EDE ENVIRONMENTAL

October 13, 2025

Mr. Wes Thomas
Oregon Department of Environmental Quality
Northwest Region, Portland Office
Portland Harbor Section
700 NE Multnomah Street, No. 600
Portland, Oregon 97232

EE Project No. 2711
DEQ ECSI File No. 84

SUBJECT: Portland Liquefied Natural Gas (LNG) Electrical Distribution Upgrade Foundation Needs, Portland LNG Plant, 7900 NW St. Helens Road, Portland, Oregon

Dear Mr. Thomas,

Ede Environmental, LLC (EE) is transmitting a geotechnical evaluation report[1] and design drawings[2] documenting foundation needs for proposed new electrical equipment upgrades at the Portland LNG facility, which operates at the Former Gasco Manufactured Gas Plant (MGP) Operable Unit (OU). NW Natural is coordinating with DEQ for information and concurrence related to construction measures specified to mitigate potential impacts from contaminated media that may be encountered during the planned foundation preparation work, to occur after all required city permitting is completed. It is noted that piling specifications and mitigation measures provided herein are identical to those that were completed for the recent Compressor Equipment Foundation Pile Project as described in a September 13, 2023 letter (Ede to Thomas), with concurrence of the proposed mitigation measures received from DEQ via e-mail (Thomas to Ede, September 28, 2023). The new electrical equipment foundation project area is located approximately 35 feet south of the 2023 Compressor Equipment Foundation Project area between the LNG Main Office Building and the LNG Tank Basin (Figure 1).

[1] Cornforth Consultants, Inc. (2025). *Geotechnical Letter Report, Portland LNG Facility – Electrical Equipment Foundations, Portland, Oregon*. July 23, 2025.

[2] Norwest Engineering, Inc. (2025). *Portland LNG Plant PDX MCC1 and 2 Detailed Engineering, Electrical Distribution Upgrade, D1628-S001 through S009*, App Date May 30, 2025.

As documented in the attached letter report and design drawings, the new electrical equipment foundation will consist of a single pad measuring approximately 59 feet by 16 feet (see attached Figure D1628-S004, Foundation Plan and Details). Because the proposed electrical distribution upgrade is considered essential to facility operations, the foundation design was prepared to be protective of seismically induced liquefaction-related displacements.

Based on soil conditions, environmental contamination, access limitations, vibration considerations, and structure type, the geotechnical evaluation concluded that a mat foundation on driven pipe piles is the most favorable support for the proposed electrical distribution system upgrade project.

The geotechnical evaluation identified a need for nine 24-inch steel pipe piles with a minimum wall thickness of 0.75-inch embedded a minimum of 5 feet into very dense gravels at the base of the alluvium, or to the surface of basalt estimated to be between approximately 50 feet and 70 feet below ground surface (bgs) at this area.

Contaminant conditions at the site are well documented. Site residuals mapping completed as part of Gasco OU FS[3] depicts dense non-aqueous phase liquid (DNAPL) presence in fill soils near the footprint of the proposed foundation that are interpreted as having saturation levels typical of potentially mobile DNAPL. High concentrations of dissolved petroleum hydrocarbons are present in groundwater within the Fill Water-Bearing Zone (WBZ) at this portion of the site, while only trace concentrations have been detected in groundwater within the underlying Alluvium WBZ in this area. The fill soils in the area of the new electrical equipment pad, as documented in the Gasco OU FS (Anchor QEA, 2024), are estimated to range between approximately 10 to 15 feet in thickness.

The upper silt unit that underlies the Fill WBZ is estimated to range from 11 to 25 feet thick in the area surrounding the proposed electrical equipment foundation, based on logs from nearby borings. The upper silt unit serves as a low permeability semi-confining layer between the Fill WBZ and the underlying Alluvium WBZ, restricting the migration of DNAPL or dissolved phase contamination downward into the Alluvium WBZ at this portion of the site.

Contaminant exacerbation concerns related to piling construction through areas of shallow contamination may typically include: 1) vertical contaminant drag-down within or at the lead edge of the pile; 2) vertical migration along the exterior of the pile if an annular space were

[3] Anchor QEA, LLC. (2024). *Draft Feasibility Study Report*, Gasco OU, ECSI No. 84. December 16, 2024.

to be created; or 3) vertical migration along the interior of the pile if a breach of the pile wall or through an improperly constructed weld were to occur.

Based on an understanding of site conditions, and as recently completed for the adjacent Compressor Equipment Foundation Piling Project, the piles are to be constructed and installed using means and methods that will mitigate the potential for contaminant transfer from the Fill WBZ to the underlying Alluvium WBZ. Measures that have been incorporated into the design to address concerns related to potential contaminant drag-down or conduit creation between the Fill WBZ and the underlying Alluvium WBZ are specified on attached drawing D1628-S005, and are summarized below:

- Increased the design specification pile wall thickness from 0.75 inch to 1.0 inch to mitigate against long term corrosion of the piling wall.
- Drive the piles with a closed end to prevent incorporation of shallow contamination into the piling orifice. In addition, to avoid carrying a plug of contaminated soil directly beneath the leading end of a closed pile, the pile end will be closed using a conical pile tip that does not extend past the outside piling wall. A conical pile tip will reduce/eliminate the volume potential of soil plug drag-down from the shallow contaminated zone (fill soils) to the largely uncontaminated zone (Alluvium).
- Fill the interior of the piles with a low permeability grout as an added precaution to protect against the breach of the piling wall due to corrosion or an improperly constructed weld.
- Use long enough lengths of pipe that will restrict the need to splice/weld pipe sections together to no more than one spliced section per pile.
- All welds will be ground flush with the exterior piling wall so that in no case would there be a protrusion beyond the smooth exterior piling surface, thereby preventing creation of an annular space around the outer edge of the piling.
- All weld joints will be inspected either by the fabrication shop or in the field to ensure each is continuous without any detectable defects. Inspections may include, but are not limited to, non-destructive methods such as ultrasound or radiographic methods sufficient to meet any City of Portland permit requirements.

As documented in a study published by The Environment Agency[4], solid cylindrical piles are effectively sealed with no vertical pathways created when driven through a low permeability confining layer with a thickness of two or more pile diameters, which for the Electrical Equipment Foundation (24-ich diameter piles) would equate to a minimum upper silt unit thickness of 4 feet. As described in adjacent borings, the upper silt in the proposed foundation area is estimated to range from 11 to 25 feet in thickness, which would be more than adequate to ensure effective sealing of a casing between WBZs.

Based on an understanding of site geology and contaminant conditions, as well as similar pile construction methods successfully completed at the property in the past, the above mitigative measures will best ensure that pile installation does not exacerbate contaminant conditions at the site.

NW Natural would like to proceed with the planned foundation preparation work once all required city permitting is complete and requests DEQ concurrence to proceed with the mitigation measures described in this letter.

Should you have any questions, please contact the undersigned.

Sincerely,

Robert Ede

Rob Ede, RG
Principal
rede@EdeEnvironmental.com

Attachments:
1) Geotechnical Letter Report– Electrical Equipment Foundations, July 23, 2025.
2) Plan Specification Drawings, D1628-S001 through S009

cc: Tim Murphy, NW Natural
Corey Raspone, NW Natural
Bob Wyatt, NW Natural
Jen Gates, Pearl Legal Group, PC
Patty Dost, Pearl Legal Group PC

---

[4] Environment Agency, (2006). *Piling in Layered Ground: Risks to Groundwater and Archaeology*, Science Report SC020074/SR. October 2006.

Halah Voges, Anchor QEA
Matt Davis, Anchor QEA
Ryan Barth, Anchor QEA
Tim Stone, Anchor QEA
Jen Mott, Anchor QEA
Mike Crystal, Sevenson Environmental Services, Inc.
Chip Byrd, Sevenson Environmental Services, Inc

FIGURE 1
Electrical Equipment Pad Project Location

Figure from: *Geotechnical Letter Report, Portland LNG Facility - Electrical Equipment Foundation*, Cornforth Consultants, July 23, 2025.

NW Natural Electrical Equipment Pad Foundation
Portland LNG
7900 NW St. Helens Road
Portland, Oregon

Ede Environmental, LLC
Project No. 2711 September 2025

Attachment 1

Geotechnical Report – Electrical Equipment Foundations, Cornforth Consultants, July 23, 2025

CORNFORTH CONSULTANTS

July 23, 2025 3335-1

Tim Murphy, PE
NW Natural
250 SW Taylor Street
Portland, Oregon 97204

Geotechnical Letter Report
Portland LNG Facility - Electrical Equipment Foundations
Portland, Oregon

Dear Mr. Murphy,

Cornforth Consultants, Inc. (CCI) is pleased to submit this geotechnical engineering letter report for the proposed new foundations to support electrical equipment at the Liquefied Natural Gas (LNG) facility in Portland, Oregon. Our services were performed in accordance with our Master Services Agreement with NW Natural dated July 25, 2022 and Purchase Order No. 4510019663.

Based on design drawings by Norwest Engineering, Inc. (Norwest), the proposed improvements will be located approximately 30 feet east of the Control Building and approximately 35 feet south of the recently constructed BOG Compressor. The electrical equipment includes a 2500kVA Pad Mount Transformer and a steel equipment shelter with associated equipment supported on a foundation pad that measures approximately 16 feet by 59 feet. While the structural loads are light (33 kips total equipment weight), the equipment is considered essential to facility operations and NW Natural has requested the foundation system be designed to account for liquefaction and related effects.

The location of the facility is shown in the Vicinity Map, Figure 1. The project location is shown relative to surrounding features in the Site Plan, Figure 2.

BACKGROUND

Numerous geotechnical studies have been completed for the Portland LNG facility. These studies have identified the susceptibility of the site to liquefaction and associated lateral spreading. Potentially liquefiable soils at the site extend from approximately 15 feet below the ground surface (bgs) to approximately 50 to 55 feet bgs near the proposed Electrical Equipment. The average liquefaction-induced vertical settlement has been estimated on the order of 9 to 16 inches. Lateral ground displacement has been estimated on the order of 1 to 3 feet. Various deep foundation and ground improvement methods have been considered to support structures at the site, including driven piles, micropiles, augercast piles, deep soil mixing, mat foundations, and aggregate piers.

SURFACE AND SUBSURFACE CONDITIONS

Previous explorations completed by GeoEngineers in 2015, 2017, and 2021 nearby encountered a variable mantling of contaminated fill consisting of very loose to medium dense fine to medium sand with silt and very soft to soft silt to depths of approximately 15 to 20 feet bgs over alluvium consisting of soft to medium stiff (occasionally stiff) silt/lean clay and very loose to medium dense sand to silty sand to a depth of approximately 50 to 74 feet bgs, over basalt bedrock. Boring B-1-15, located approximately 100 feet east of the electrical equipment foundation, encountered a 5-foot layer of very dense sandy gravel with silt between the loose to medium dense silty sand and Columbia River Basalt at a depth of 69 to 74 feet bgs. Boring B-3-17, located approximately 65 feet northwest of the proposed electrical equipment foundation, did not encounter the gravel layer and encountered basalt at 49 feet bgs.

CCI provided geotechnical construction observation during pile installation for the adjacent Compressor and Heat Exchanger pads. The dense bearing layer was first encountered approximately 52 to 55 feet bgs at the piles closest to the proposed Electrical Equipment.

Groundwater was encountered at approximately 15 to 17 feet bgs.

Exploration locations near the proposed Electrical Equipment are shown in the Site Plan, Figure 2. Nearby boring logs are provided as an attachment.

GEOTECHNICAL DESIGN RECOMMENDATIONS

To mitigate for liquefaction-related displacements, we recommend the Electrical Equipment be supported on deep foundations consistent with recently constructed structures. Associated non-critical project components may be supported on shallow foundations, provided they can accommodate the estimated seismically induced vertical settlement and lateral ground displacement described above. The piles were sized to limit lateral displacement of the structure to 6 inches or less under seismic conditions.

Driven Pile Foundations

Based on soil conditions, environmental contamination, access limitations, vibration considerations, and proposed structure type, it is our opinion that a mat foundation supported on driven pipe piles is the most favorable foundation support option for the proposed Electrical Equipment.

Lateral Pile Capacity

Pile design for this project is controlled by the lateral forces on the foundation system (piles and pile cap) during the design earthquake. Lateral spread during the design earthquake is estimated to result in large lateral forces as the upper non-liquefied material moves toward the river. The piles were sized to limit lateral displacement resulting from these forces to 6-inches or less, as described above.

The lateral loads on the foundation system resulting from lateral spread were evaluated using procedures presented in Caltrans (2012)[1]. Due to these high lateral loads, the lateral deflection under

[1] Caltrans. (2012). Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading.

seismic conditions controls the pile design. This procedure requires the approximate dimensions of the pile cap. For our analysis we assumed an approximately 59 feet long by 16 feet wide pile cap. If alternate layouts are selected, we may need to perform additional analysis and update our recommendations.

We utilized LPILE by Ensoft, Inc. to apply foundation loads against the pile as a uniform horizontal pressure distributed over the non-liquefiable upper "crust" (0 to 15 feet bgs). A uniform horizontal load of 60 kips/ft was applied over the upper 15 feet (900 kips total). We completed analyses modeling various pile groups with an equivalent linear-elastic single "super pile" under free-head conditions. The super pile requires parameter modifications to mimic the behavior of the pile group being analyzed. Group reduction factors for the lateral analyses were estimated assuming a total of eight, 24-inch diameter piles installed in a 2 by 4 pile group. Based on the Foundation Plan (Sheet D1628-S004) prepared by Norwest, pile spacings of approximately 18 feet were measured in the lengthwise direction. If the orientation of the foundation or the pile layout changes, we may need to perform additional analysis and update our recommendations.

Based on this analysis, 24-inch diameter pipe piles with a 0.75-inch wall thickness will meet the lateral deflection criteria. We recommend the pile wall thickness be increased to 1-inch to account for potential corrosion of the steel due to groundwater and environmental contamination during the design life of the structure.

Axial Pile Capacity

The axial capacity for a single 24-inch-diameter closed-end pipe pile is presented below and includes factors of safety of 2.0 for shaft friction and 3.0 for end bearing. We recommend the piles be embedded a minimum of 5 feet into the very dense gravel or basalt encountered below approximately 50 to 69 feet bgs. A reasonable contingency should be added to the pile lengths to account for construction considerations such as variable subsurface conditions. It is generally more cost effective to require the contractor to provide longer piles than weld, inspect and redrive piles that are too short to develop capacity. As discussed below, any welds should be ground flush to the pile face to minimize the potential to carry contaminated soil into the uncontaminated zone during pile installation.

Settlement of soils surrounding piles can induce frictional downdrag loads that essentially reduce the allowable pile capacity. This typically occurs if there are large fill embankments or if liquefaction-induced settlement occurs. Liquefaction will result in downdrag or negative skin friction from the top of the deep foundation to the base of the liquefiable layer. The downdrag load has been accounted for in the axial downward capacity presented below.

The structural engineer should verify that the piling is structurally capable of supporting the anticipated loads. The axial pile capacities are for single piles and do not include a group reduction factor. Group reduction factors are not required for piles with center-to-center spacing at least 3 times the pile diameter. Based on the anticipated design loads, the 24-inch-diameter piles will adequately support the estimated loads.

Table 1: Axial Pile Capacity

Pile Diameter (inches)	Minimum Wall Thickness (inches)	Allowable Downward Capacity (kips)	Allowable Uplift Capacity (kips)
24	1	120	40

DESIGN AND CONSTRUCTION CONSIDERATIONS

Pile Installation

Piles may be vibrated or driven; however, all piles should be driven a minimum of the last 10 feet to their final tip elevation to verify the required capacities. We recommend using fixed leads and careful alignment and support of the piles during installation because the piles will tend to "run" in loose/soft soils or a sloping bedrock contact.

Our recommendations are based on using closed-end pipe piles. The piles should be equipped with a driving shoe to minimize damage to the pile tip during driving through underlying dense gravels and basalt. The pile driving shoe should be selected by the contractor and approved by the geotechnical engineer. To minimize the potential to carry contaminated soil into the uncontaminated zone, the driving shoe should not extend beyond the outside diameter of the pile. Any welds should be ground flush to the pile surface. Localized soil heave may occur adjacent to the pile during installation. The contractor should be prepared to remove and properly dispose of contaminated soil adjacent to the piles following installation.

During pile driving, each pile should be driven continuously, with interruptions kept to a minimum. Piles should be driven with an impact hammer to establish the required penetration and terminal blow counts in the underlying very dense gravel and hard basalt. Driving criteria, including selection of hammer size and driving cushion, should be defined when the foundation design is completed. The Wave Equation Analysis of Pile Driving (WEAP) analysis should be used for establishing the criteria. We can provide driving criteria for the piles when the foundation design has been finalized and a driving system has been selected.

A continuous record of pile driving resistance (blows per foot) should be maintained by our representative for each pile during driving. If the pile cannot be driven to the required depth following an interruption, the pile may have to be extracted and re-driven, replaced and/or used with a reduced capacity. If piles reach refusal criteria before achieving the specified penetration, the adequacy of the pile should be determined by our representative who will advise whether to accept the pile at full capacity, at a reduced capacity, or reject the pile and require installation of substitute pile(s).

We do not recommend more than one splice per pipe pile. All splices must be capable of developing the full strength of the pile. No splices should be permitted within two-pile diameters of the depth at which maximum bending moment is developed. The maximum bending moment of the pile occurs at approximately 20 feet bgs and zero bending occurs at approximately 42 feet bgs. As discussed in

the previous section of this report, it is generally more cost effective to require the contractor to provide longer piles than weld, inspect and redrive piles.

Pile Load Tests

Pile load testing is not required provided the piles are installed as recommended, since the anticipated axial load is significantly less than the axial capacity.

Vibration Considerations

We understand that significant vibrations are not permissible at the LNG tank periphery, but that surrounding structures are not vibration sensitive. Vibration monitoring should be completed during pile driving. The piles furthest from vibration sensitive structures should be installed first. If measured vibrations exceed the acceptable limit, alternate pile installation methods may be required, possibly including using a lower energy pile driving hammer, vibrating the piles before driving to final tip elevations, or other methods. We recommend the contractor provide a pile installation plan for review and approval by the geotechnical engineer.

In addition, a photographic survey of adjacent buildings should be considered to document pre-construction and post-construction conditions.

SEISMIC DESIGN PARAMETERS

Parameters provided in Table 2 are based on previous explorations performed adjacent to the proposed Electrical Equipment at the site. Based on the presence of liquefiable soils, Site Class F was selected for preliminary seismic design. However, since the fundamental period of the proposed structure will be less than 0.5 seconds, exceptions documented in Section 20.3.1 of the 2016 *Minimum Design Loads for Buildings and Other Structures* (American Society of Civil Engineers [ASCE] 7-16) can be used to approximate recommended seismic design parameters for the project. In determining seismic design parameters with this exception, Site Class D was selected for the project, as allowed by ASCE 7-16 for structures with a period less than 0.5 seconds.

We recommend seismic design be performed using the procedure outlined in the 2021 International Building Code (IBC) and 2022 Oregon Structural Specialty Code (OSSC). Per American Society of Civil Engineers (ASCE) 7-16 Section 11.4.8, a ground motion hazard analysis or site-specific response analysis is required to determine the design ground motions for structures on Site Class D sites with S1 greater than or equal to 0.2g.

As discussed above, the site is classified as Site Class D with an S_1 value of 0.408g; therefore, the provision of 11.4.8 applies. The parameters listed in Table 2 below may be used to determine the design ground motions if Exception 2 of Section 11.4.8 of ASCE 7-16 is used. Using this exception, the seismic response coefficient (Cs) is determined by Equation (Eq.) (12.8-2) for values of $T \leq 1.5T_S$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq T > 1.5T_S$ or Eq. (12.8-4) for $T > T_L$, where T represents the fundamental period of the structure and T_S=0.756 sec. If requested, we can complete a site-specific seismic response analysis which might provide somewhat reduced seismic demands from the parameters in Table 2 and the requirements for

using Exception 2 of Section 11.4.8 in ASCE 7-16. The reduced values will likely not be significant enough to warrant the additional cost of further evaluation if designing to 2021 IBC.

Table 2: Mapped 2021 IBC Seismic Design Parameters

Parameter	Value[1,2,3]
Site Class	F
Mapped Spectral Response Acceleration at Short Period (S_S)	0.894 g
Mapped Spectral Response Acceleration at 1 Second Period (S_1)	0.408 g
Site Modified Peak Ground Acceleration (PGA_M)	0.484 g
Site Amplification Factor at 0.2 second period (F_a)	1.142
Site Amplification Factor at 1.0 second period (F_v)	1.892
Design Spectral Acceleration at 0.2 second period (S_{DS})	0.681 g
Design Spectral Acceleration at 1.0 second period (S_{D1})	0.515 g

Notes:

[1] In accordance with American Society of Civil Engineers (ASCE) 7-16, Site Class F soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils, may be classified in accordance with Section 20.3, without regard for liquefaction, provided the structure under design has a fundamental period of vibration equal or less than 0.5 seconds.

[2] Parameters developed based on Latitude 45.578178° and Longitude -122.760778° using the ATC Hazards online tool.

[3] These values are only valid if the structural engineer utilizes Exception 2 of Section 11.4.8 (ASCE 7-16).

DESIGN REVIEW AND CONSTRUCTION SERVICES

Recommendations presented in this report are based on the assumptions and preliminary design information presented herein. Satisfactory foundation and earthwork performance depends to a large degree on the quality of construction. Sufficient monitoring of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those assumed for design. Recognition of changed conditions often requires experience; therefore, qualified personnel should provide full time observation during pile driving to detect whether subsurface conditions are significantly different from those anticipated.

LIMITATIONS

This report has been prepared for the exclusive use of NW Natural and their authorized agents and/or regulatory agencies for the Portland LNG Electrical Equipment project in Portland, Oregon. This report is not intended for use by others, and information contained herein is not applicable to other sites. No other party may rely on the product of our services unless we agree in advance and in writing to such reliance.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted geotechnical engineering practices in the area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood.

CLOSING

We appreciate the opportunity to assist NW Natural on this project. If you have questions, please call us at (503) 452-1100.

Sincerely,

CORNFORTH CONSULTANTS, INC.

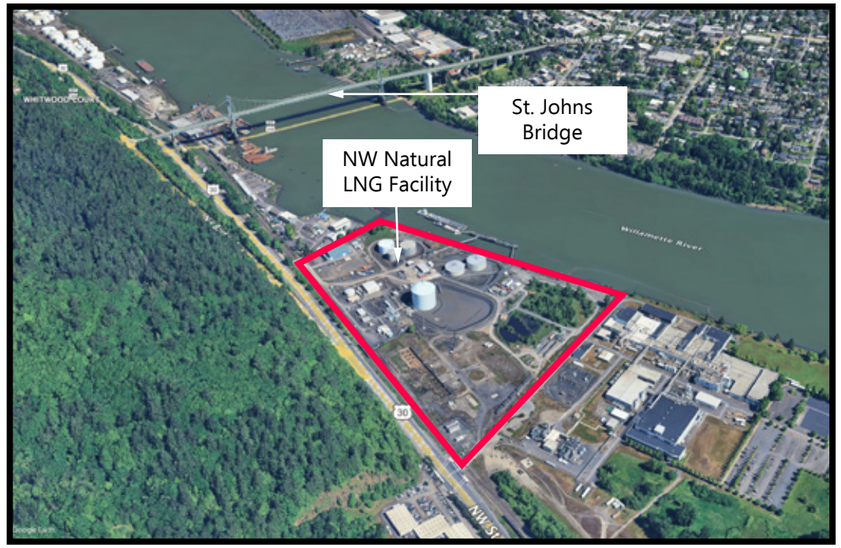
Tygh Gianella, P.E.
Associate Engineer

REGISTERED PROFESSIONAL ENGINEER
77490PE
OREGON
NOVEMBER 08, 2005
GREG ALAN LANDAU
EXPIRES: 12.31.2026

Greg A. Landau, P.E., G.E.
Senior Associate Engineer

ATTACHMENTS:

Figure 1 – Vicinity Map
Figure 2 – Site Plan
Attachment A - Boring Logs Performed by Others



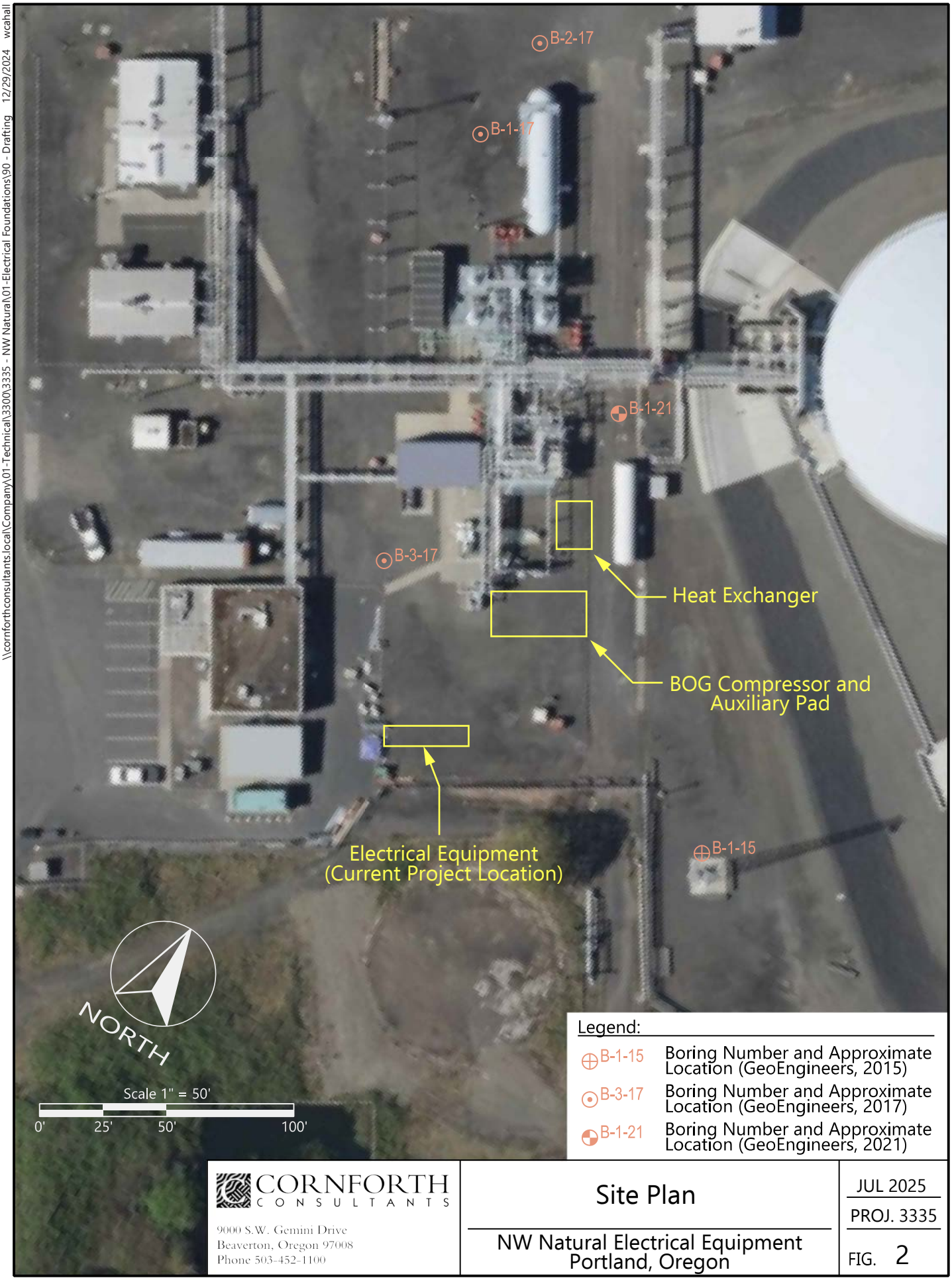
0 .5 1
SCALE IN MILES
1"=.5 Miles

CORNFORTH CONSULTANTS
9000 S.W. Gemini Drive
Beaverton, Oregon 97008
Phone 503-452-1100

Vicinity Map

NW Natural Electrical Equipment
Portland, Oregon

JULY 2025
PROJ. 3335
FIG. 1



Legend:

B-1-15	Boring Number and Approximate Location (GeoEngineers, 2015)
B-3-17	Boring Number and Approximate Location (GeoEngineers, 2017)
B-1-21	Boring Number and Approximate Location (GeoEngineers, 2021)

CORNFORTH CONSULTANTS
9000 S.W. Gemini Drive
Beaverton, Oregon 97008
Phone 503-452-1100

Site Plan

NW Natural Electrical Equipment
Portland, Oregon

JUL 2025
PROJ. 3335
FIG. 2

ATTACHMENT A

Boring Logs Performed by Others

Drilled	Start 6/12/2015	End 6/12/2015	Total Depth (ft) 75	Logged By JL / Checked By GAL	Driller Western States Drilling	Drilling Method HSA
Surface Elevation (ft) / Vertical Datum	Undetermined		Hammer Data	Auto 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME-75
Latitude / Longitude			System Datum	Geographic	Groundwater: Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: D&M values reduced by approximately 50% to correlate with SPT N-values

Elevation (feet) / Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
0						GM	Dark gray silty sandy gravel, angular basalt gravel to 2 inches (dense, moist) (fill)			
	16	26	1			SM	Black silty sand with gravel (medium dense, moist)			Slight sheen, strong petrochemical odor
5	14	7	2 MD				Grades to loose	9	81	No sheen to slight sheen
	16	4	3							
10	16	2	4 %F			SP	Dark gray to black poorly graded fine sand with trace silt (very loose, moist)			No sheen, faint petrochemical odor %F = 5
	16	3	5				Grades to wet			Heavy sheen, strong petrochemical odor
15	16	5	6							
						ML	Black silt with organics, trace fine sand (very loose to loose, wet)			Heavy sheen, strong organic odor
	16	6	7 MD			SP	Black to dark brown-black poorly graded fine sand (loose, wet)	30	88	
20	16	10	8				Grades to loose to medium dense			Brown thick tarry oil residiue, heavy sheen, strong odor
25	18	3	9 MD, AL					30	89	(LL = 25, PL = 23, PI = 2) No sheen, no odor
						ML/CL	Gray silt to lean clay, trace fine sand, low plasticity (soft, moist) (alluvium)			
30										

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1-15

GeoEngineers

Project: Proposed Communication Tower - Portland LNG Plant
Project Location: Portland, Oregon
Project Number: 6024-172-00

Figure A-5
Sheet 1 of 3

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	30	0		10							
		24		11 Consol, MD				Grades to very soft, trace small angular granules of sand			
		16	1	12					47	70	
	35	18	4	13				Grades to gray-green, trace to some wood fragments, low to moderate plasticity, medium stiff			
							CL	Gray-green lean clay, low to moderate plasticity, with trace brown mottling (medium stiff, moist)			
	40	18	5	14 MD, AL					35		(LL = 44, PL = 25, PI = 19)
	45	16	8	15 MD				Grades to brown, trace fine sand, medium stiff to stiff	37	83	
	50	14	10	16 %F							%F = 75
							SM	4-inch thick brown silty fine sand interbed (loose to medium dense, wet)			
							ML	Gray silt, trace fine sand, low plasticity (stiff, wet)			
	55	16	10	17							
							SM	Brown silty fine to medium sand (loose to medium dense, wet)			
	60	18	12	18				Grades to medium dense			
	65										

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1-15(continued)

GeoEngineers

Project: Proposed Communication Tower - Portland LNG Plant
Project Location: Portland, Oregon
Project Number: 6024-172-00

Figure A-5
Sheet 2 of 3

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample / Sample Name Testing	FIELD DATA: Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
							GP-GM	Dark gray sandy gravel with silt, fine to medium sand (very dense, wet)			Drill action indicates gravel at 69 feet
70		18	84/11"	19							
											Very slow drilling, drilling actions suggests occasional cobbles
							BSLT	Basalt; angular basalt chips (Columbia River Basalt)			
75		0	50/0"	20							Basalt chip in shoe at 25 feet

Boring completed at 75 feet
Groundwater encountered at 12½ feet while drilling

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1-15 (continued)

GeoEngineers

Project: Proposed Communication Tower - Portland LNG Plant
Project Location: Portland, Oregon
Project Number: 6024-172-00

Figure A-5
Sheet 3 of 3

Drilled	Start 8/3/2017	End 8/4/2017	Total Depth (ft)	60	Logged By / Checked By	DMH / GAL	Driller	Cascade Drilling, LP	Drilling Method	Hollow-stem Auger/ Mud Rotary
Surface Elevation (ft) / Vertical Datum	40.57 NAVD88		Hammer Data	Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME-75				
Latitude / Longitude	45° 34' 42.942" -122° 45' 40.5576"		System Datum	OR Degree Decimal Minutes WGS84 (feet)	Groundwater Date Measured	Depth to Water (ft) Yes	Elevation (ft)			

Notes: D&M N-values reduced by approximately 50% to roughly correlate with SPT N-values

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
40	0							GP	3 inches crushed aggregate			
								SP-SM	Brown fine to medium sand with silt (loose to medium dense, moist) (fill)			
		12	26		1 %F			SP	Gray-brown to black sand with gravel (medium dense, moist)		8	Heavy sheen and petrochemical-like odor
35	5	14	9		2 MD				Grades to loose	17		DD = 88 pcf
		12	7		3							Heavy sheen and odor
30	10	14	4		4 SA				Grades to very loose to loose		8	
		16	3		5				Grades to very loose			Heavy sheen and odor
								ML	Gray silt with organic matter (soft to medium stiff, moist)			
25	15	18	4		6 AL							AL (LL = 44; PI = 10)
20	20	16	3		7 MD,%F				Grades to soft	42	64	Heavy sheen and odor DD = 76 pcf
												Groundwater observed at 24 feet at time of exploration
15	25	14	7		8 AL							Heavy sheen and odor AL (non-plastic)
								SM	Gray silty fine sand (very loose to loose, moist to wet) (alluvium)			
10	30	16	3		9 %F			ML	Gray fine sandy silt (soft, moist to wet)		73	No sheen and no odor
	35											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery, Vertical approximated based on DEM

Date:10/6/17 Path:P:\6\6024210\GINT\602421000.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F

Log of Boring B-1-17

GeoEngineers

Project: NW Natural Portland LNG Liquification Facility
Project Location: Portland, Oregon
Project Number: 6024-210-00

Figure A-2
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample / Sample Name Testing	FIELD DATA: Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
-5	35	16	9	10 MC				Grades to stiff	23		No sheen and no odor
-10	40	12	10	11 MD,%F					34	54	No sheen and no odor DD = 88 pcf
-15	45	0	7	12				No recovery, medium stiff			
	50	0	8	13				No recovery, medium stiff to stiff			
	55	10	18	14 MD,%F				Grades with trace sand, very stiff	34	96	No sheen and no odor DD = 85 pcf
	60		50/0"				BSLT	Basalt, angular basalt chips (very dense) (Columbia River Basalt)			

Date:10/6/17 Path:P:\6\6024210\GINT\602421000.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F

Log of Boring B-1-17 (continued)

GeoEngineers

Project: NW Natural Portland LNG Liquification Facility
Project Location: Portland, Oregon
Project Number: 6024-210-00

Figure A-2
Sheet 2 of 2

Drilled: Start 8/7/2017 End 8/8/2017	Total Depth (ft): 50	Logged By: DMH Checked By: GAL	Driller: Cascade Drilling, LP	Drilling Method: Hollow-stem Auger/ Mud Rotary	
Surface Elevation (ft) / Vertical Datum: 39.77 NAVD88	Hammer Data: Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment: CME-75			
Latitude: 45° 34' 43.3596" Longitude: -122° 45' 40.5612"	System Datum: OR Degree Decimal Minutes WGS84 (feet)	Groundwater Date Measured	Depth to Water (ft): Yes	Elevation (ft)	

Notes: D&M N-values reduced by approximately 50% to roughly correlate with SPT N-values

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							GP	3 inches crushed aggregate			
								SP-SM	Brown fine to medium sand with silt (loose to medium dense, moist) (fill)			
35		14	8		1 MC				Becomes black	18		Heavy sheen and petrochemical-like odor
	5	12	5		2 MC					13		
		16	5		3 MD					18		Heavy sheen and odor DD = 85 pcf
30								SP	Brown fine to medium sand (loose, moist)			
	10	16	4		4 %F						1	
		16	3		5 MD,%F			ML	Gray silt with trace organic matter (soft, moist)	17	98	Heavy sheen and odor DD = 84 pcf
25	15	16	5		6 AL				Grades to medium stiff			AL (LL = 43; PI = 9)
20	20	16	5		7 MD					41		Heavy sheen and odor DD = 80 pcf
												Groundwater observed at 24 feet at time of exploration
15								SM	Black silty fine sand (loose, moist to wet)			
	25	14	6		8 SA						33	Heavy sheen and odor
10	30	16	4		9 %F				Grades to very loose to loose		42	Heavy sheen and odor
5	35											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery, Vertical approximated based on DEM

Date:10/6/17 Path:P:\6\6024210\GINT\602421000.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F

Log of Boring B-2-17

GeoEngineers

Project: NW Natural Portland LNG Liquification Facility
Project Location: Portland, Oregon
Project Number: 6024-210-00

Figure A-3
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample / Sample Name Testing	FIELD DATA: Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
0	35	14	11	10 %F			ML	Brown fine sandy silt (stiff, moist to wet) (alluvium)		64	No sheen and no odor
	40	12	11	11 MD					35		No sheen and no odor Driller noted sheen in drilling mud; pumped out and replaced with clean mud DD = 89 pcf
-5	45	14	11	12 SA			SM	Brown silty fine sand (medium dense, moist to wet)		20	No sheen and no odor
							BSLT	Basalt, angular basalt chips (very dense) (Columbia River Basalt)			
-10	50		50/0"								

Log of Boring B-2-17 (continued)

GeoEngineers

Project: NW Natural Portland LNG Liquification Facility
Project Location: Portland, Oregon
Project Number: 6024-210-00

Drilled: Start 8/8/2017 End 8/9/2017	Total Depth (ft): 50.5	Logged By: DMH Checked By: GAL	Driller: Cascade Drilling, LP	Drilling Method: Hollow-stem Auger/ Mud Rotary	
Surface Elevation (ft): 44.4385 Vertical Datum: NAVD88		Hammer Data: Automatic 140 (lbs) / 30 (in) Drop		Drilling Equipment: CME-75	
Latitude: 45° 34' 41.3508" Longitude: -122° 45' 39.7044"		System Datum: OR Degree Decimal Minutes WGS84 (feet)		Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: D&M N-values reduced by approximately 50% to roughly correlate with SPT N-values

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
40	0							GP	3 inches crushed aggregate			
								SP	Brown fine to medium sand with gravel (dense, moist) (fill)			
		8	40		1 SA				Becomes black		1	Slight sheen and petroleum-like odor
	5	12	14		2 %F			SP-SM	Brown fine to medium sand with silt (medium dense, moist) (fill)		6	Moderate sheen and odor
35		12	8		3 MD				Grades to loose	7		High sheen and odor DD = 86 pcf
	10	16	4		4 SA						9	
		16	2		5 MD,%F			SM	Black silty fine sand (very loose to loose, moist)			
30								ML	Black silt with trace sand and organic matter (soft to medium stiff, moist)	39	84	Heavy sheen and odor DD = 82 pcf
	15	18	7		6 AL				Grades to gray with brown mottling, without sand or organic matter			Slight sheen and odor AL (LL = 45; PI = 10)
25	20	14	5		7 MD					40		Slight sheen and odor DD = 78 pcf
20									Grades to brown with trace sand, very soft and moist to wet			
	25	16	2		8 %F,AL						92	Slight sheen and no odor AL (LL = 36; PI = 5)
15	30	16	10		9 MD,%F			ML	Gray fine to medium sandy silt (stiff, moist) (alluvium)	34	66	No sheen and no odor DD = 86 pcf
10	35											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery, Vertical approximated based on DEM

Date:10/6/17 Path:P:\6\6024210\GINT\602421000.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F

Log of Boring B-3-17

GeoEngineers

Project: NW Natural Portland LNG Liquification Facility
Project Location: Portland, Oregon
Project Number: 6024-210-00

Figure A-4
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name Testing	FIELD DATA: Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
5	35	16	16		10 SA			SM	Gray fine to medium silty sand (medium dense, moist)		17	No sheen and no odor
	40	16	10		11 AL			ML	Gray with brown mottling silt (stiff, moist)			No sheen and no odor AL (non-plastic)
0	45	0	14		12				No recovery			No sheen and no odor
-5	50	5	50/5"		13			BSLT	Basalt, angular basalt chips and gravel (very dense) (Columbia River Basalt)			

Log of Boring B-3-17 (continued)

GeoEngineers

Project: NW Natural Portland LNG Liquification Facility
Project Location: Portland, Oregon
Project Number: 6024-210-00

Drilled	Start 4/22/2021	End 4/23/2021	Total Depth (ft)	70	Logged By	JLL	Driller	Western States Soil Conservation, Inc.	Drilling Method	Hollow-stem Auger/Mud-Rotary
					Checked By	BJH				

Surface Elevation (ft) Vertical Datum	39 NAVD88	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	CME-75 truck
Latitude Longitude	45.578425 -122.760852	System Datum	Decimal Degrees WGS84	See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
0	0						AC	4-inch-thick asphalt concrete pavement			
							GM	8-inch-thick aggregate base			
							SM	Black silty medium to coarse sand, occasional rounded to angular gravel (loose, moist) (fill)			Strong petroleum odor
35	5	16	1		1		ML	Gray silt with fine sand, occasional gravel to cobble-sized basalt fragments, trace wood fragments and organic matter (very soft, moist)			Strong odor
30	10	14	8		2		SP-SM	Black poorly-graded fine sand with silt (loose, wet)			Groundwater observed at approximately 9 feet below ground surface during drilling
25	15										Heavy tar-like sheen at 17 feet Static water level at 17 feet
20	20	16	7		3		ML	Gray silt, low plasticity, micaceous, homogeneous (medium stiff, moist) (alluvium)			No odor
15	25										
10	30	16	8		4		SM	Dark gray silty fine sand, micaceous (loose, wet)			No odor
5	35										

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Date:6/16/21 Path:C:\USERS\CESTES\DOCUMENTS\SHAREPOINT DRAFTS\6024210O3.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW

Log of Boring B-1-21

GeoEngineers

Project: NW Natural Cold Box FEED - Portland LNG Facility
Project Location: Portland, Oregon
Project Number: 6024-210-03

Figure A-2
Sheet 1 of 2

Depth (feet)	Elevation (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
35	0										
40	-5	16	10		5 %F			Becomes gray-brown, homogeneous	35	14	
45	-10										
50	-15	14	11		6			Becomes brown, medium dense			
55	-20						GP-GM	Dark gray poorly-graded basalt gravel with sand and silt, rounded to subangular, medium to coarse sand (very dense, wet)			
60	-25	10	50		7 %F				8	7	
65	-30						BSLT	Black basalt, trace red-brown staining, hard, fresh to slightly weathered (Columbia River Basalt)			Drill action becomes slow, smooth drilling
70		TR	50/0"		8						

FIELD DATA

Date:6/16/21 Path:C:\USERS\CESTES\DOCUMENTS\SHAREPOINT DRAFTS\6024210103.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEIB_GEOTECH_STANDARD_%F_NO_GW

Log of Boring B-1-21 (continued)

GeoEngineers

Project: NW Natural Cold Box FEED - Portland LNG Facility
Project Location: Portland, Oregon
Project Number: 6024-210-03

Figure A-2
Sheet 2 of 2

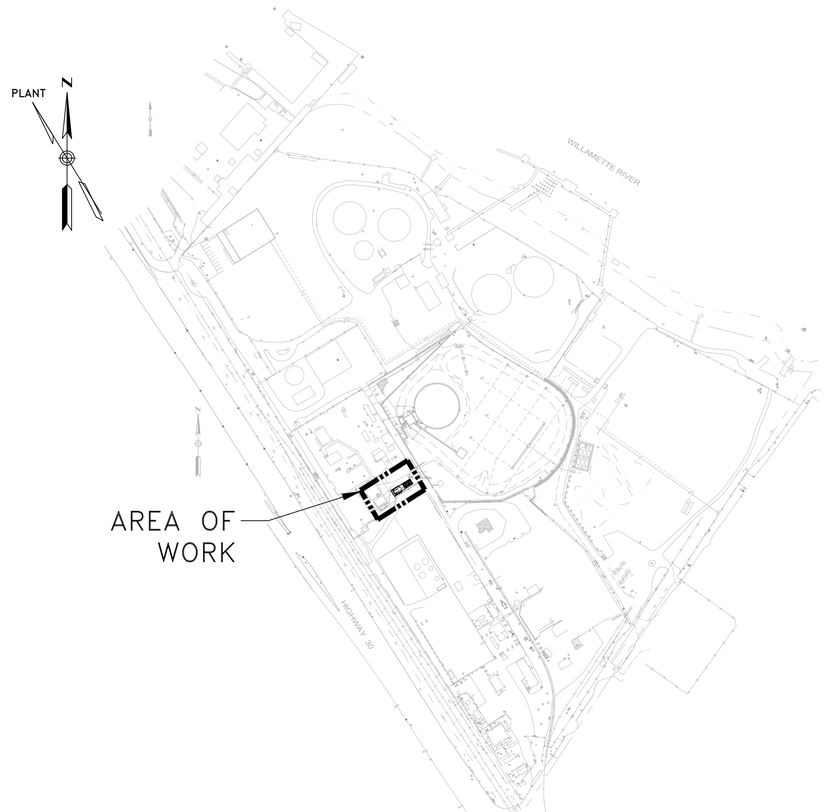
Attachment 2

Plan Specification Drawings, D1628-S001 through S009

NW Natural

PORTLAND LNG PLANT
PDX MCC1 AND 2 DETAILED ENGINEERING
PROJECT # RV1628
7900 NW Saint Helens Road
Portland, OR 97210

STRUCTURAL DRAWING INDEX		
DWG. NO.	DRAWING TITLE	REV.
D1628-S001	COVER SHEET AND DRAWING INDEX	0
D1628-S002	GENERAL NOTES	0
D1628-S003	LOCATION PLAN	0
D1628-S004	FOUNDATION PLAN AND DETAILS	0
D1628-S005	PILE DETAILS	0
D1628-S006	SHELTER PLANS	0
D1628-S007	SHELTER ELEVATIONS	0
D1628-S008	FRAME CONNECTION DETAILS	0
D1628-S009	SHELTER SECONDARY FRAMING DETAILS	0



LOCATION PLAN
SCALE: N.T.S.

PROJECT DESCRIPTION
INSTALLATION OF SEVERAL ELECTRICAL EQUIPMENT AND RAIN SHELTER

GEOTECHNICAL AND SEISMIC HAZARDS ANALYSIS:
CORNFORTH CONSULTANTS, INC. REPORT DATED JULY 23, 2025

BUILDING CODE SUMMARY
CODE: 2022 IBC (OREGON STRUCTURAL SPECIALTY CODE)
OCCUPANCY: UTILITY AND MISCELLANEOUS GROUP U
CONSTRUCTION TYPE: IIB (NOT FIRE RATED)
BUILDING RISK CATEGORY; RISK CATEGORY OF IV WAS USED TO MEET DEQ REQUIREMENTS, BUT A LOWER RISK CATEGORY OF II IS REQUIRED PER OSSC TABLE 1604.5
IMPORTANCE FACTOR – 1.5

DESIGN LOADS
1. FLOOR LIVE LOAD: 125 PSF WITH 5,000 LBS CONCENTRATED ON EQUIPMENT SLABS
2. ROOF LIVE LOAD = 20 PSF
3. ROOF SNOW LOAD: PG = 25 PSF
4. ICE, NO STRUCTURES SENSITIVE TO ICE LOADING
5. WIND DESIGN DATA: 112 BASIC WIND SPEED.
   EXPOSURE C
6. EARTHQUAKE DATA
   IE = 1.5
   S1 = 0.408 SS = 0.894
   SITE CLASS F
   SDS = 0.681 SD1 = 0.515
   SEISMIC DESIGN CATEGORY D
   BASE LOCATION = GROUND LEVEL
7. GEOTECHNICAL AND FOUNDATION INFORMATION:
   CORNFORTH CONSULTANTS, INC. REPORT DATED JULY 23, 2025.
8. FLOOD DATA: NA
9. SPECIAL LOADS:
   DETAILED EQUIPMENT LOADS TO COME WITH IFC PACKAGE
   REFER TO VENDOR CUT SHEETS.
10. ROOF RAIN LOAD DATA:
    15 MIN. RAINFALL INTENSITY – IN./HR.
    60 MIN. RAINFALL INTENSITY – IN./HR.

STATEMENT OF SPECIAL INSPECTIONS AND TESTS 2022 IBC (CBC OR OSSC) 1704.3
THE FOLLOWING SYSTEMS ARE DESIGNATED FOR SPECIAL INSPECTIONS AND TESTS BY THE REGISTERED DESIGN PROFESSIONAL:
STRUCTURAL STEEL – IBC TABLE 1705.2
CONCRETE AND ANCHORING – IBC TABLE 1705.3
SOILS – IBC TABLE 1705.6
DEEP DRIVEN FOUNDATION PILES – IBC TABLE 1705.7
CAST-IN-PLACE FOUNDATIONS – IBC TABLE 1705.8
SPECIAL INSPECTION FOR SEISMIC AND WIND RESISTING SYSTEMS IS NOT REQUIRED.
THE BDS FORM WITH APPROVED TESTING AGENCY INFORMATION WILL BE PROVIDED WHEN THE CONSTRUCTION CONTRACTOR IS SELECTED.

STATEMENT OF STRUCTURAL OBSERVATION 2022 IBC 1704.6
THE OWNER WILL EMPLOY A FULL TIME CONSTRUCTION INSPECTOR, DEDICATED STRUCTURAL OBSERVATION BY A REGISTERED DESIGN PROFESSIONAL IS NOT REQUIRED BUT NORWEST ENGINEERING WILL PROVIDE CONSULTATION WITH THE INSPECTOR AND WILL REVIEW MATERIAL SUBMITTALS.

REGISTERED PROFESSIONAL ENGINEER
83999PE
OREGON
DECEMBER 12, 2014
VALERIY QUINCHAEV
08/04/25
RENEWAL DATE: 06/30/2027

NORWEST ENGINEERING, INC.
CONSULTING ENGINEERS
PORTLAND, OREGON 503-254-0110
IRVINE, CALIFORNIA www.NorwestEngineering.com
N.E. # RV1628

REV	DR.	APP.	REVISION	DATE
0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

NW Natural
220 NW 2ND AVENUE
PORTLAND, OR 97209

PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
COVER SHEET AND DRAWING INDEX

BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

DWG. NO. D1628-S001
SHEET 1 OF 9
SCALE NONE
DR. DS
APP. DATE 05/30/25
APP. BY VVG

CONCRETE – CAST IN PLACE

1. CONCRETE RELATED WORK ON THIS PROJECT SHALL CONFORM TO ALL REQUIREMENTS OF ACI 301, LATEST EDITION, STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE PUBLISHED BY THE AMERICAN CONCRETE INSTITUTE.

2. STRUCTURAL CONCRETE:

EXPOSURE CATEGORY				f'c AT 28 DAYS	CEMENT	ENTRAINED AIR	W/C RATIO	SLUMP RANGE*	CHLORIDE CONTENT
F	S	W	C						
F2	S0	W0	C1	4,500 PSI	TYPE I	5.5–6%	0.45 MAX	4" – 6"	0.30% MAX

* CONFORMANCE OF SLUMP TO THIS RANGE SPECIFICATION DOES NOT, ON IT'S OWN, CONSTITUTE ACCEPTANCE.

3. FINISHES

SLABS	BROOM
TOP SURFACE	FLOAT
EXPOSED SIDES	FORM
EXPOSED EDGES	¾" CHAMFER

TYPICAL UNLESS INDICATED ON PLANS, SECTIONS OR DETAILS

4. CURING: CURE ALL CONCRETE WITH MIST OR MEMBRANE CURING CONFORMING TO THE STANDARDS SPECIFICATION.

5. REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO ASTM A615 GRADE 60.

POST–INSTALLED ANCHORING

1. ALL POST–INSTALLED ANCHORS ARE "DRILL AND ANCHOR" TYPE ADHESIVE ANCHORS, UNLESS NOTED OTHERWISE.

2. INSTALLER TRAINING: CONDUCT A THOROUGH TRAINING WITH THE MANUFACTURER OR THE MANUFACTURER'S REPRESENTATIVE FOR THE INSTALLERS ON THE PROJECT. TRAINING TO CONSIST OF A REVIEW OF THE COMPLETE INSTALLATION PROCESS FOR DRILLED–IN ANCHORS, TO INCLUDE BUT NOT LIMITED TO:
   HOLE DRILLING PROCEDURE
   HOLE PREPARATION & CLEANING TECHNIQUE
   ADHESIVE INJECTION TECHNIQUE & DISPENSER TRAINING / MAINTENANCE
   REBAR DOWEL PREPARATION AND INSTALLATION
   PROOF LOADING/INSTALLATION TORQUE EMBEDMENT

3. LOCATE REINFORCING STEEL PRIOR TO HOLE DRILLING.

4. ADHESIVE FOR DRILL AND ANCHOR REINFORCING BARS AND ANCHOR RODS TO BE SET–3G SIMPSON STRONG TIE ADHESIVE ANCHORING ADHESIVE. FOR MISCELLANEOUS EQUIPMENT AND PIPE SUPPORT INSTALLATION, ANCHOR RODS TO BE ASTM F1554 GRADE 55, ATR (ALL THREAD ROD), FURNISH BLACK, U.N.O. FURNISH WITH 45° CHISEL POINT FOR EMBEDDED END, AND HEAVY HEX NUT AND COMPATIBLE ROUND PLATE WASHER. NUTS FOR ANCHOR RODS SHALL BE TIGHTENED TO SNUG CONDITION EXCEPT WHERE TORQUE VALUE IS SPECIFIED ON THE DESIGN DRAWINGS, OR AT THE LOCATIONS OF SLIDE PLATES.

ADHESIVE ANCHORS

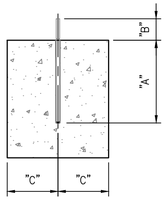
THREADED RODS (ATR) ASTM F1554 GR 55 OR STAINLESS STEEL TYPE PER DETAILS

DIA.	"A"	"B"	"C" MIN.
½"	6"	3"	4"
⅝"	10"	4"	6"
¾"	12"	4"	7"
⅞"	14"	4"	9"
1"	15"	4"	10"

ADHESIVE DOWELS

DEFORMED REINFORCING BARS ASTM A615 GR 60

DIA.	"A"	"B"	"C" MIN.
#4	6"	AS NOTED ON PLAN	4"
#5	10"		6"
#6	12"		7"



CAST–IN ANCHORING

1. CAST–IN ANCHOR RODS TO BE ASTM F1554 GRADE 36, U.N.O. EMBEDMENT DEPTH AND THREADED PROJECTION SHOWN ON DETAILS. FURNISH WITH JAM NUTS FOR LEVELING AND COMPATIBLE ROUND PLATE WASHER AND HEAVY HEX NUT. ANCHORAGE END TO BE HEAVY HEX HEADED. NUTS FOR ANCHOR RODS SHALL BE TIGHTENED TO SNUG CONDITION EXCEPT WHERE TORQUE VALUE IS SPECIFIED ON THE DESIGN DRAWINGS.

STRUCTURAL STEEL

1. FABRICATION & ERECTION OF STRUCTURAL STEEL TO BE IN ACCORDANCE WITH THE AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS ANSI/AISC 360–16 AND AISC CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES ANSI/AISC 303–16.

2. MATERIAL WILL MEET THE REQUIREMENTS OF THE FOLLOWING SPECIFICATIONS, UNLESS NOTED OTHERWISE (U.N.O.):
   W–SHAPES AND TEES – ASTM A992
   PLATES AND BARS – ASTM A36
   PIPE SECTIONS – ASTM A53 GR. B
   HOLLOW STRUCTURAL SHAPES – A500 GR. B
   OTHER SHAPES – ASTM A36

3. BOLTING PRACTICE TO BE IN ACCORDANCE WITH RCSC SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH–STRENGTH BOLTS, AUGUST 1, 2014. JOINT TYPES AS FOLLOWS:
   BRACING AND BOLTED MOMENT CONNECTIONS: PRETENSIONED
   ALL OTHERS: SNUG–TIGHTENED

4. ALL STRUCTURAL BOLTS TO BE ¾"ø ASTM F3125, GRADE A325, TYPE 1.

5. ALL WELDING TO BE DONE IN ACCORDANCE WITH AWS D1.1. WELDING ELECTRODES TO BE E70XX.

6. STRUCTURAL STEEL TO BE HOT DIPPED GALVANIZED PER COMPANY SPECIFICATIONS.

7. WHERE PERSONNEL MIGHT BE SUBJECTED TO CONTACT HAZARD (7'–6" ABOVE GRADE AND BELOW), ROUND EXPOSED CORNERS OF FLANGES, ANGLE LEGS AND PLATES WITH ½" RADIUS MINIMUM.

EARTHWORK

1. SUBGRADE PREPARATION: REMOVE ALL LOOSE OR SOFT MATERIAL, ORGANICS, UNSUITABLE FILL, PRIOR TOPSOIL ZONES, AND SOFTENED SUBGRADES PRIOR TO PREPARATION AND REPLACE WITH STRUCTURAL FILL. FOUNDATION–BEARING SURFACES MUST NOT BE EXPOSED TO STANDING WATER FOR PROLONGED PERIODS OF TIME. SHOULD WATER INFILTRATE AND POOL IN THE EXCAVATION, REMOVE BEFORE PLACING REINFORCING STEEL OR CONCRETE. COMPACT TO A FIRM, UNYIELDING CONDITION AND PROOF ROLL.

2. STRUCTURAL FILL: USE AGGREGATE BASE ROCK CONSISTING OF ¾ INCH MINUS OR 1½ INCH MINUS MATERIAL MEETING THE LOCAL STANDARDS FOR SUBBASE, BASE AND SHOULDERS, WITH THE EXCEPTION THAT THE AGGREGATE SHOULD HAVE LESS THAN 5 PERCENT BY DRY WEIGHT PASSING THE U.S. STANDARD NO. 200 SIEVE. PLACE THE AGGREGATE BASE ROCK MATERIAL IN LIFTS WITH A MAXIMUM UNCOMPACTED THICKNESS OF 12 INCHES AND COMPACTED TO NOT LESS THAN 95 PERCENT OF THE MAXIMUM DRY DENSITY, AS DETERMINED BY ASTM D 1557.

   ALTERNATIVE TO AGGREGATE BASE ROCK IS IMPORTED GRANULAR MATERIAL CONSISTING OF PIT– OR QUARRY–RUN ROCK, CRUSHED ROCK, OR CRUSHED GRAVEL AND SAND THAT MEET THE REQUIREMENTS FOR SELECTED GRANULAR BACKFILL PER LOCAL STANDARDS. IMPORTED GRANULAR MATERIAL TO BE WELL GRADED BETWEEN COARSE AND FINE MATERIAL AND HAVE LESS THAN 5 PERCENT BY DRY WEIGHT PASSING THE U.S. STANDARD NO. 200 SIEVE.

ABBREVIATIONS:

℄ / CL	CENTERLINE
#	POUND
(E)	EXISTING
(N)	NEW
AR	ANCHOR ROD
ACI	AMERICAN CONCRETE INSTITUTE
ADDL	ADDITIONAL
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ALT	ALTERNATE
ALUM	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ARCH	ARCHITECTURAL
ASTM	AMERICAN SOCIETY FOR TESTING & MATERIALS
AWS	AMERICAN WELDING SOCIETY
BM	BEAM
BOT	BOTTOM
BOBP	BOTTOM OF BASE PLATE
C	CHANNEL
CJ	CONSTRUCTION JOINT
CLR	CLEAR
COL	COLUMN
CONC	CONCRETE
CONT	CONTINUOUS
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DTL	DETAIL
DWG	DRAWING
EG	EXISTING GRADING
EF	EACH FACE
EJ	EXPANSION JOINT
ELV/EL	ELEVATION
ELEC	ELECTRICAL
EMBED	EMBEDMENT
EQ	EQUAL
EQUIP	EQUIPMENT
ES	EACH SIDE
EW	EACH WAY
FND	FOUNDATION
FG	FINISH GRADE
FS	FAR SIDE
FT	FOOT/FEET
FTG	FOOTING
GA	GAUGE
GALV	GALVANIZED
HORIZ	HORIZONTAL
HP	HIGH POINT
HSS	HOLLOW STRUCTURAL SECTION
∠	ANGLE
LB	POUND
LG	LONG
LP	LOW POINT
MAX	MAXIMUM
MIN	MINIMUM
MISC	MISCELLANEOUS
NO	NUMBER
NS	NEAR SIDE
NTS	NOT TO SCALE
OC	ON CENTER
OPNG	OPENING
OPP	OPPOSITE
PL	PLATE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
R / RAD	RADIUS
REINF	REINFORCING
REQD	REQUIRED
SCH	SCHEDULE
SHT	SHEET
SIM	SIMILAR
SL	STEEL LINE
SOG	SLAB ON GRADE
SPECS	SPECIFICATIONS
SQ	SQUARE
STAG	STAGGERED
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
T/O	TOP OF
T&B	TOP & BOTTOM
TBD	TO BE DETERMINED
THK	THICK
TOB	TOP OF BEAM
TOC	TOP OF CONCRETE
TOF	TOP OF FRAMING
TOG	TOP OF GRATING
TOP	TOP OF PLYWOOD/PAVING
TOS	TOP OF STEEL/SHEATHING
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
U/S	UNDER SIDE OF
VERT	VERTICAL
VIF	VERIFY IN FIELD
WP	WORK POINT
W/	WITH
W/O	WITHOUT
W	WIDE FLANGE BEAM
WT	STRUCTURAL TEE

REGISTERED PROFESSIONAL ENGINEER
83999PE
OREGON
DECEMBER 12, 2014
VALERIY DUSCHKIN
08/04/25
RENEWAL DATE: 06/30/2027

NORWEST ENGINEERING, INC.
CONSULTING ENGINEERS
PORTLAND, OREGON 503–254–0110
IRVINE, CALIFORNIA www.NorwestEngineering.com
N.E. # RV1628

REV	DR.	APP.	REVISION	DATE
0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

NW Natural
220 NW 2ND AVENUE
PORTLAND, OR 97209

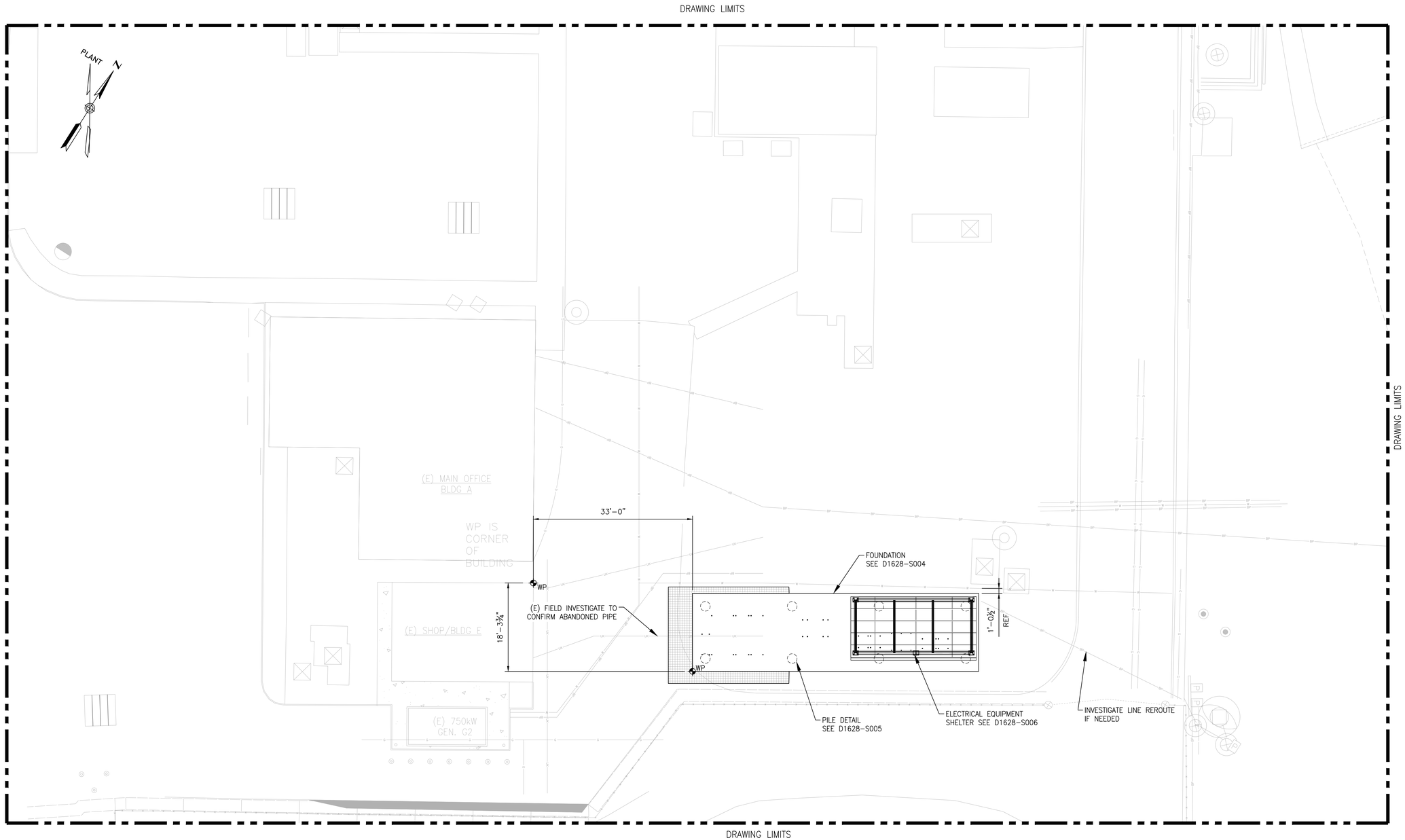
PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
GENERAL NOTES

BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

DWG. NO. D1628-S002
SHEET 2 OF 9
SCALE NONE
DR. DS
APP. DATE 01/16/25
APP. BY VVG

NOTES:

1. FOR GENERAL NOTES, SEE DRAWING D1628–S002.



LOCATION PLAN

SCALE: 3/32"=1'–0"

3/32"=1'–0" 5' 0' 10' 20' 30'

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REV	DR.	APP.	REVISION	DATE
0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

REGISTERED PROFESSIONAL ENGINEER 83999PE OREGON DECEMBER 17, 2014 VALERIY GUBCHAK

08/04/25

RENEWAL DATE 06/30/2027

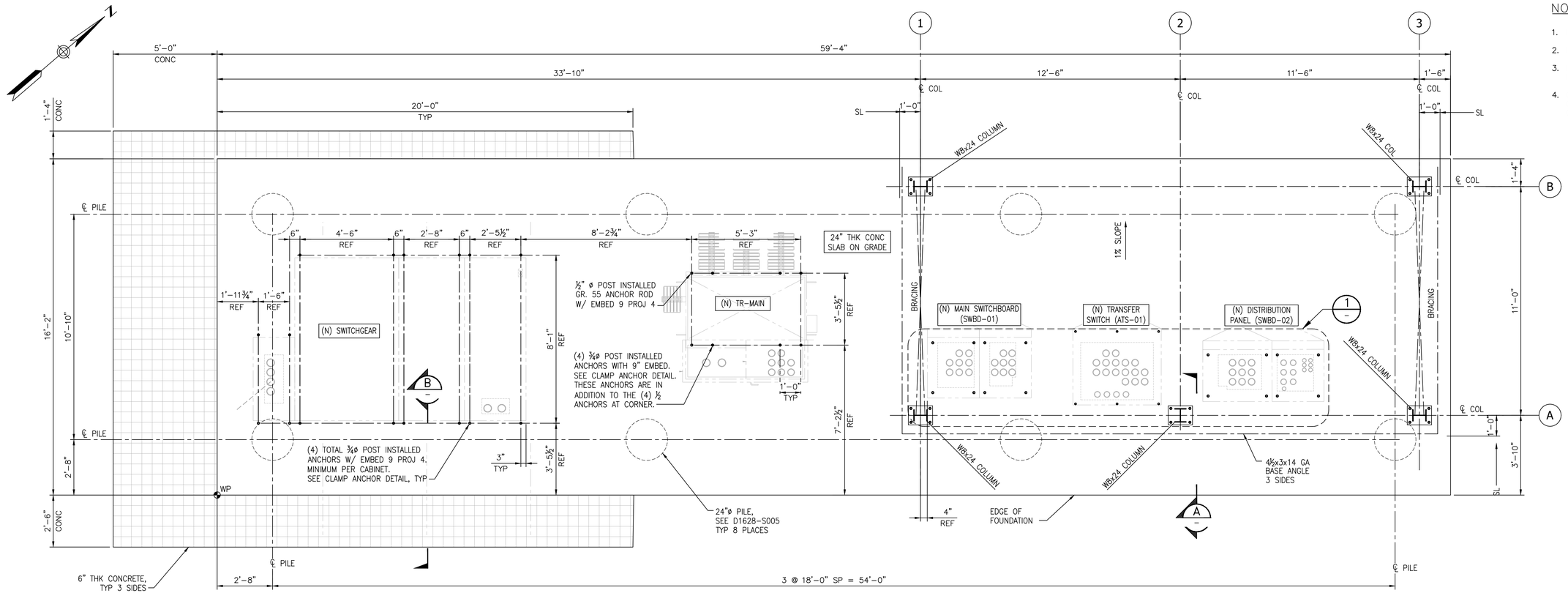
NW Natural
220 NW 2ND AVENUE
PORTLAND, OR 97209

PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
COVER SHEET AND DRAWING INDEX

BAR IS ONE INCH ON ORIGINAL DRAWING.

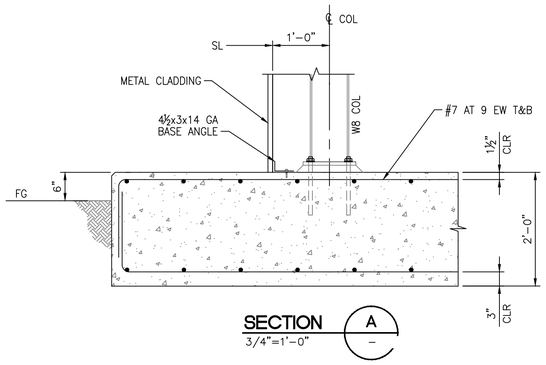
ADJUST SCALE AS SHOWN ACCORDINGLY.

DWG. NO. D1628-S003
SHEET 3 OF 9
SCALE 3/32"=1'-0"
DR. DS
APP. DATE 05/30/25
APP. BY VVG

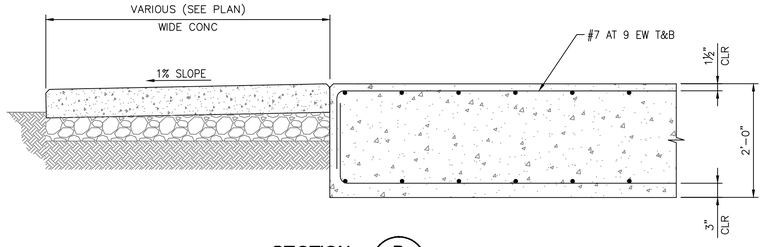


NOTES:

1. FOR GENERAL NOTES, SEE DRAWING D1628-S002.
2. FOR FOUNDATION LOCATION, REFER TO D1628-S003.
3. REFER TO ELECTRICAL DRAWING SET FOR EQUIPMENT LOCATION. DIMENSIONS SHOWN ARE FOR REFERENCE.
4. CIVIL AND ELECTRICAL CONTRACTOR TO COORDINATE FOR CONDUIT STUBPUS AND EQUIPMENT LOCATING PRIOR TO CONCRETE PLACEMENT.



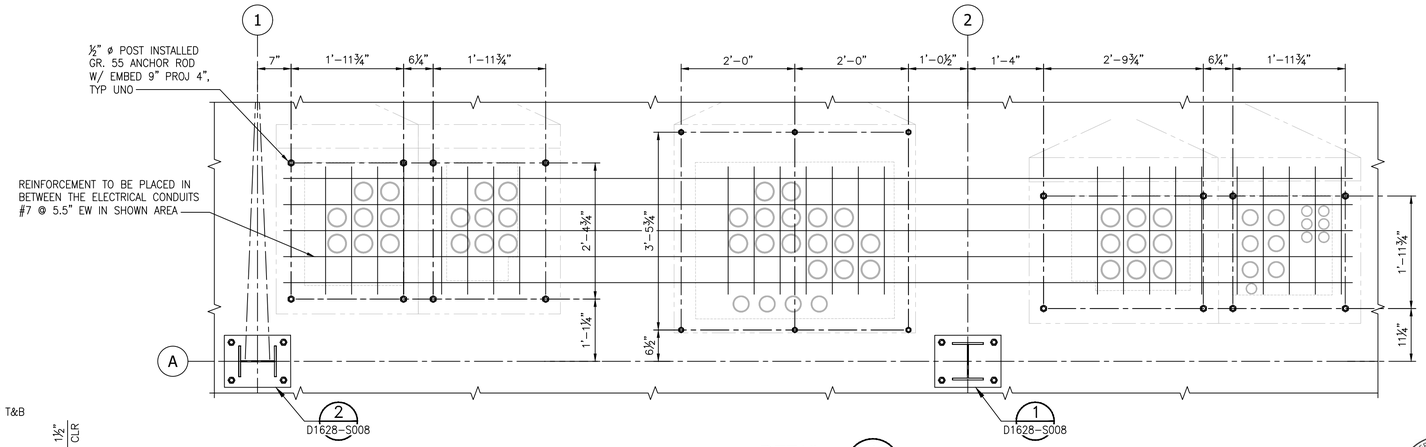
SECTION A
3/4"=1'-0"



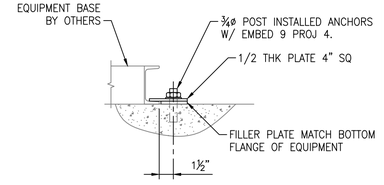
SECTION B
3/4"=1'-0"

FOUNDATION PLAN

3/8"=1'-0"



DETAIL 1
1"=1'-0"



DETAIL 2
1"=1'-0"

1"=1'-0" 1' 0' 1' 2'

3/4"=1'-0" 1' 0' 1' 2' 3'

3/8"=1'-0" 1' 0' 1' 2' 3' 4' 5' 6' 7'

REGISTERED PROFESSIONAL ENGINEER 83999PE OREGON JANUARY 17, 2014 VALERIY GURCHAK

08/04/25

RENEWAL DATE 06/30/2027

REV	DR.	APP.	REVISION	DATE
0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

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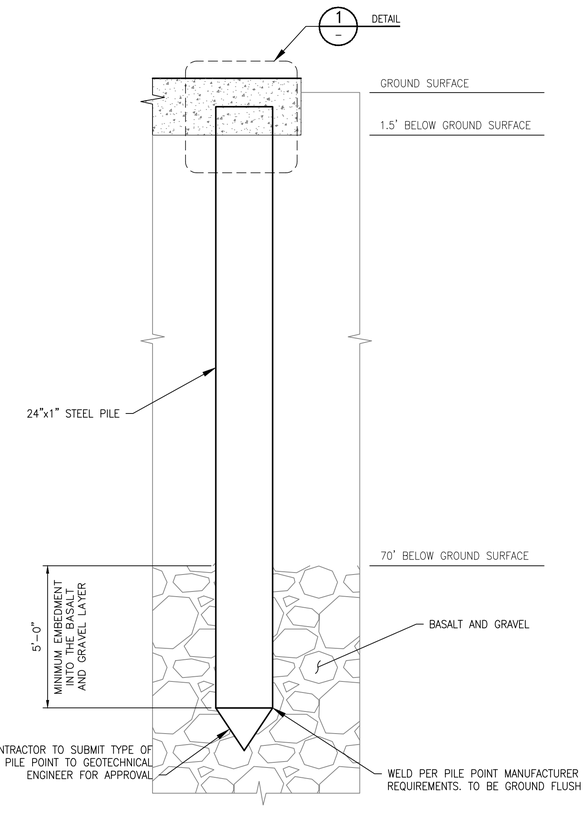
PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
FOUNDATION PLAN AND DETAILS

BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

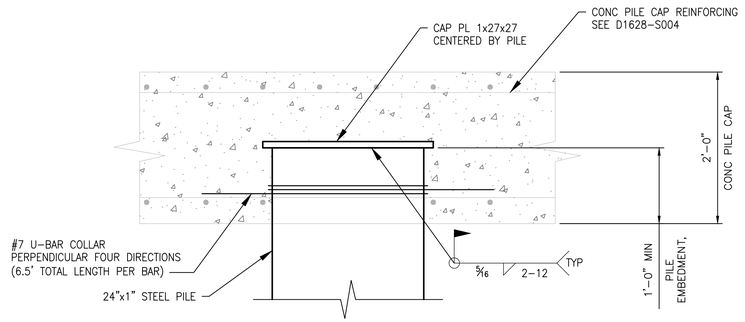
DWG. NO. D1628-S004
SHEET 4 OF 9
SCALE NONE
DR. DS
APP. DATE 01/16/25
APP. BY VVG



GENERALIZED SUBSURFACE PROFILE

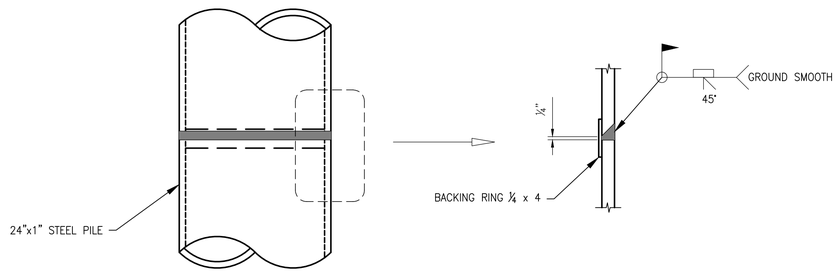
SCALE: 3/8"=1'-0"

FOR SUBSURFACE LAYERS OF SOILS REFER TO GEOTECHNICAL REPORT BY CORNFORTH CONSULTANTS



1 – PILE EMBED DETAIL

1"=1'-0"



2 – PILE SPLICE DETAIL

1"=1'-0"

NOTES:

1. FOR GENERAL NOTES, SEE DRAWING D1628-S002.

PILE NOTES:

1. THE CENTER OF THE PILES AND CAISSONS HAVE A HORIZONTAL INSTALLATION TOLERANCE OF ±4". THE ENGINEER SHALL BE NOTIFIED OF OUT OF TOLERANCE PILES AND GIVEN SUFFICIENT TIME TO DETERMINE THE SAFETY OF THE STRUCTURE, BEFORE ANY ADDITIONAL MEMBERS CAN BE ATTACH ED TO THE PILE.
2. CLOSED END STEEL PIPE PILES SHALL CONFORM TO THE REQUIREMENTS OF ASTM A252, GRADE 2 OR HIGHER.
3. THE STEEL PILES BENEATH THE SLABS SHALL BE AS OUTLINED IN THE PLAN SHEETS. ALL PILES SHALL BE EMBEDDED PER THE GEOTECHNICAL REPORT TO PROVIDE SUFFICIENT BEARING, SHEAR, AND MOMENT CAPACITY. (CALCULATIONS FOR PIPE PILES HAVE BEEN PERFORMED BY AN OWNER SPECIFIED INDEPENDENT DESIGN AGENCY.)
4. THE STEEL PILES SHOULD NOT HAVE MORE THAN ONE SPLICE PER PILE. ALL WELDED SPLICES SHALL BE CAPABLE OF DEVELOPING FULL STRENGTH OF THE PILE. NO SPLICES SHALL BE WITHIN TWO-PILE DIAMETERS OF THE DEPTH OF MAXIMUM BENDING MOMENT WHICH IS AT 16 FEET BELOW GROUND SURFACE.
5. APPROXIMATE PRETRIMMED PILE ESTIMATED TO BE WITHIN 80-90FT.
6. STEEL PILE DRIVING:
   - A. GEOTECHNICAL ENGINEER OF RECORD SHALL BE ON SITE DURING THE PILE DRIVING PROCESS AND SHALL CALL THE TERMINATION OF THE PILE.
   - B. SHOE SHALL BE INSTALLED AT THE PILE TIP TO PREVENT DAMAGE TO THE PILE DURING THE DRIVING PROCESS. THE SHOE SHALL BE SELECTED BY THE CONTRACTOR AND APPROVED BY THE GEOTECHNICAL ENGINEER. THE SHOE SHOULD NOT EXTEND BEYOND THE OUTSIDE DIAMETER OF THE PILE.
   - C. DURING PILE DRIVING, EACH PILE SHOULD BE DRIVEN CONTINUOUSLY WITH INTERRUPTIONS TO BE KEPT TO A MINIMUM.
   - D. FIXED LEADS AND CAREFUL ALIGNMENT AND SUPPORT OF THE PILES SHOULD BE USED TO PREVENT THE PILE FROM MALIGNING IN LOOSE/SOFT SOILS OR UPON CONTACT WITH A SLOPED BEDROCK.
   - E. PILES SHOULD BE DRIVEN WITH AN IMPACT HAMMER TO ESTABLISH THE REQUIRED PENETRATION AND TERMINAL BLOW COUNTS IN THE UNDERLYING VERY DENSE GRAVEL AND HARD BASALT.
   - F. PILES SHALL BE EMBEDDED 5 FEET INTO THE DENSE GRAVEL OR BASALT LAYER APPROXIMATELY 70 FEET BELOW GROUND SURFACE.
   - G. PILE DRIVING CRITERIA, INCLUDING SELECTION OF HAMMER SIZE AND DRIVING CUSHION SHALL BE PROVIDED BY THE GEOTECHNICAL ENGINEER OF RECORD AFTER THE PILE DRIVING SYSTEM HAS BEEN SELECTED BY THE CONTRACTOR.
7. GROUT FILL THE PILES AFTER PILE DRIVING IS COMPLETE

REGISTERED PROFESSIONAL ENGINEER
83999PE
OREGON
DECEMBER 17, 2014
VALENTIN QUSTINOV
08/04/25
RENEWAL DATE: 06/30/2027

3/8"=1'-0" 1' 0' 1' 2' 3' 4' 5' 6' 7'

1"=1'-0" 1' 0' 1' 2'

0	DS	VVG	ISSUED FOR CONSTRUCTION		07/25/25
REV	DR.	APP.	REVISION		DATE

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NW Natural
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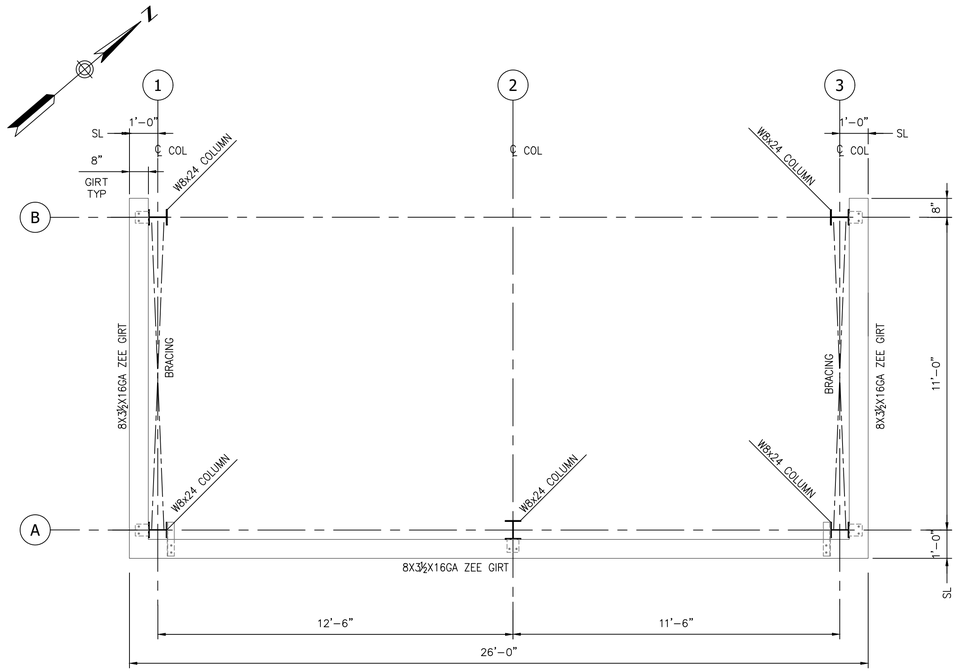
PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
PILE DETAILS

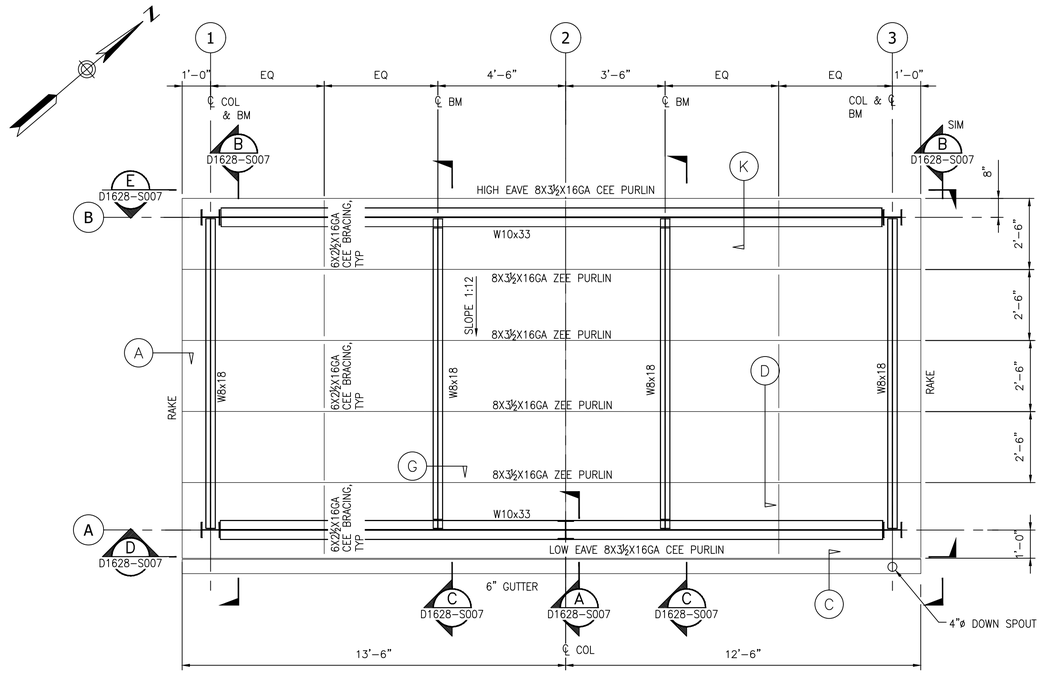
BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

DWG. NO. D1628-S005
SHEET 5 OF 9
SCALE NONE
DR. DS
APP. DATE 5/30/25
APP. BY VVG



GIRT PLAN

⅜"=1'–0"



ROOF PLAN

⅜"=1'–0"

NOTES:

1. FOR GENERAL NOTES, SEE DRAWING D1628–S002.

LEGEND:

(A) SECONDARY FRAMING DETAILS, SEE DWG D1628–S009

PREFORMED WALL AND ROOF PANELS

1. REFERENCES
   A. AISI "AMERICAN IRON AND STEEL INSTITUTE"
   B. NRCA "NATIONAL ROOFING CONTRACTORS ASSOC."
2. ROOF AND WALL PANELS ARE TO BE INSTALLED WITH FLASHING. SEALS AND CLOSER STRIPS TO PROVIDE WEATHER TIGHT ENCLOSURE. ALTERNATE BUT EQUAL WALL AND ROOF PANEL SECTIONS MAY BE USED UPON APPROVAL BY THE CONSTRUCTION MANAGER BUT ALL PANELS, ACCESSORIES, TRIMS, FASTENERS, MUST BE FROM A SINGLE–SOURCE PROVIDER. ALL ROOF AND WALL PANELS TO HAVE A 20 YEAR WARRANTY.

MATERIALS: (STANDARD GALVALUME COATING)
   A. ROOF PANELS – 26 GAUGE, GRD. 80 "PBR" PROFILE
   B. WALL PANELS – 24 GAUGE, GRD. 80 "PBR" PROFILE

SECONDARY AND METAL STUD FRAMING

1. REFERENCES
   A. LGSI "LIGHT GAGE STRUCTURAL INSTITUTE"
   B. SSMA "STEEL STUD MANUFACTURERS ASSOC"
2. LIGHT GAGE MEMBERS TO BE OF THE SIZES AND FINISH AS SHOWN AND BE PRODUCED BY AN LGSI MEMBER COMPANY
3. ⅝"ø BOLTING TO BE ASTM A307, GR A. GALV
4. BOLT GAGES/HOLE LINES FOR LIGHT GAGE MEMBERS MAY BE ADJUSTED FROM THE DIMENSIONS SHOWN TO FIT STD. OR PREFERRED DIMENSIONS FOR THE LIGHT GAGE SUPPLIER.

REGISTERED PROFESSIONAL ENGINEER 83999PE OREGON DECEMBER 17, 2024 VALENTY QUACHAN

08/04/25

RENEWAL DATE: 06/30/2027

3/8"=1'–0"

1' 0' 1' 2' 3' 4' 5' 6' 7'

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0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

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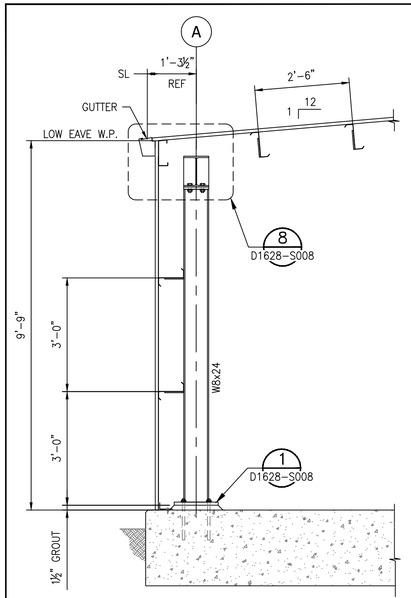
PORTLAND, OR 97209

PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
SHELTER PLANS

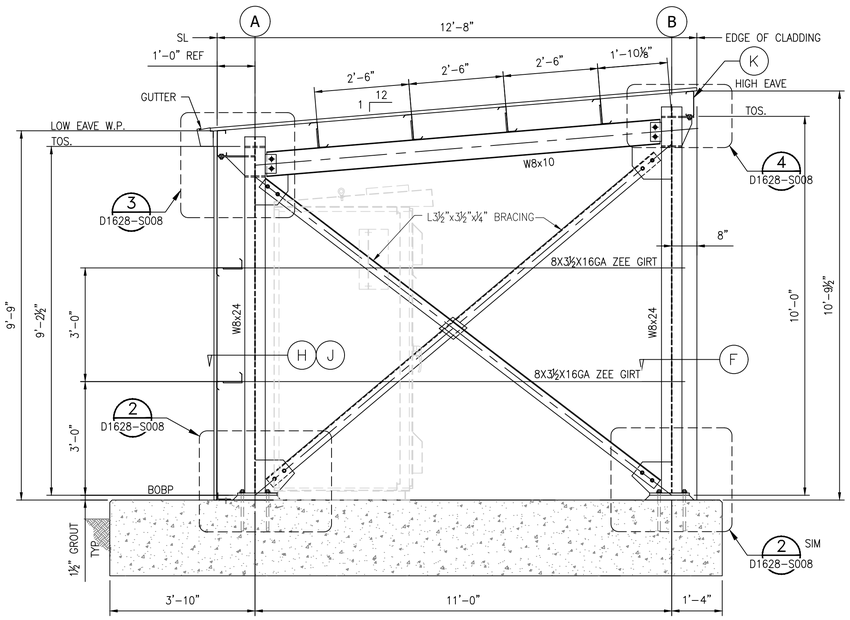
BAR IS ONE INCH ON ORIGINAL DRAWING.

ADJUST SCALE AS SHOWN ACCORDINGLY.

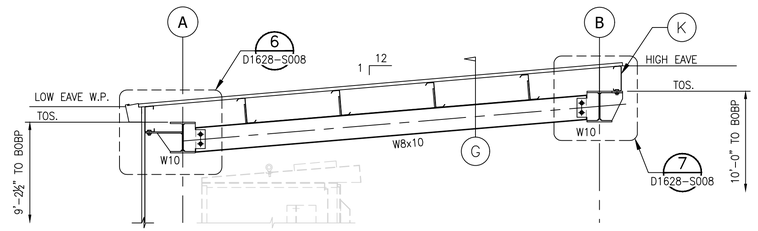
DWG. NO. D1628-S006
SHEET 6 OF 9
SCALE NONE
DR. DS
APP. DATE 05/30/25
APP. BY VVG



A SECTION
D1628-S006 1/2"=1'-0"
LOOKING SOUTH



B SECTION
D1628-S006 1/2"=1'-0"
LOOKING SOUTH



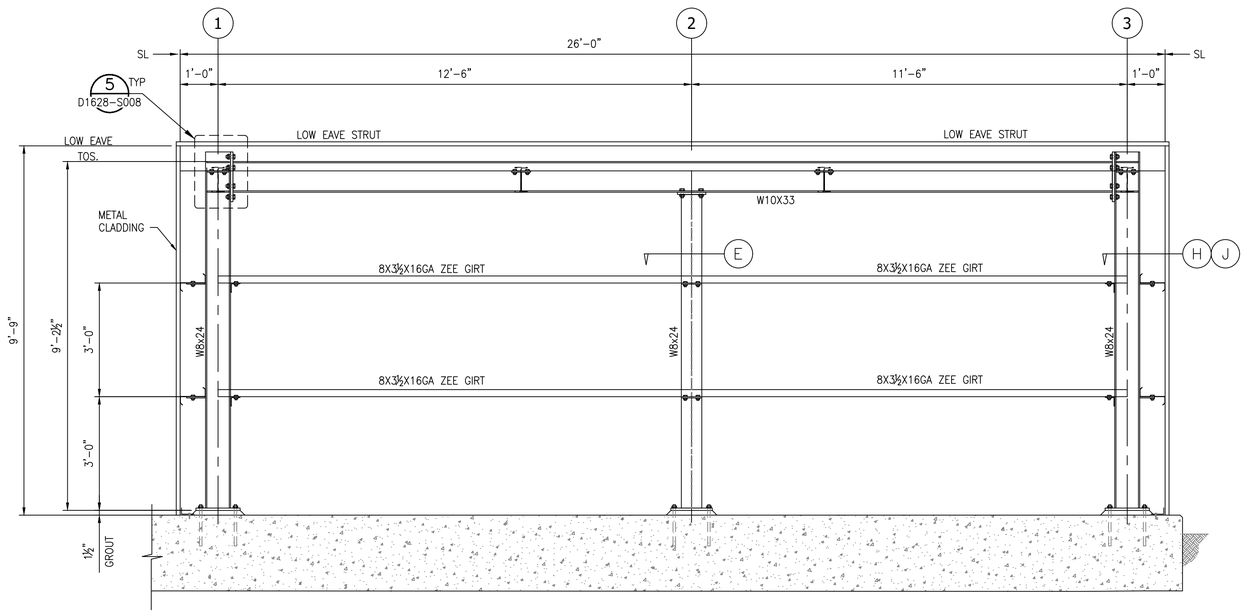
C SECTION
D1628-S006 1/2"=1'-0"
LOOKING SOUTH

NOTES:

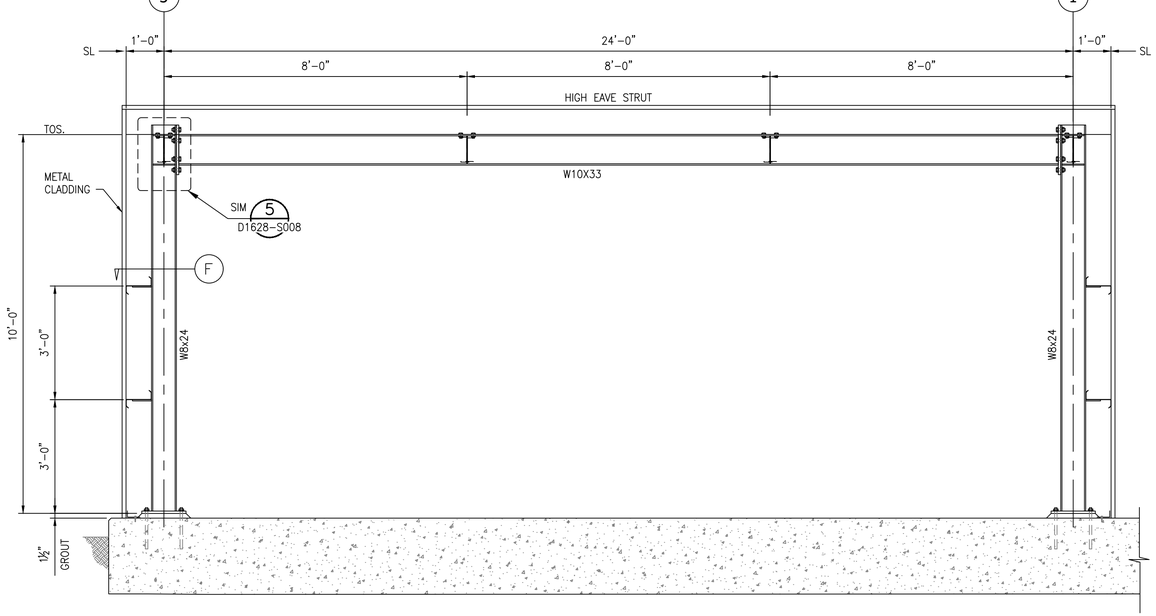
1. FOR GENERAL NOTES, SEE DRAWING D1628-S002.

LEGEND:

(A) SECONDARY FRAMING DETAILS, SEE DWG D1628-S009



D SECTION
D1628-S006 1/2"=1'-0"



E SECTION
D1628-S006 1/2"=1'-0"

REGISTERED PROFESSIONAL ENGINEER
83999PE
OREGON
DECEMBER 17, 2021
VALENTIY GURGANUS
08/04/25
RENEWAL DATE: 06/30/2027

3/8"=1'-0"
1' 0' 1' 2' 3' 4' 5' 6' 7'

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503-254-0110
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REV	DR.	APP.	REVISION	DATE
0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

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220 NW 2ND AVENUE
PORTLAND, OR 97209

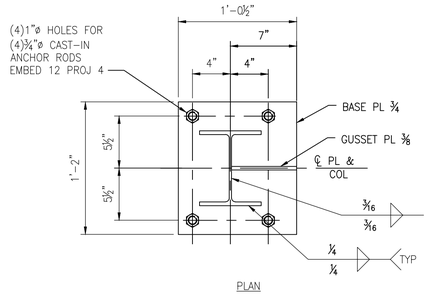
PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
ELEVATIONS

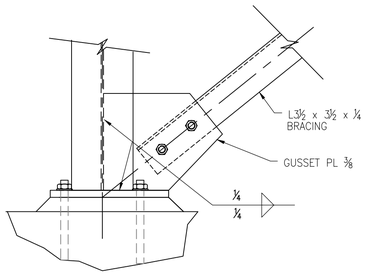
BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

DWG. NO. D1628-S007
SHEET 7 OF 9
SCALE NONE
DR. DS
APP. DATE 05/30/25
APP. BY VVG

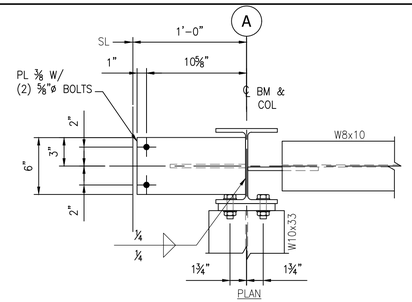
NOTES:

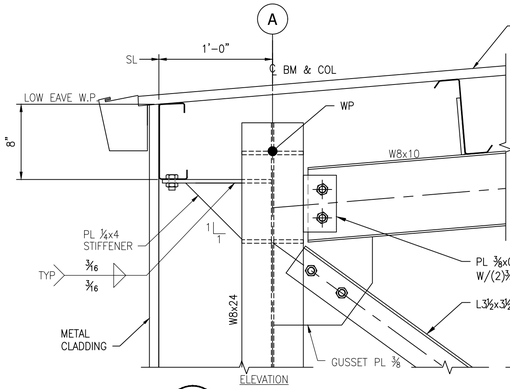
1. FOR GENERAL NOTES, SEE DRAWING D1628-S002.



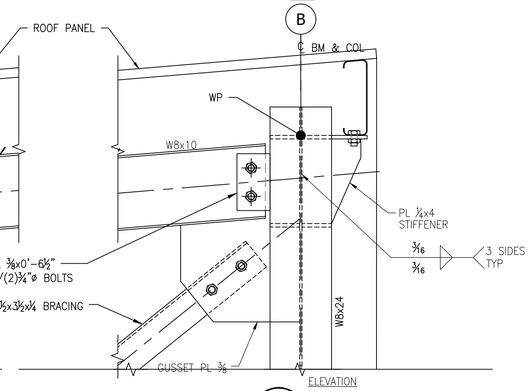


2 S007 DETAIL 1 1/2"=1'-0"

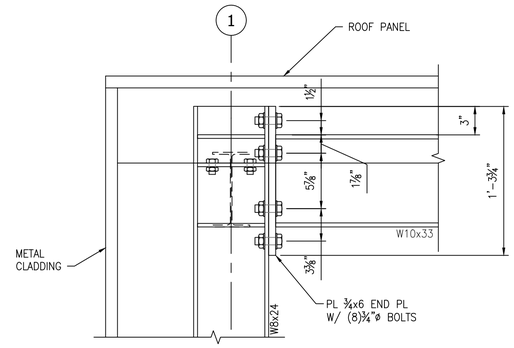




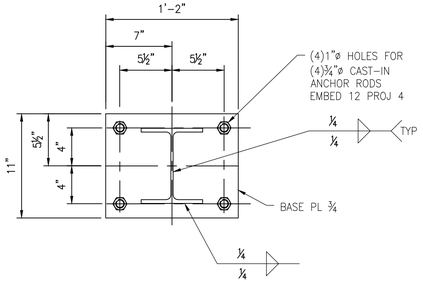
3 S007 DETAIL 1 1/2"=1'-0"



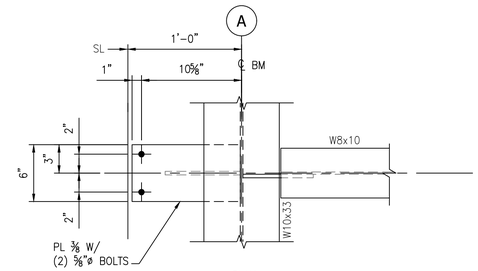
4 S007 DETAIL 1 1/2"=1'-0"

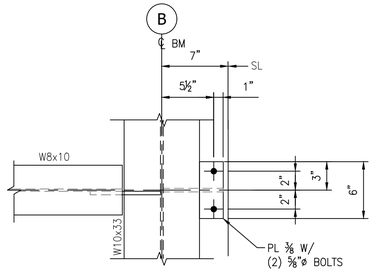


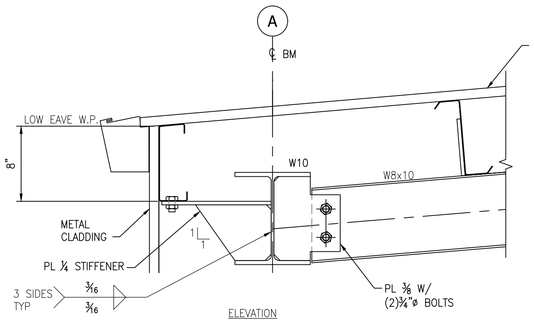
5 S007 DETAIL 1 1/2"=1'-0"



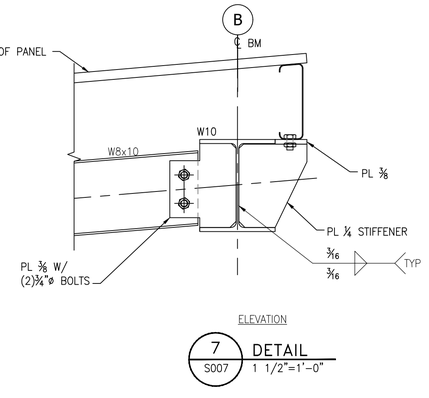
1 S007 DETAIL 1 1/2"=1'-0"



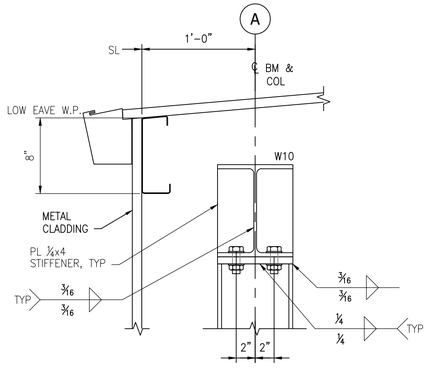




6 S007 DETAIL 1 1/2"=1'-0"



7 S007 DETAIL 1 1/2"=1'-0"



8 S007 DETAIL 1 1/2"=1'-0"

REGISTERED PROFESSIONAL ENGINEER
83999PE
OREGON
DECEMBER 31, 2026
VALERIY GUBCHENKO
08/04/25
RENEWAL DATE: 06/30/2027

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

NORWEST ENGINEERING, INC.
CONSULTING ENGINEERS
PORTLAND, OREGON 503-254-0110
IRVINE, CALIFORNIA www.NorwestEngineering.com
N.E. # RV1628

REV	DR.	APP.	REVISION	DATE
0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

NW Natural
220 NW 2ND AVENUE
PORTLAND, OR 97209

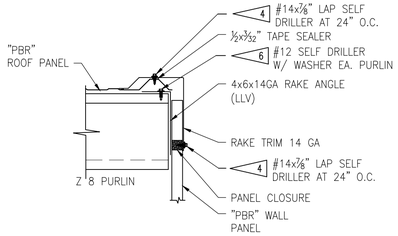
PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
DETAILS

BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

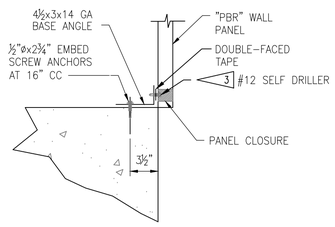
DWG. NO. D1628-S008
SHEET 8 OF 9
SCALE AS SHOWN
DR. DS
APP. DATE 05/30/25
APP. BY VVG

NOTES:

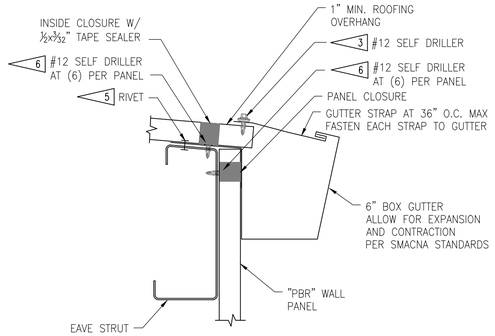
1. FOR GENERAL NOTES, SEE DRAWING D1628–S002.



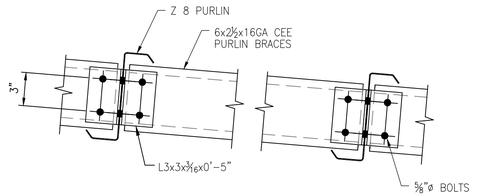
A RAKE ANGLE



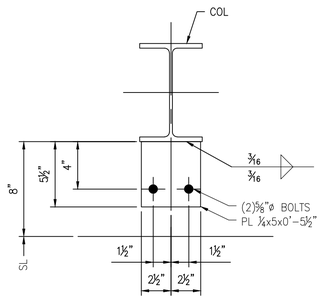
B PANEL BASE



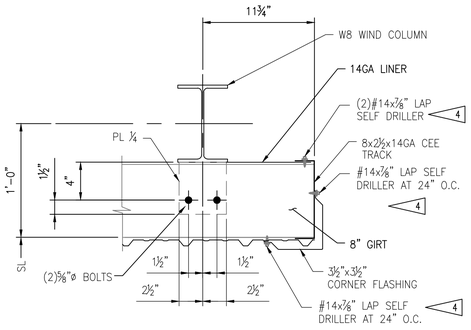
C LOW EAVE



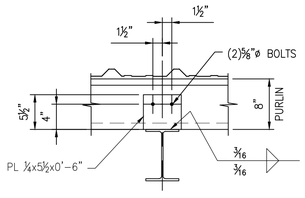
D PURLIN BRACING



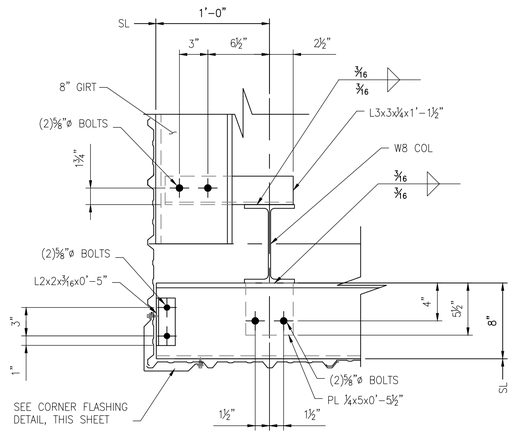
E GIRT CONNECTION



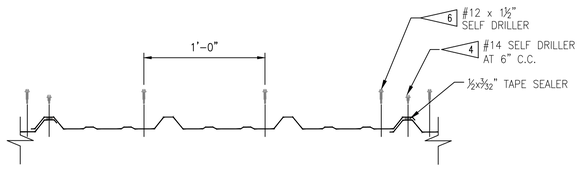
F END WALL FLASHING



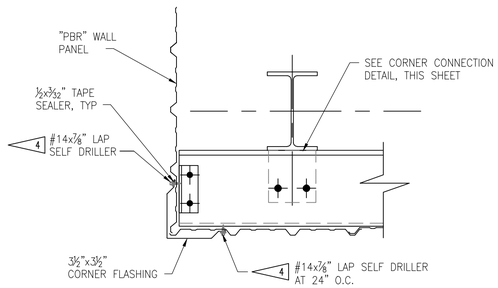
G PURLIN CONNECTION



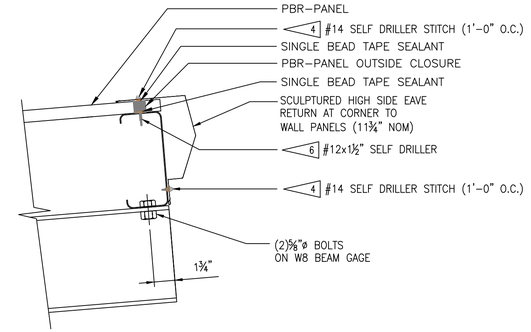
H CORNER CONNECTION



FASTENER PLACEMENT
PBR (36" COVERAGE)



J CORNER FLASHING



K HIGH EAVE

FASTENERS

3	#12 x 3/4" STITCH SCREW 1/4" HEX HEAD	TRIM AND SIDE LAP ATTACHMENTS
4	#14 x 7/8" LAP SELF DRILLER, 5/16" HEX HEAD	TRIM AND SIDE LAP ATTACHMENTS
5	STST-42 SS RIVET 1/8x3/8 *REQUIRES SEALANT	TRIM-TO-TRIM OR TRIM-TO-WALL PANEL ATTACHMENT
6	#12x 1", 1 1/2", 2", 2 1/2" SELF DRILLER, 5/16" HEX HEAD	PANEL TO PURLIN/GIRT ATTACHMENTS

REGISTERED PROFESSIONAL ENGINEER 83999PE OREGON DECEMBER 17, 2014 VALERIY GURCHAK
08/04/25
RENEWAL DATE 06/30/2027

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

NORWEST ENGINEERING, INC.
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0	DS	VVG	ISSUED FOR CONSTRUCTION	07/25/25

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PORTLAND, OR 97209

PORTLAND LNG PLANT
ELECTRICAL DISTRIBUTION UPGRADE
SHELTER SECONDARY FRAMING DETAILS

BAR IS ONE INCH ON ORIGINAL DRAWING.
ADJUST SCALE AS SHOWN ACCORDINGLY.

DWG. NO. D1628-S009
SHEET 9 OF 9
SCALE AS SHOWN
DR. DS
APP. DATE 05/30/25
APP. BY VVG