where H is the total wall height in feet.

A continuous one-foot-thick zone of free-draining, washed, open-graded 1-inch by 2-inch drain rock and a 4-inch perforated gravity drainpipe is assumed behind retaining walls. Geotextile filter fabric should be placed between the drain rock and backfill soil. Specifications for drainpipe design are presented in Section 5.10, *Drainage*. If walls cannot be gravity drained, saturated base conditions and/or applicable hydrostatic pressures should be assumed.

Final retaining wall design should be reviewed and approved by Columbia West. Retaining wall subgrade and backfill activities should also be observed and tested for compliance with recommended specifications by Columbia West during construction.

5.7 Seismic Design Considerations

According to the *ASCE 7 Hazard Tool,* the anticipated peak ground and maximum considered earthquake spectral response accelerations resulting from seismic activity for the subject site are summarized in Table 2.

The listed probabilistic ground motion values are based upon "firm rock" sites with an assumed shear wave velocity of 2,500 ft/s in the upper 100 feet of soil profile. These values should be adjusted for site class effects by applying site coefficients F_a F_v, and F_{PGA} as defined in *ASCE 7-16,* and associated *ASCE 7-16 Supplement 1,* dated December 12, 2018, *Tables 11.4-1, 11.4-2, and 11.8-1.* The site coefficients are intended to more accurately characterize estimated peak ground and respective earthquake spectral response accelerations by considering site-specific soil characteristics and index properties.

Table 2. Approximate Probabilistic Ground Motion Values for 'firm rock' sites based on subject property longitude and latitude

	2% Probability of Exceedance in 50 yrs
Peak Ground Acceleration	0.371 g
0.2 sec Spectral Acceleration (S_S)	0.818 g
1.0 sec Spectral Acceleration (S_1)	0.390 g

The *Site Class Map of Cowlitz County, Washington (Washington State Department of Natural Resources, 2004)* indicates that site soils may be represented by Site Class D to E as defined by *2018 IBC Section 1613.3.2*. This site class designation indicates that some amplification of seismic energy may occur during a seismic event because of subsurface conditions.

Based upon subsurface information obtained from local geologic maps and Columbia West's past experience in the area, in our opinion site soils are likely to meet the definition of Site Class F as defined in *2018 IBC Section 1613.3.2*. Due to the presence of potentially liquefiable soils at the site, Site Class F criteria may be met if the fundamental period of vibration for proposed structures is greater than 0.5 seconds. This site class designation indicates that amplification of seismic energy may occur during a seismic event because of subsurface conditions.

Localized peak ground accelerations exceeding the adjusted values may occur in some areas in direct proximity to an earthquake's origin. This may be a result of amplification of seismic energy due to depth to competent bedrock, compression and shear wave velocity of bedrock, presence and thickness of loose, unconsolidated alluvial deposits, soil plasticity, grain size, and other factors.

Identification of specific seismic response spectra is beyond the scope of this investigation. If site structures are designed in accordance with recommendations specified in the *2018 IBC*, the potential for peak ground accelerations in excess of the adjusted and amplified values should be understood.

5.8 Soil Liquefaction or Dynamic Settlement

According to the *Liquefaction Susceptibility Map of Cowlitz County Washington* (Washington State Department of Natural Resources, 2004), the site is mapped as moderate to high susceptibility for liquefaction. Liquefaction, defined as the transformation of the behavior of a granular material from a solid to a liquid due to increased pore-water pressure and reduced effective stress, may occur when granular materials quickly compact under cyclic stresses caused by a seismic event. The effects of liquefaction may include immediate ground settlement and lateral spreading.

As mentioned previously, potential for soil liquefaction may be high. Quantifying this potential is beyond the scope of this investigation. Columbia West recommends additional exploration to effectively evaluate dynamic settlement potential resulting from soil liquefaction.

5.9 Infiltration Testing Results

To investigate the feasibility of subsurface disposal of stormwater, Columbia West conducted in situ infiltration testing at four locations within the project area on May 19, 2022. Results of in situ infiltration testing are presented in Table 3. The soil classifications presented in Table 3 are based upon laboratory analysis where available. The infiltration rates are presented as a recommended coefficient of permeability (k) and have been reported without application of a factor of safety.

As indicated in Table 3, infiltration testing was conducted in all test pits at depths from 1.5 to 5 feet bgs. Soils in the tested locations were observed and sampled to adequately characterize the subsurface profile. Tested native soils are classified as poorly-graded SAND with silt (SP-SM), poorly-graded SAND (SP), and SILT (ML) according to USCS specifications. Soil laboratory analytical test reports are provided in Appendix A.

Single-ring, falling head infiltration testing was performed by inserting a three-inch diameter pipe into the soil at the noted depths. The tests were conducted by filling the apparatus with water and measuring time relative to changes in hydraulic head at regular intervals. Using Darcy's Law for saturated flow in homogenous media, the coefficient of permeability (k) was then calculated.

Table 3. Infiltration Test Results

Test Number	Location	Test Depth (feet bgs)	Groundwater Depth on 05/19/22 (feet bgs)	USCS Soil Type (* Indicates Visual Classification)	Passing No. 200 Sieve (%)	Infiltration Rate (Coefficient of Permeability, k) (inches/hour)
IT-1.1	TP-1	4.5	Not observed to 10	SP-SM, Poorly-graded SAND with Silt	8.2	15
IT-2.1	TP-2	1.5	4.5	SP, Poorly-graded SAND	0.5	50
IT-3.1	TP-3	3.0	Not observed to 9.5	ML, SILT	93.0	0.5
IT-4.1	TP-4	5.0	Not observed to 9.0	SP, Poorly-graded SAND	3.6	50

The reported infiltration rates, as defined by the soil coefficient of permeability, reflect approximate raw observed data, without application of a factor of safety. An appropriate factor of safety should be applied to the observed infiltration rates prior to use in design calculations.

Infiltration facilities should maintain code-specified horizontal structural setback distances and be protected from erosion, especially during construction. Improperly designed or constructed systems may become fouled or plugged with mud or micaceous sediment. Excavation and preparation of stormwater disposal facilities should be closely monitored by Columbia West. An emergency overflow discharge point should be provided.

It is important to note that site soil conditions and localized infiltration capability may be variable. Therefore, infiltration rates should be verified by additional testing during construction when subgrade soils are exposed. Subgrade soils should also be observed by

Columbia West to verify soil index properties pertaining to infiltration are similar to those at the tested locations.

The observed infiltration rates provided in Table 3 are based upon an assumed adequate vertical separation distance between the infiltrating surface and the groundwater table and Columbia West's observations during limited subsurface exploration. Therefore, they may not be an accurate indicator of post-developed long-term system performance. Systems may require additional infiltration capacity if submerged or mounded conditions are present or construction verification testing or future performance indicate the system is not functioning according to original tested and designed parameters.

5.10 Drainage

At a minimum, site drainage should include surface water collection and conveyance to properly designed stormwater management structures and facilities. Drainage design in general should conform to City of Woodland regulations. Finished site grading should be conducted with positive drainage away from structures. Depressions or shallow areas that may retain ponding water should be avoided. Roof drains, low-point drains, and perimeter foundation drains are recommended for structures. Drains should consist of separate systems and gravity flow with a minimum two-percent slope away from foundations into an approved discharge location.

Subdrains should also be considered if portions of the site are cut below surrounding grades. Shallow groundwater, springs, or seeps should be conveyed via drainage channel or perforated pipe into an approved discharge. Recommendations for design and installation of perforated drainage pipe may be performed on a case-by-case basis by Columbia West during construction. Failure to provide adequate surface and sub-surface drainage may result in soil slumping or unanticipated settlement of structures exceeding tolerable limits.

Drains should be closely monitored after construction to assess their effectiveness. If additional surface or shallow subsurface seeps become evident, the drainage provisions may require modification or additional drains. Columbia West should be consulted to provide appropriate recommendations.

5.11 Bituminous Asphalt and Portland Cement Concrete

Columbia West recommends adherence to City of Woodland standards for street improvements in the public right-of-way. For dry weather construction, pavement surface sections should bear upon competent subgrade consisting of scarified and compacted native soil or engineered structural fill. Wet weather pavement construction is discussed in Section 5.12, *Wet Weather Construction Methods and Techniques*. Subgrade conditions should be evaluated and tested by Columbia West prior to placement of crushed aggregate base. Subgrade evaluation should include nuclear gauge density testing and wheel proof-roll observations conducted with a loaded 12-cubic yard, double-axle dump truck or equivalent. Nuclear gauge density testing should be conducted at 150-foot intervals or as determined by the onsite geotechnical engineer. Subgrade soil should be compacted to at least 95 percent of the modified Proctor dry density, as determined by *ASTM D1557*. Areas of observed deflection or rutting during proof-roll evaluation should be excavated to a firm surface and replaced with compacted crushed aggregate.

Aggregate base should consist of 1 ¼”-0 crushed aggregate meeting *WSDOT 9-03.9(3)* and be compacted to at least 95 percent of maximum dry density as determined by *ASTM D1557*. Aggregate base should also be subject to proof-roll observations as described above. Asphalt concrete pavement should be compacted to at least 91 percent of maximum Rice density. Nuclear gauge density testing should be conducted to verify adherence to recommended specifications. Testing frequency should be in accordance with Washington Department of Transportation and City of Woodland specifications.

Portland cement concrete curbs and sidewalks should be installed in accordance with City of Woodland specifications. Curb and sidewalk aggregate base should consist of 1 ¼”-0 crushed aggregate meeting *WSDOT 9-03.9(3)* and be compacted to at least 95 percent of maximum dry density as determined by *ASTM D1557*. Curb and sidewalk base should also be subject to proof-roll observations as described above. Soft areas that deflect or rut should be stabilized prior to pouring concrete. Concrete should be tested during installation in accordance with *ASTM C171, C138, C231, C143, C1064, and C31*. This includes casting of cylinder specimens at a frequency of four cylinders per 100 cubic yards of poured concrete. Recommended field concrete testing includes slump, air entrainment, temperature, and unit weight.

5.12 Wet Weather Construction Methods and Techniques

Wet weather construction often results in significant shear strength reduction and soft areas that may rut or deflect. Installation of granular working layers may be necessary to provide a firm support base and sustain construction equipment. Granular layers should consist of all-weather gravel, 2x4-inch gabion, or other similar material (six-inch maximum size with less than five percent passing the No. 200 sieve).

Construction equipment traffic across exposed soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for wet soils. Wet weather construction may also result in generation of significant excess quantities of soft wet soil. This material should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Over-excavation of subgrade soils or subgrade amendment with lime and/or cement may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric is also recommended. If soil amendment with lime or cement is considered, Columbia West should be contacted to provide appropriate recommendations based upon observed field conditions and desired performance criteria.

Crushed aggregate base should be installed in a single lift with trucks end-dumping from an advancing pad of granular fill. During extended wet periods, stripping activities may also need to be conducted from an advancing pad of granular fill. Once installed, the crushed aggregate base should be compacted with several passes from a static drum roller. A vibratory compactor is not recommended because it may further disturb the subgrade.

Subdrains may also be necessary to provide subgrade drainage and maintain structural integrity.

Aggregate base should consist of 1 ¼”-0 crushed aggregate meeting *WSDOT 9-03.9(3)* and be compacted to at least 95 percent of maximum dry density according to the modified Proctor density test (ASTM D1557). Compaction should be verified by nuclear gauge density testing, conducted at 150-foot intervals or as determined by the onsite geotechnical engineer. Observation of a proof-roll with a loaded dump truck is also recommended as an indication of the compacted aggregate’s performance.

It should be understood that wet weather construction is risky and costly. Columbia West should observe and document wet weather construction activities. Proper construction methods and techniques are critical to overall project integrity.

5.13 Erosion Control Measures

Based upon field observations and laboratory testing, the erosion hazard for site soils in flat to shallow-gradient portions of the property is likely to be low. The potential for erosion generally increases in sloped areas. Therefore, disturbance to vegetation in sloped areas should be minimized during construction activities. Soil is also prone to erosion if unprotected and unvegetated during periods of increases precipitation. Erosion can be minimized by performing construction activities during dry summer months.

Site-specific erosion control measures should be implemented to address the maintenance of exposed areas. This may include silt fence, biofilter bags, straw wattles, or other suitable methods. During construction activities, exposed areas should be well-compacted and protected from erosion with visqueen, surface tackifier, or other means, as appropriate. Temporary slopes or exposed areas may be covered with straw, crushed aggregate, or riprap in localized areas to minimize erosion. Erosion and water runoff during wet weather conditions may be controlled by application of strategically placed channels and small detention depressions with overflow pipes.

After grading, exposed surfaces should be vegetated as soon as possible with erosion-resistant native vegetation. Jute mesh or straw may be applied to enhance vegetation. Once established, vegetation should be properly maintained. Disturbance to existing native vegetation and surrounding organic soil should also be minimized during construction activities.

5.14 Utility Installation

Utility installation may require subsurface excavation and trenching. Excavation, trenching and shoring should conform to federal (Occupational Safety and Health Administration) (OSHA) (29 CFR, Part 1926) and WISHA (WAC, Chapter 296-155) regulations. Site soils may slough when cut vertically and sudden precipitation events or perched groundwater may result in accumulation of water within excavation zones and trenches.

Utilities should be installed in general accordance with manufacturer’s recommendations. Utility trench backfill should consist of *WSDOT 9-03.19 Bank Run Gravel for Trench Backfill* or *WSDOT 9-03.14(2) Select Borrow* with a maximum particle size of 2 ½-inches. Trench backfill material within 18 inches of the top of utility pipes should be hand compacted (i.e., no heavy compaction equipment). The remaining backfill should be compacted to at least 95 percent of maximum dry density as determined by the standard Proctor moisture-density test (ASTM D698). Clean, free-draining, fine bedding sand is recommended for use in the pipe zone. With exception of the pipe zone, backfill should be placed in loose lifts not exceeding 12 inches in thickness.

Compaction of utility trench backfill material should be verified by nuclear gauge field compaction testing performed in accordance with *ASTM D6938*. Field compaction testing should be performed at 200-foot intervals along the utility trench centerline at the surface and midpoint depth of the trench. Compaction frequency and specifications may be modified for non-structural areas in accordance with recommendations of the site geotechnical engineer.

6.0 CONCLUSION AND LIMITATIONS

This geotechnical site investigation report was prepared in accordance with accepted standard conventional principles and practices of geotechnical engineering. This investigation pertains only to material tested and observed as of the date of this report and is based upon proposed site development as described in the text herein. This report is a professional opinion containing recommendations established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. Soil conditions may differ between tested locations or over time. Slight variations may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions are as anticipated in this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Columbia West cannot accept responsibility for deviations from recommendations described in this report. Future performance of structural facilities is often related to the degree of construction observation by qualified personnel. These services should be performed to the full extent recommended.

This report is not an environmental assessment and should not be construed as a representative warranty of site subsurface conditions. The discovery of adverse environmental conditions, or subsurface soils that deviate from those described in this report, should immediately prompt further investigation. The above statements are in lieu of all other statements expressed or implied.

This report was prepared solely for the client and is not to be reproduced without prior authorization from Columbia West. Final engineering plans and specifications for the project should be reviewed and approved by Columbia West as they relate to geotechnical and grading issues prior to final design approval. Columbia West is not responsible for independent conclusions or recommendations made by other parties based upon information presented in this report. Unless a particular service was expressly included in the scope, it was not performed and there should be no assumptions based upon services not provided. Additional report limitations and important information about this document are presented in Appendix E. This information should be carefully read and understood by the client and other parties reviewing this document.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

Lance V. Lehto, PE, GE
President

LANCE V. LEHTO
STATE OF WASHINGTON
36301
REGISTERED
PROFESSIONAL ENGINEER

6-9-2022

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Palmer, Stephen P., Magsino, Sammantha L., Bilderback, Eric L., Poelstra, James L., Folger, Derek L., and Niggemann, Rebecca A., *Liquefaction Susceptibility Map of Cowlitz County, Washington;* Washington State Department of Natural Resources, September 2004.

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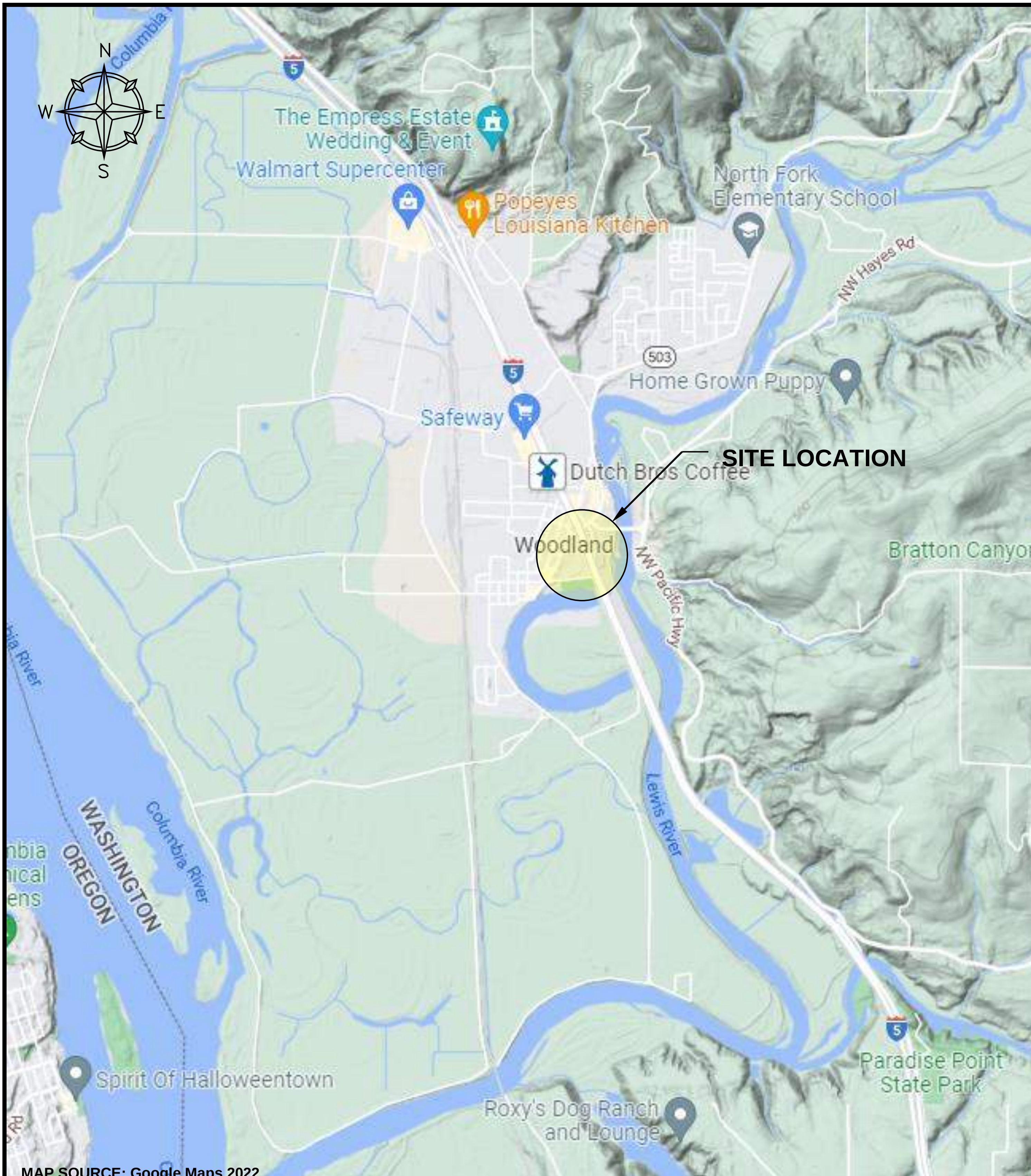
FIGURES



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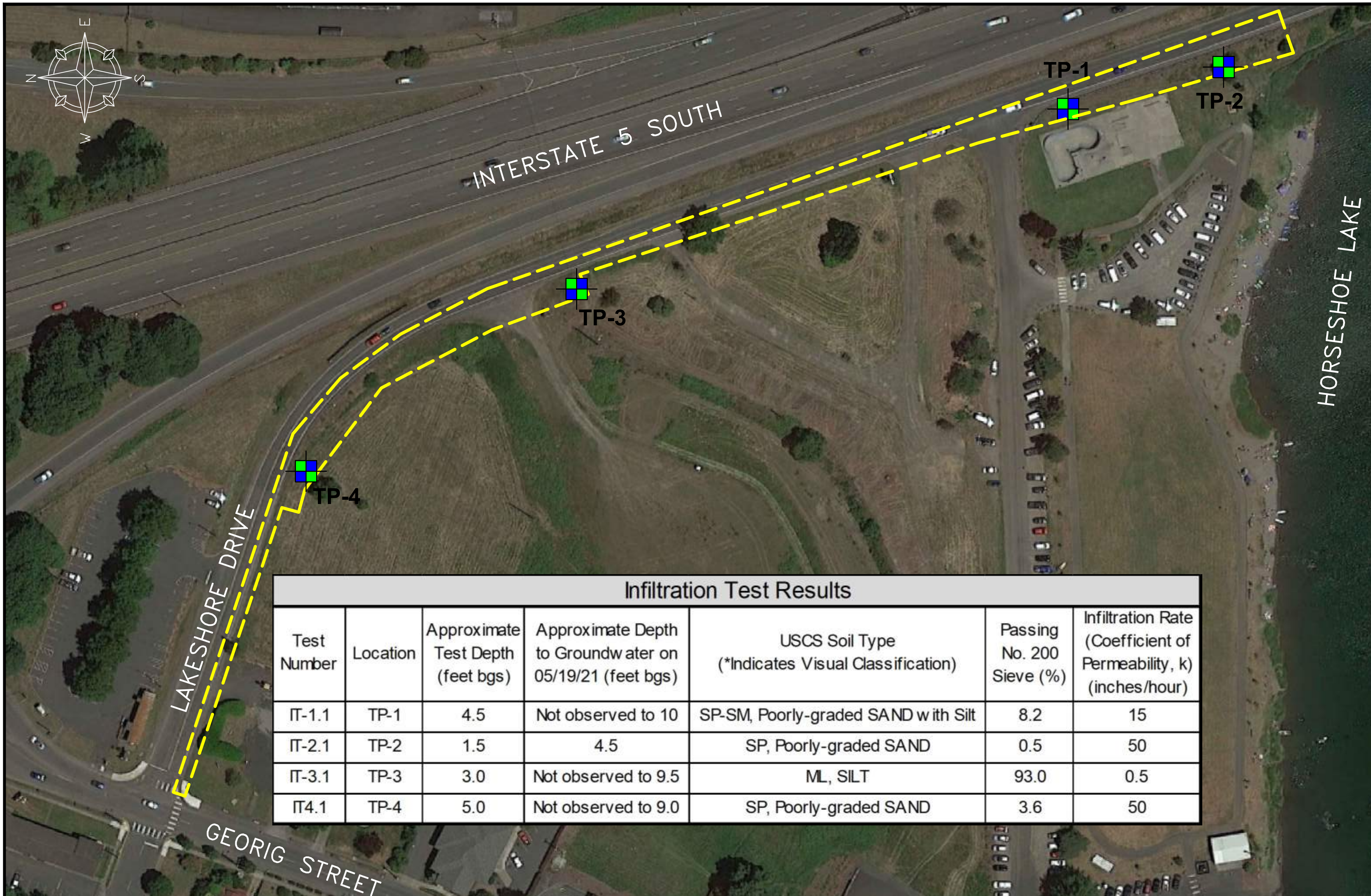
Design	Drawn: EMU			SITE LOCATION MAP	FIGURE 1
Checked: ASR	Date: 05/17/22				
Client: HHPR	Rev	By	Date	LAKESHORE DRIVE WOODLAND, WASHINGTON	
Job No.: 22086					
CAD File: FIGURE 1					
Scale: NONE					



Infiltration Test Results						
Test Number	Location	Approximate Test Depth (feet bgs)	Approximate Depth to Groundwater on 05/19/21 (feet bgs)	USCS Soil Type (*Indicates Visual Classification)	Passing No. 200 Sieve (%)	Infiltration Rate (Coefficient of Permeability, k) (inches/hour)
IT-1.1	TP-1	4.5	Not observed to 10	SP-SM, Poorly-graded SAND with Silt	8.2	15
IT-2.1	TP-2	1.5	4.5	SP, Poorly-graded SAND	0.5	50
IT-3.1	TP-3	3.0	Not observed to 9.5	ML, SILT	93.0	0.5
IT4.1	TP-4	5.0	Not observed to 9.0	SP, Poorly-graded SAND	3.6	50

APPROXIMATE SITE BOUNDARY — APPROXIMATE LOCATION OF INFILTRATION TEST — APPROXIMATE LOCATION OF TEST PIT

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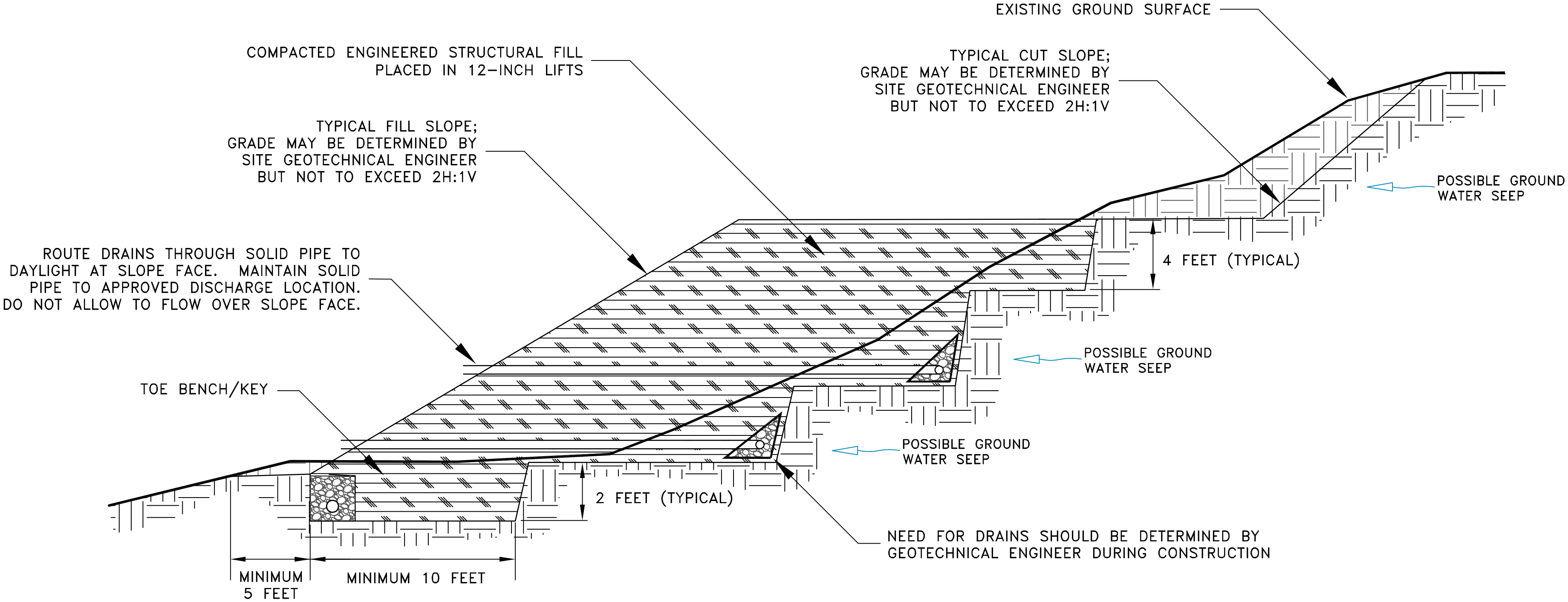
Job No: 22086
Date: 06/03/22
Drawn: EMU
Checked: ASR

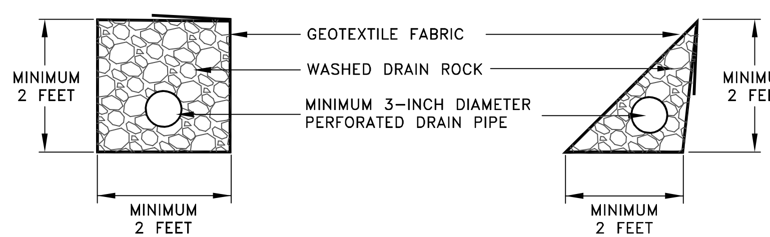
EXPLORATION LOCATION MAP
LAKESHORE DRIVE PAVEMENTS AND PEDESTRIAN IMPROVEMENTS

NOTES:
1. SITE LOCATION: LAKESHORE DRIVE FROM GOERIG STREET TO HORSESHOE LAKE IN WOODLAND, WASHINGTON.
2. AERIAL PHOTO SOURCED FROM GOOGLE EARTH.
3. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
4. TEST PITS BACKFILLED LOOSELY WITH ONSITE SOILS ON MAY 19, 2022.

FIGURE 2



TYPICAL DRAIN SECTION DETAIL



DRAIN SPECIFICATIONS

GEOTEXTILE FABRIC SHALL CONSIST OF MIRAFI 140N OR APPROVED EQUIVALENT WITH AOS BETWEEN No. 70 AND No. 100 SIEVE.

WASHED DRAIN ROCK SHALL BE OPEN-GRADED ANGULAR DRAIN ROCK WITH LESS THAN 2 PERCENT PASSING THE No. 200 SIEVE AND A MAXIMUM PARTICLE SIZE OF 3 INCHES.

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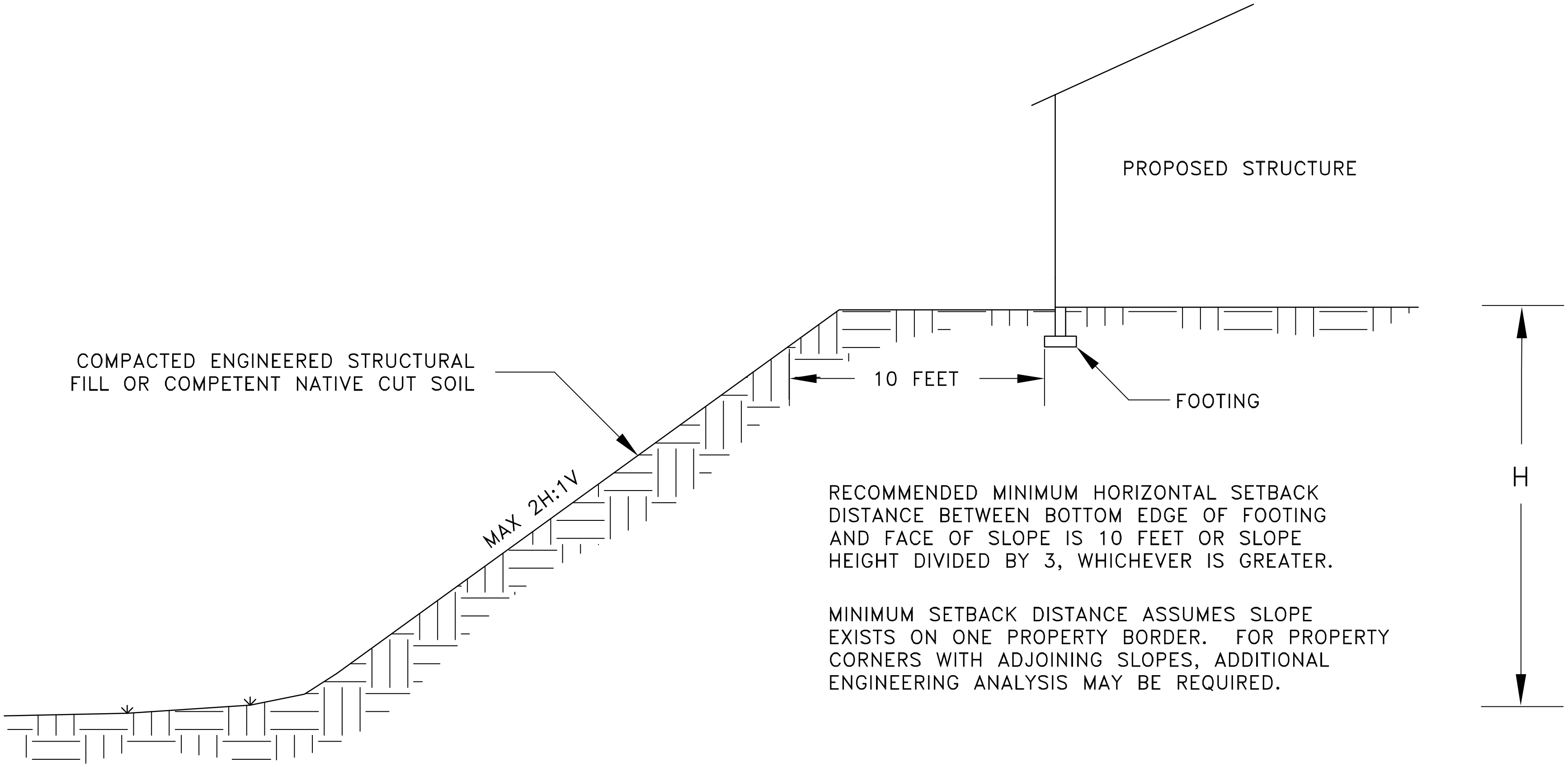
TYPICAL CUT AND FILL SLOPE CROSS SECTION

NOTES:
1. DRAWING IS NOT TO SCALE.
2. DRAWING REPRESENTS TYPICAL CUT AND FILL SLOPE CROSS SECTION AND MAY NOT BE SITE-SPECIFIC.

FIGURE 3



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TYPICAL MINIMUM FOUNDATION SLOPE SETBACK DETAIL

NOTES:
1. DRAWING IS NOT TO SCALE.
2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
3. DRAWING REPRESENTS TYPICAL FOUNDATION SETBACK DETAIL AND MAY NOT BE SITE-SPECIFIC.

FIGURE 4

APPENDIX A
LABORATORY TEST RESULTS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Lakeshore Drive Pavement and Pedestrian Improvements Woodland, Washington	Harper Houf Peterson Righellis Inc. 1220 Main Street #150 Vancouver, Washington 98660	22086	S22-0536
		REPORT DATE: 06/01/22	FIELD ID: TP1.1
		DATE SAMPLED: 05/19/22	SAMPLED BY: EMU

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded SAND with Silt	Test Pit TP-01 depth = 4.5 feet	SP-SM, Poorly graded Sand with Silt

SPECIFICATIONS	AASHTO CLASSIFICATION
none	A-3(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter, moist prep, hand washed, 12" single sieve-set	ASTM D6913, Method A

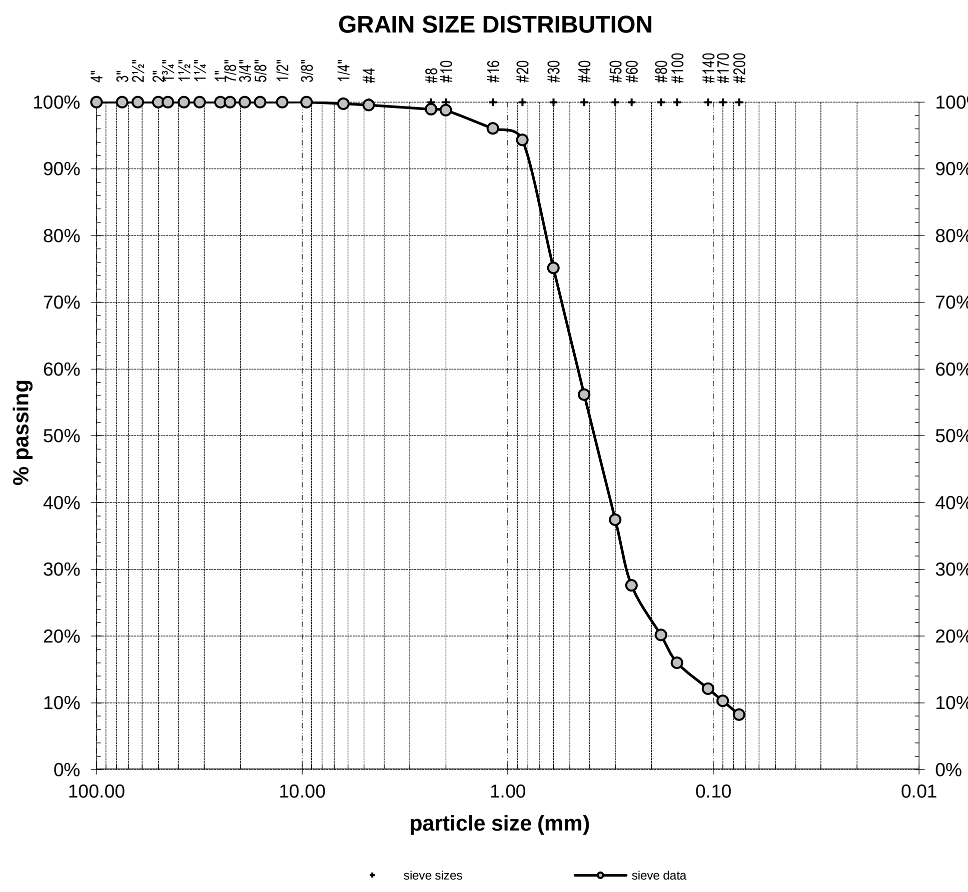
ADDITIONAL DATA

initial dry mass (g) =	228.19		
as-received moisture content =	9.4%	coefficient of curvature, C_C =	1.71
liquid limit =	-	coefficient of uniformity, C_U =	5.19
plastic limit =	-	effective size, $D_{(10)}$ =	0.088 mm
plasticity index =	NP	$D_{(30)}$ =	0.261 mm
fineness modulus =	n/a	$D_{(60)}$ =	0.456 mm

SIEVE DATA

% gravel = 0.4%
% sand = 91.3%
% silt and clay = 8.2%

	SIEVE SIZE		PERCENT PASSING			
			SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50	100%			
	1/4"	6.30	100%			
	#4	4.75	100%			
SAND	#8	2.36		99%		
	#10	2.00	99%			
	#16	1.18		96%		
	#20	0.850	94%			
	#30	0.600		75%		
	#40	0.425	56%			
	#50	0.300		37%		
	#60	0.250	28%			
	#80	0.180		20%		
	#100	0.150	16%			
	#140	0.106		12%		
	#170	0.090		10%		
	#200	0.075	8%			



DATE TESTED	TESTED BY
06/01/22	KMS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Lakeshore Drive Pavement and Pedestrian Improvements Woodland, Washington	Harper Houf Peterson Righellis Inc. 1220 Main Street #150 Vancouver, Washington 98660	22086	S22-0537
		REPORT DATE: 06/01/22	FIELD ID: TP2.1
		DATE SAMPLED: 05/19/22	SAMPLED BY: EMU

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded SAND	Test Pit TP-02 depth = 1.5 feet	SP, Poorly graded Sand

SPECIFICATIONS	AASHTO CLASSIFICATION
none	A-1-b(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter, moist prep, hand washed, 12" single sieve-set	ASTM D6913, Method A

ADDITIONAL DATA

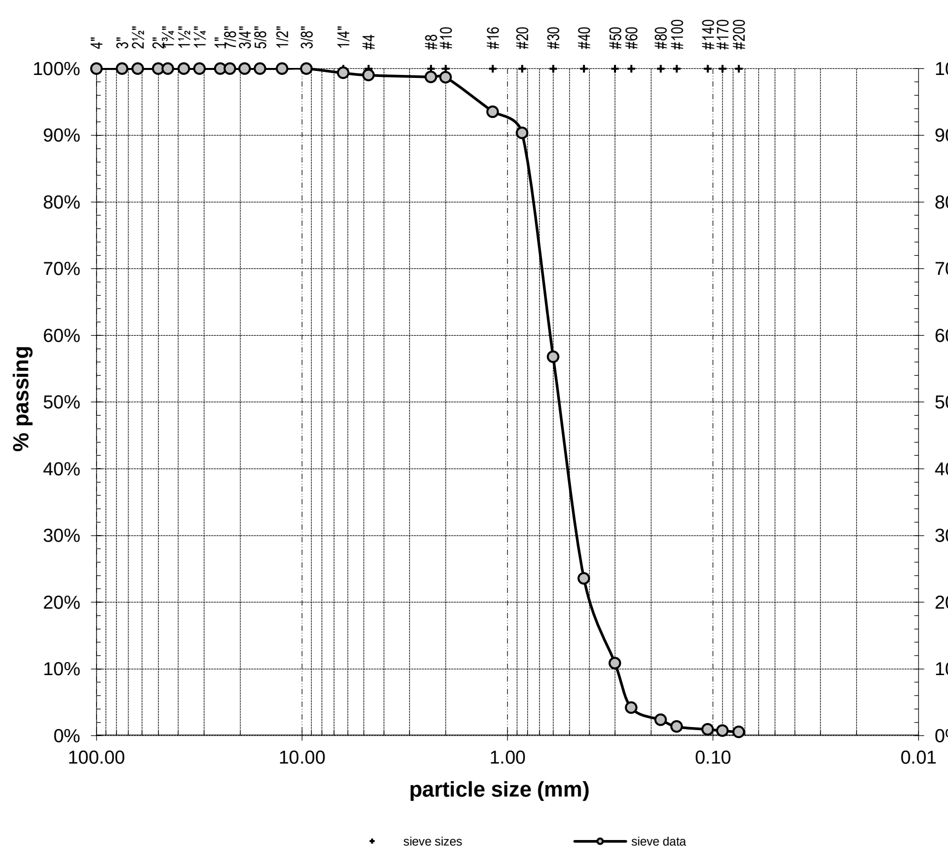
initial dry mass (g) =	225.99		
as-received moisture content =	7.3%	coefficient of curvature, C_C =	1.13
liquid limit =	-	coefficient of uniformity, C_U =	2.12
plastic limit =	-	effective size, $D_{(10)}$ =	0.293 mm
plasticity index =	NP	$D_{(30)}$ =	0.454 mm
fineness modulus =	n/a	$D_{(60)}$ =	0.620 mm

SIEVE DATA

% gravel = 1.0%
% sand = 98.5%
% silt and clay = 0.5%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50	100%			
	1/4"	6.30	99%			
	#4	4.75	99%			
SAND	#8	2.36		99%		
	#10	2.00	99%			
	#16	1.18		94%		
	#20	0.850	90%			
	#30	0.600		57%		
	#40	0.425	24%			
	#50	0.300		11%		
	#60	0.250	4%			
	#80	0.180		2%		
	#100	0.150	1%			
	#140	0.106		1%		
	#170	0.090		1%		
	#200	0.075	1%			

GRAIN SIZE DISTRIBUTION



DATE TESTED	TESTED BY
06/01/22	KMS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Lakeshore Drive Pavement and Pedestrian Improvements Woodland, Washington	Harper Houf Peterson Righellis Inc. 1220 Main Street #150 Vancouver, Washington 98660	22086	S22-0538
		REPORT DATE: 06/01/22	FIELD ID: TP3.1
		DATE SAMPLED: 05/19/22	SAMPLED BY: EMU

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT	Test Pit TP-03 depth = 3 feet	ML, Silt

SPECIFICATIONS	AASHTO CLASSIFICATION
none	A-4(3)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter, moist prep, hand washed, 12" single sieve-set	ASTM D6913, Method A

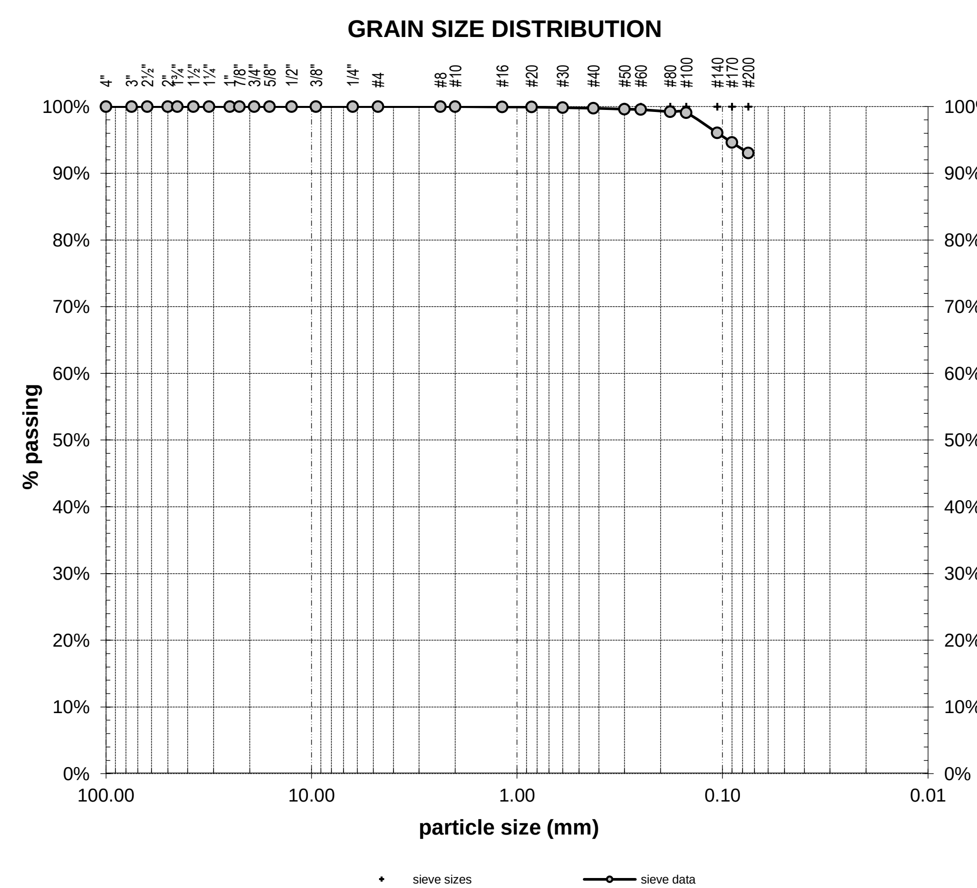
ADDITIONAL DATA

initial dry mass (g) =	184.53		
as-received moisture content =	35.0%	coefficient of curvature, C_C =	n/a
liquid limit =	34	coefficient of uniformity, C_U =	n/a
plastic limit =	33	effective size, $D_{(10)}$ =	n/a
plasticity index =	1	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 7.0%
% silt and clay = 93.0%

	SIEVE SIZE US	mm	SIEVE act.	SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		100%		
	#40	0.425	100%			
	#50	0.300		100%		
	#60	0.250	100%			
	#80	0.180		99%		
	#100	0.150	99%			
	#140	0.106		96%		
	#170	0.090		95%		
	#200	0.075	93%			



DATE TESTED	TESTED BY
05/31/22	KMS

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Lakeshore Drive Pavement and Pedestrian Improvements Woodland, Washington	Harper Houf Peterson Righellis Inc. 1220 Main Street #150 Vancouver, Washington 98660	22086	S22-0538
		REPORT DATE: 06/01/22	FIELD ID: TP3.1
		DATE SAMPLED: 05/19/22	SAMPLED BY: EMU

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT	Test Pit TP-03 depth = 3 feet	ML, Silt

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

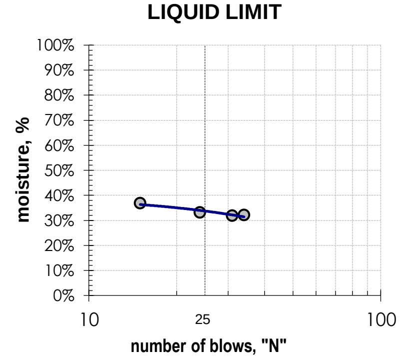
ATTERBERG LIMITS

liquid limit =	34
plastic limit =	33
plasticity index =	1

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	35.25	35.16	35.40	35.29
dry soil + pan weight, g =	31.77	31.71	31.84	31.41
pan weight, g =	20.93	20.88	21.08	20.88
N (blows) =	34	31	24	15
moisture, % =	32.1 %	31.9 %	33.1 %	36.9 %

LIQUID LIMIT



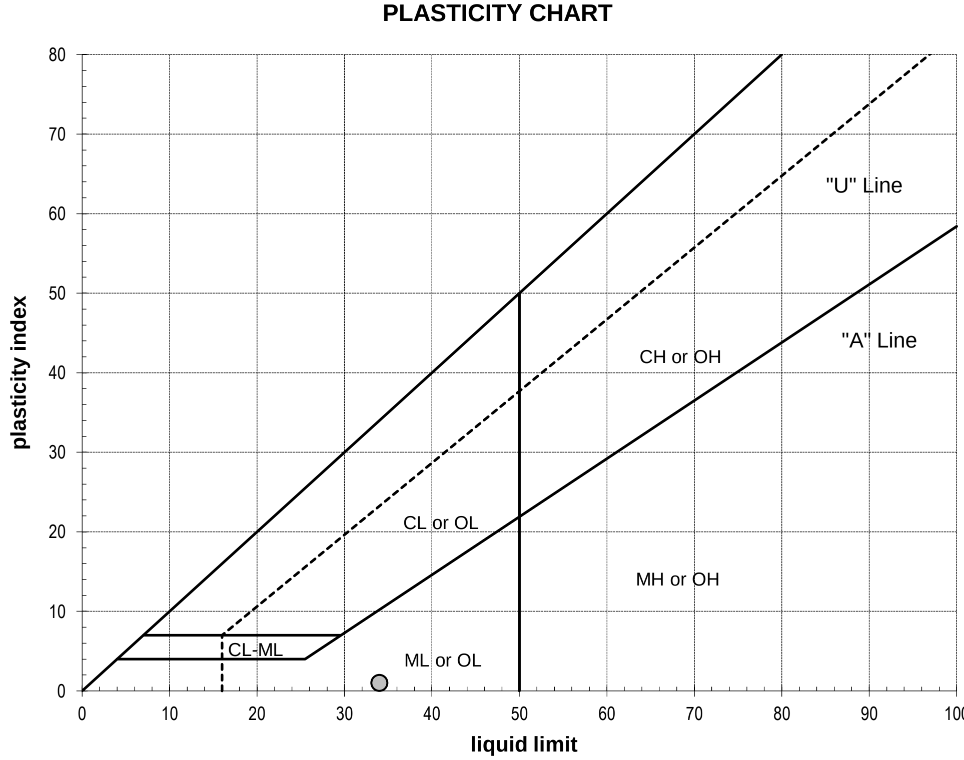
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.11	27.41		
dry soil + pan weight, g =	25.57	25.77		
pan weight, g =	20.98	20.80		
moisture, % =	33.6 %	33.0 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	7.0%
% silt and clay =	93.0%
% silt =	n/a
% clay =	n/a
moisture content =	35.0%

DATE TESTED	TESTED BY
05/31/22	KMS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Lakeshore Drive Pavement and Pedestrian Improvements Woodland, Washington	Harper Houf Peterson Righellis Inc. 1220 Main Street #150 Vancouver, Washington 98660	22086	S22-0539
		REPORT DATE: 06/01/22	FIELD ID: TP4.1
		DATE SAMPLED: 05/19/22	SAMPLED BY: EMU

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded SAND	Test Pit TP-04 depth = 5 feet	SP, Poorly graded Sand

SPECIFICATIONS	AASHTO CLASSIFICATION
none	A-3(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter, moist prep, hand washed, 12" single sieve-set	ASTM D6913, Method A

ADDITIONAL DATA

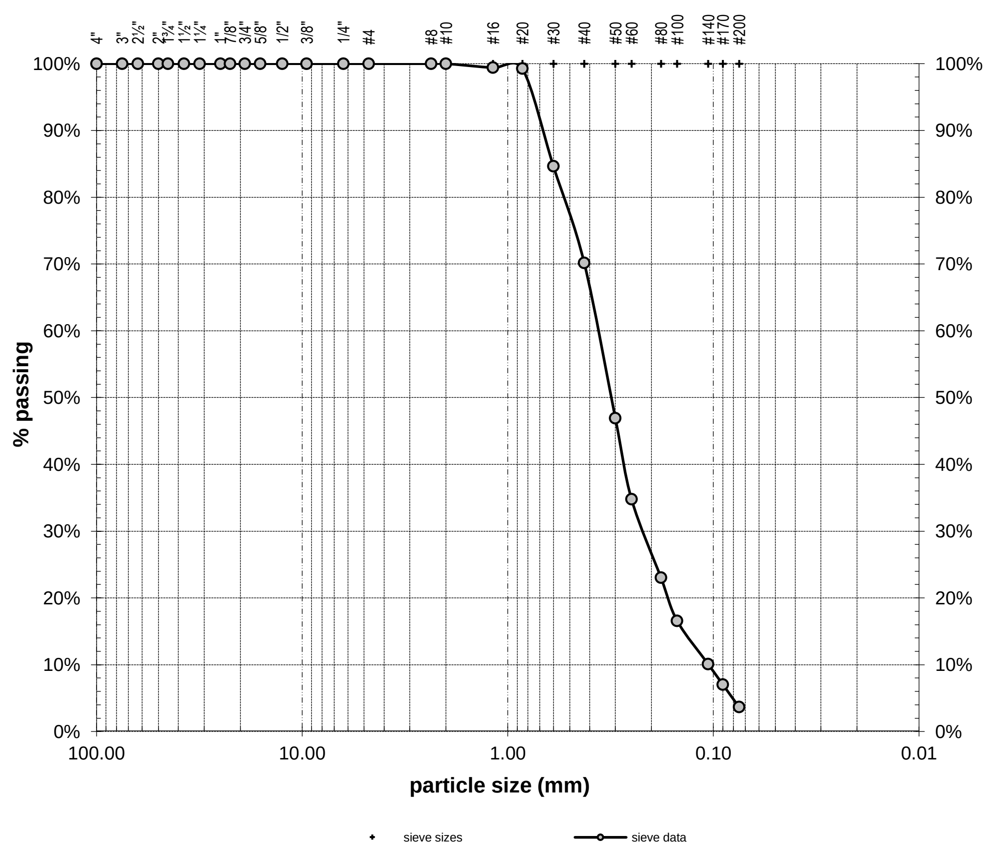
initial dry mass (g) =	229.07		
as-received moisture content =	7.7%	coefficient of curvature, C_C =	1.24
liquid limit =	-	coefficient of uniformity, C_U =	3.46
plastic limit =	-	effective size, $D_{(10)}$ =	0.106 mm
plasticity index =	NP	$D_{(30)}$ =	0.219 mm
fineness modulus =	n/a	$D_{(60)}$ =	0.365 mm

SIEVE DATA

% gravel = 0.0%
% sand = 96.4%
% silt and clay = 3.6%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		99%		
	#20	0.850	99%			
	#30	0.600		85%		
	#40	0.425	70%			
	#50	0.300		47%		
	#60	0.250	35%			
	#80	0.180		23%		
	#100	0.150	17%			
	#140	0.106		10%		
	#170	0.090		7%		
	#200	0.075	4%			

GRAIN SIZE DISTRIBUTION



DATE TESTED	TESTED BY
06/01/22	KMS

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APPENDIX B
SUBSURFACE EXPLORATION LOGS

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Lakeshore Drive	HHPR		22086	TP-1
PROJECT LOCATION: Woodland, Washington	CONTRACTOR: L&S Contractors	EQUIPMENT: Excavator	ENGINEER: EMU	DATE: 05/19/22
TEST PIT LOCATION: See Figure 2, adjacent skate park.	APPROX. SURFACE ELEVATION: not surveyed	GROUNDWATER DEPTH: Not Encountered	START TIME: 0803	FINISH TIME: 0910

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 6 to 8 inches of grass and topsoil.					
						FILL. Brown silty to clayey sand with minor gravel, moist, medium stiff, low plasticity [Soil Type 1]. piece of silt fence and a few 6-inch asphalt chunks.					
		Newberg		SP-SM		Gray poorly-graded SAND with silt, moist, loose to medium dense, non-plastic [Soil Type 2].					
5	TP1.1		A-3(0)			Caving at 3.5 feet.	9.4	8.2	NP	NP	IT1.1 D = 4.5-ft k = 15 in/hr
						Layer of rounded 2 inch gravels at 8 feet.					
10						Bottom of test pit at 10 feet bgs. Groundwater not observed on 05/19/22.					
15											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Lakeshore Drive	HHPR		22086	TP-2
PROJECT LOCATION: Woodland, Washington	CONTRACTOR: L&S Contractors	EQUIPMENT: Excavator	ENGINEER: EMU	DATE: 05/19/22
TEST PIT LOCATION: See Figure 2, above toe of road embankment.	APPROX. SURFACE ELEVATION: not surveyed	GROUNDWATER DEPTH: 4.5 ft	START TIME: 0912	FINISH TIME: 0933

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 16 to 20 inches of grass and topsoil. Begin test pit approximately 3 feet above toe of embankment - very near Horseshoe Lake.					IT2.1
	TP2.1	Newberg	A-1-b(0)	SP		Gray poorly-graded SAND, damp to wet, loose to medium dense, non-plastic. Groundwater corresponds to approximate lake level [Soil Type 2].	7.3	0.5	NP	NP	D = 1.5-ft k = 50 in/hr
5						Bottom of test pit at 5 feet bgs. Groundwater observed at 4.5 feet bgs on 05/19/22.					
10											
15											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Lakeshore Drive	HHPR		22086	TP-3
PROJECT LOCATION Woodland, Washington	CONTRACTOR L&S Contractors	EQUIPMENT Excavator	ENGINEER EMU	DATE 05/19/22
TEST PIT LOCATION See Figure 2, outside of road embankment.	APPROX. SURFACE ELEVATION not surveyed	GROUNDWATER DEPTH Not Encountered	START TIME 0950	FINISH TIME 1135

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 8 to 10 inches of grass and topsoil.					
		Pilchuck	A-3	SP		Gray poorly-graded SAND, damp to moist, loose to medium dense, non-plastic. Apparent bedding planes with minor pebbles [Soil Type 2]. Caving at 1 foot.					
	TP3.1		A-4(3)	ML		Brown to gray SILT to silty fine SAND, moist, medium stiff, low plasticity. Likely fine-grained flood deposit layer [Soil Type 3].	35.0	93.0	34	1	IT3.1 D = 3.0-ft k = 0.5 in/hr
5											
			A-3	SP		Gray poorly-graded SAND, moist, loose to medium dense, non-plastic [Soil Type 2]. Caving at 7.5 feet.					
10						Bottom of test pit at 9.5 feet bgs. Groundwater not observed on 05/19/22.					
15											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Lakeshore Drive	HHPR		22086	TP-4
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	ENGINEER	DATE
Woodland, Washington	L&S Contractors	Excavator	EMU	05/19/22
TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2, outside of road embankment.	not surveyed	Not Encountered	1025	1055

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 8 to 12 inches of grass and topsoil.					
		Caples	A-4	ML		Brown SILT to silty SAND, moist, medium stiff, low plasticity. Likely fine-grained flood deposit [Soil Type 3].					
5	TP4.1		A-3(0)	SP		Gray poorly-graded SAND, damp to moist, loose to medium dense, non-plastic [Soil Type 2]. Caving at 5 feet.	7.7	3.6	NP	NP	IT4.1 D = 5.0-ft k = 50 in/hr
						Bottom of test pit at 9 feet bgs. Groundwater not observed on 05/19/22.					
10											
15											

APPENDIX C
SOIL CLASSIFICATION INFORMATION

SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

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

Consistency for Cohesive Soil

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

Relative Density for Granular Soil

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

Moisture Designations

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

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

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

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

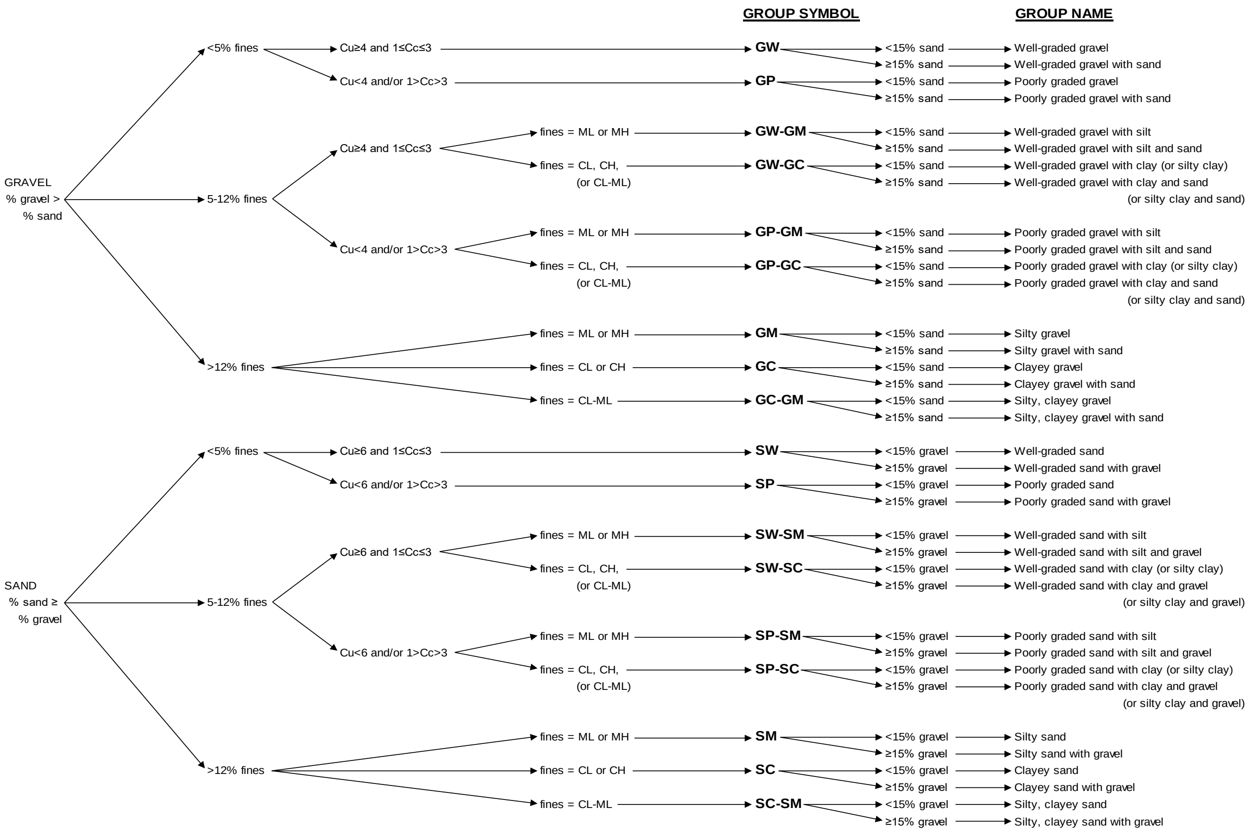
TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

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

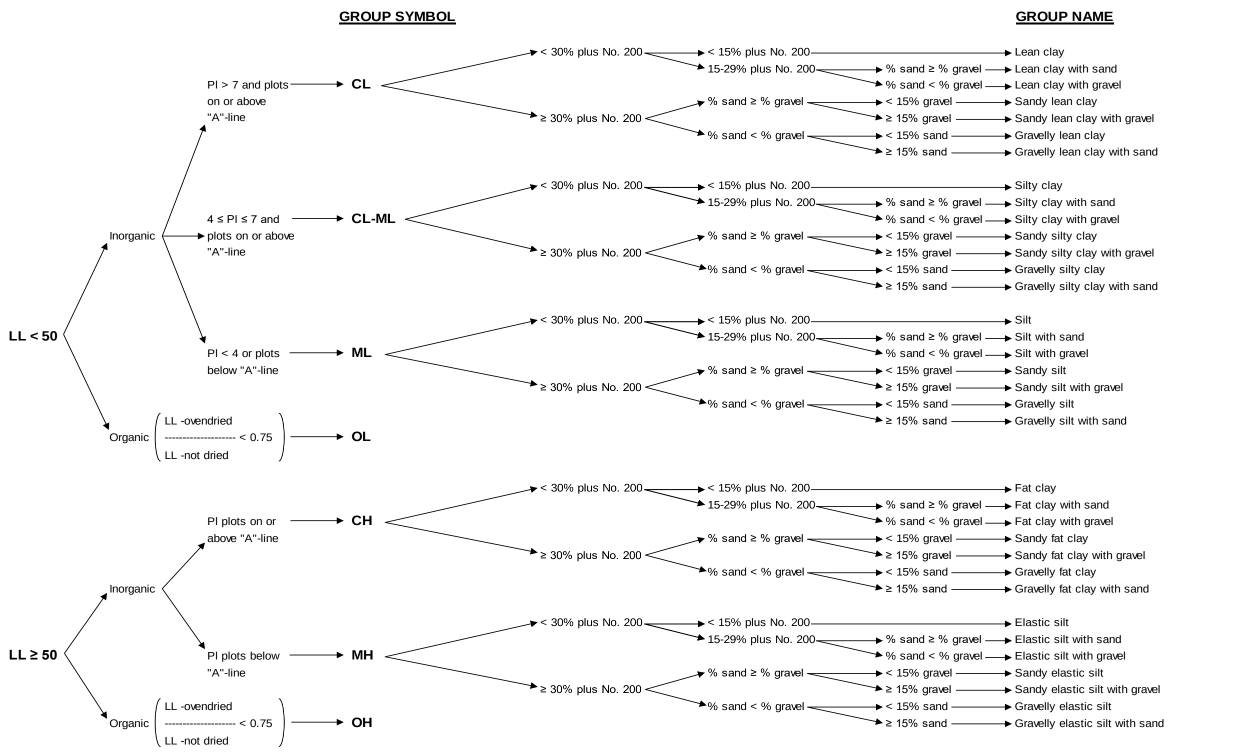
Note: Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30 (see Figure 2).

AASHTO = American Association of State Highway and Transportation Officials

USCS SOIL CLASSIFICATION SYSTEM



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



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

APPENDIX D
PHOTO LOG

Lakeshore Drive Pavement and Pedestrian Improvements

June, 2022

Woodland, Washington

Northwestern Site Area, Facing Southeast

Lakeshore Drive Pavement and Pedestrian Improvements

June, 2022

Woodland, Washington

Southern Site Area, Facing South

Lakeshore Drive Pavement and Pedestrian Improvements

June, 2022

Woodland, Washington

Southern Site Area, Facing North

Lakeshore Drive Pavement and Pedestrian Improvements

June, 2022

Woodland, Washington

Test Pit Profile, TP-1

Lakeshore Drive Pavement and Pedestrian Improvements

June, 2022

Woodland, Washington

Test Pit Profile, TP-2

APPENDIX E
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

Date: June 9, 2022
Project: Lakeshore Drive Pavement and Pedestrian Improvements
Woodland, Washington

Geotechnical and Environmental Report Limitations and Important Information

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction QA/QC

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled *Report Ownership*. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors

Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

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Consultant Responsibility

Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.