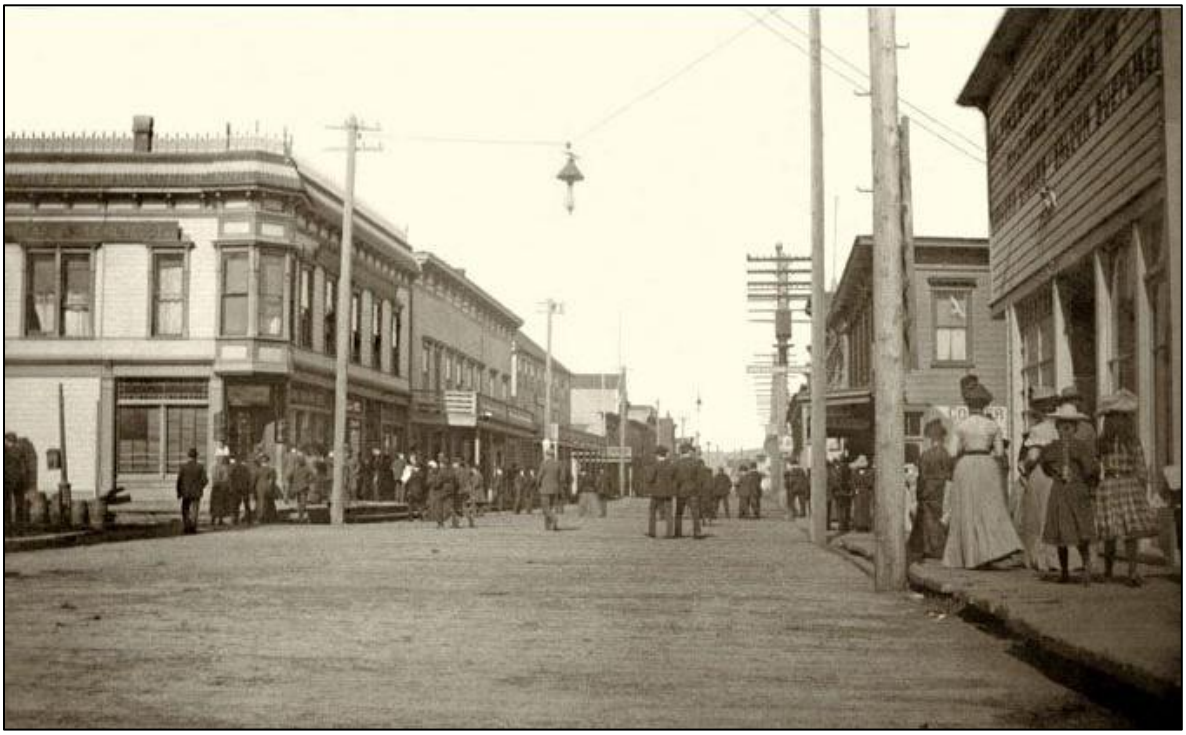
Eastside Housing and Infrastructure Feasibility Study



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Client: City of Coos Bay

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Executive Summary

The City of Coos Bay and the Oregon International Port of Coos Bay jointly commissioned this feasibility study to evaluate the potential for residential development on approximately 110 acres of Port-owned land located on the Eastside of Coos Bay. The study is grounded in two primary objectives: addressing the region's persistent housing shortage and identifying viable, revenue-generating uses for underutilized Port property that support long-term economic sustainability.

This report provides a comprehensive evaluation of the site's physical characteristics, environmental constraints, infrastructure requirements, market conditions, and financial feasibility. The analysis integrates technical engineering data, environmental and regulatory considerations, and detailed financial modeling, supplemented by a structured community engagement process to ensure that local perspectives inform the conclusions.

The findings demonstrate that the site is subject to a combination of significant and interrelated constraints. Subsurface conditions consist of deep, compressible dredge fill soils that present long-term settlement risks and substantial seismic vulnerability. In addition, a large portion of the property is encumbered by jurisdictional wetlands, which both reduce the amount of buildable land and introduce complex regulatory and mitigation requirements. These constraints are compounded by the need for extensive infrastructure improvements, including transportation upgrades, utility extensions, and stormwater management systems.

As a result, development costs substantially exceed what the local housing market can support. Financial analysis indicates a persistent and material gap between total development cost and achievable sales prices or rental revenues. Even under optimistic assumptions, including reduced land costs or partial public subsidy, the project remains financially infeasible for private development.

Community input further reinforces these conclusions. Public feedback consistently raised concerns related to environmental impacts, traffic and access limitations, and the overall suitability of the site for residential use. Many participants expressed a preference for lower-impact alternatives such as open space, recreational uses, or limited commercial development.

Based on this integrated analysis, the study concludes that large-scale residential development on the Eastside property is not feasible under current conditions. The report recommends reconsideration of the site's residential designation and exploration of alternative development strategies that better align with site constraints, market realities, and community priorities.

1.0 Introduction and Study Purpose

The Eastside Development Feasibility Study evaluates the potential to develop approximately 110 acres of Port-owned land on the Eastside of Coos Bay for residential and complementary uses. This effort was undertaken jointly by the City of Coos Bay and the Oregon International Port of Coos Bay (the Port) to determine whether the property can be transformed from a historically underutilized asset into a productive and community-serving development. The study reflects a long-standing interest in aligning the City's housing needs with the Port's strategic objective of generating revenue from non-performing land holdings while supporting broader economic development goals.

At its core, this analysis is intended to provide a clear, data-driven understanding of whether residential development on the Eastside property can be achieved in a manner that is physically feasible, environmentally responsible, financially viable, and supported by the community. Each of these dimensions represents a critical component of overall feasibility, and the absence of any one would significantly undermine the likelihood of successful implementation. Accordingly, this study integrates engineering analysis, environmental evaluation, market assessment, financial modeling, and stakeholder input to provide a comprehensive and balanced assessment.

The purpose of this work extends beyond determining whether housing can be constructed on the site. It is designed to inform policy decisions, guide future public and private investment, and support long-term land use planning for both the City and the Port. By evaluating the full range of opportunities and constraints associated with the property, this study establishes a framework for aligning housing objectives with economic development priorities, while also identifying the risks and tradeoffs inherent in pursuing redevelopment.

The study also builds upon a broader vision for the Eastside property that has evolved over several decades. The Eastside Development Strategy was originally conceived as an opportunity to transform a long-held, low-value Port asset—approximately 110 acres within the larger 312-acre Eastside holding—into a vibrant mixed-use waterfront district capable of generating both economic return and community benefit. Historically, the site was zoned for water-dependent industrial uses and functioned as a dredged material disposal area. However, over time, it has become increasingly clear that industrial redevelopment is impractical given the site's physical limitations, surrounding land uses, and lack of direct deepwater access. As a result, previous planning and market analyses have identified residential development, potentially complemented by selective commercial, recreational, and environmental enhancements, as the highest and best use for long-term value creation. This study reexamines that assumption in light of updated technical, market, and financial data.

The Eastside property itself consists of approximately 110 acres of largely undeveloped land situated east of the Coos Bay estuary. The site is characterized by a complex combination of dredged fill materials, jurisdictional wetlands, and limited areas of upland terrain. Its history as a disposal area has resulted in subsurface conditions that are highly variable and often unstable, while the presence of wetlands introduces additional regulatory and environmental considerations. Access to the property is constrained and is currently provided primarily by existing bridge infrastructure, which raises both capacity and reliability concerns. These physical and locational characteristics are central to understanding the site's development potential and serve as a primary focus of the feasibility analysis.

The study is further guided by a set of long-standing objectives established by the Port Commission, which emphasize the importance of transforming underperforming assets into productive uses, generating sustainable revenue streams to support Port operations, and ensuring that redevelopment efforts provide tangible benefits to the surrounding community. These objectives underscore the need for a development strategy that not only achieves financial returns but also enhances public access, supports local economic activity, and integrates compatibly with adjacent neighborhoods.

Within this context, the primary objective of the feasibility study is to identify development approaches that maximize public value and attract private investment while minimizing long-term cost and risk. This includes a detailed evaluation of site constraints such as soils, wetlands, and topography, as well as the identification of necessary mitigation measures. The study also assesses the infrastructure improvements required to support development, including water, sewer, stormwater, and transportation systems, and evaluates the associated costs and implementation challenges. In parallel, it examines local housing market conditions to determine the types of residential products that could be supported, and it develops alternative development scenarios to test financial feasibility under realistic assumptions.

Ultimately, this analysis is intended to provide clear and actionable guidance to the City and the Port regarding the future of the Eastside property. By integrating technical, financial, and community considerations into a single framework, the study supports informed decision-making and helps ensure that any future actions are grounded in a realistic understanding of both the opportunities and limitations associated with the site.

1.1 Background

1.1.1 Housing Need and Context

Coos Bay has a demonstrated and persistent shortage of housing that spans ownership and rental sectors and affects a broad range of household incomes. Historical market work completed for the Eastside site (Hobson Johnson & Associates) showed substantial annual demand in the regional market during the late 1990s/early 2000s planning horizons — roughly 400–440 income-qualified ownership households per year and more than 1,100 annual rental unit demand from structural growth and turnover. Those studies concluded there was clear absorption potential for both for-sale and rental homes and recommended a mix of small-lot single family, attached ownership (townhomes/duplexes), and market-rate rental housing, plus limited waterfront commercial to support a neighborhood center. While these numeric projections are dated, they establish that the Coos Bay/North Bend market has historically been undersupplied relative to household growth and turnover, and that sizable near-term demand can be expected when the product, price, and location align.

The City's housing shortfall is compounded by constrained land supply for residential development and by rising costs for developing marginal sites. The Port-owned Eastside property represents an unusually large opportunity for new housing, but it is encumbered by wetlands, deep, compressible dredge fill, and infrastructure limitations. Those physical constraints substantially raise development costs and compress feasible product types. In practice that reduces the kinds of lower-cost, ground-plane housing forms that would best serve workforce and moderate-income households unless mitigation, infrastructure funding, or subsidy strategies are pursued.

Demographic and affordability considerations indicate the community needs a balanced portfolio of housing choices. The prior market analysis and the Port/City objectives point to demand for: small-lot and

standard single-family homes that serve local ownership market entrants and families; moderate-density attached ownership and townhome products to efficiently use limited developable land; and market-rate rental housing (including workforce and age-restricted options) to serve younger households, renters displaced by limited supply, and seniors seeking lower-maintenance units. A meaningful share of new units should be targeted at price points affordable to households in the lower half of the income distribution to address local workforce needs.

Because the earlier demand estimates are now two decades old and development costs (especially for ground improvement and wetland mitigation) have changed significantly, this evaluation provides an update on these conditions.

1.1.2 How the Eastside Residential Project Advances Port Strategic Goals

The Oregon International Port of Coos Bay's Strategic Business Plan frames the Port's primary role as a facilitator of maritime commerce and regional economic development while also serving as a steward of coastal and estuarine resources. The Plan emphasizes protecting and maintaining water-dependent and water-related uses, diversifying the Port's revenue base, leveraging Port assets to support regional job creation, and coordinating investments in facilities and infrastructure (including dredging, rail, and marine terminals) that sustain long-term economic value. The Eastside Port-owned property sits squarely within that policy context: it is a large, underutilized parcel that was historically used for dredged-material disposal and is identified in the Strategic Business Plan as likely suited to housing or other non-commercial uses. Any proposal to redevelop the site must therefore be evaluated not only for housing supply outcomes but also for how it advances the Port's broader strategic objectives.

A thoughtfully planned residential redevelopment of the Eastside site can advance multiple Port goals. First, by converting a non-operational, marginal upland asset into a revenue-generating use the Port can use to diversify its income sources and strengthen its ability to fund core maritime capital needs—supporting investments called out in the capital facilities plan (e.g., Charleston and North Spit improvements, dredging reserves, and rail investments). Second, providing new, attainable housing near Port facilities can help retain and recruit workers for maritime, processing, and rail-related businesses that the Port supports; this aligns with the Plan's economic development and community support objectives and can help stabilize the local labor pool for Port tenants and the broader regional economy. Third, redeveloping the Eastside parcel for housing (rather than industrial conversion) is consistent with the Plan's recognition that some Port properties are best used for non-commercial purposes and with the community-oriented vision advanced through the Port's public engagement findings.

At the same time, the Port's Strategic Business Plan makes clear that any Eastside redevelopment must comply with state and local environmental and planning requirements (including Estuary Management Plan/Goal 16 designations and Shorelands/Coastal Shorelands Goal 17 and Ocean Resources Goal 19 policies), and must be coordinated with the Port's dredging and upland disposal responsibilities. The site's history as dredge disposal and its estuarine/wetland features mean redevelopment will implicate wetland mitigation, dredged-material permitting and disposal considerations, and strict estuarine management classifications. These constraints are central to the feasibility conclusions: environmental compliance and mitigation, ground-improvement needs, and infrastructure upgrades materially affect project costs and timing and therefore must be integrated into any strategy to advance Port objectives.

To maximize alignment with the Strategic Business Plan, the feasibility work recommends that the Port and City approach the Eastside project as a coordinated, phased initiative that simultaneously: (a) protects and does not displace or diminish adjacent water-dependent uses; (b) incorporates an environmental stewardship plan consistent with the Port's environmental policies and Goal 16/17/19 requirements; (c) captures financial value for the Port that can be invested back into priority maritime projects (dredging reserves, rail and Charleston improvements); and (d) leverages public funding, mitigation banking, or targeted subsidies to address the high upfront costs associated with wetland mitigation and geotechnical ground improvement so the project can deliver housing that meets local workforce needs. In short, a well-designed Eastside residential development can be a strategic tool to diversify Port revenues, support the local workforce, and free Port capacity to invest in its core maritime infrastructure—provided the project is advanced in full coordination with the Port's environmental, operational, and capital priorities.

1.2 History of Past Feasibility Efforts

The Eastside property has been the subject of multiple technical and planning studies over several decades. These prior efforts provide an important foundation for the current analysis, as they consistently identified a set of constraints that continue to define the site's development potential. While methodologies and data have evolved over time, the core findings have remained largely unchanged, reinforcing the reliability of the conclusions presented in this report.

1.2.1 Geotechnical Findings

Previous geotechnical investigations have consistently documented the presence of deep layers of compressible fill material underlying much of the site. These materials, which are largely the result of historic dredging activities, low strength and high settlement potential. As a result, any structural loading associated with development would induce long-term consolidation, leading to gradual ground subsidence over time.

In addition to settlement concerns, earlier studies identified a significant risk of soil liquefaction during seismic events. This condition, which occurs when saturated soils temporarily lose strength under shaking, can result in sudden and uneven ground displacement. The combination of long-term settlement and seismic vulnerability presents a complex engineering challenge that must be addressed through costly and technically demanding mitigation measures.

1.2.2 Environmental Constraints

Wetland delineation studies conducted across the site have consistently shown that a substantial portion of the property qualifies as jurisdictional wetlands under state and federal regulations. These areas are subject to strict protections, limiting the extent to which they can be altered or filled for development purposes.

The presence of wetlands not only reduces the amount of land available for construction but also introduces a layered regulatory process that includes permitting, mitigation, and potential compensatory restoration. These requirements add both cost and uncertainty to any development scenario and must be carefully considered when evaluating overall feasibility.

1.2.3 Planning Efforts

Past planning efforts have explored a range of potential land uses for the Eastside property, including residential, commercial, and mixed-use concepts. These studies have generally concluded that only limited portions of the site may be suitable for development without significant intervention.

Importantly, previous analyses have emphasized that development feasibility is highly sensitive to both site-specific constraints and broader market conditions. Even in scenarios where physical challenges could be addressed through engineering solutions, the associated costs often exceed what the market can support. This finding has remained a consistent theme and is reaffirmed by the current study.

Collectively, prior efforts consistently identified three persistent constraints that have driven subsequent feasibility thinking: (1) substantial geotechnical risk due to deep, compressible deposits and localized liquefiable sands; (2) extensive wetland mosaics that constrain buildable area and require mitigation; and (3) offsite infrastructure and transportation improvements needed to support significant new residential development. Those constraints directly informed the alternatives and financial modeling undertaken in the present feasibility analysis.

This study was commissioned to provide an updated assessment of the Eastside property's development feasibility in the context of the current permitting and regulatory environment, to review development cost feasibility under present-day conditions, and to identify any additional highest and best use opportunities for the site. AKS was not engaged to perform new geotechnical investigations, land surveying, or natural resource fieldwork, including wetland delineation or biological assessments. Accordingly, all site-specific findings related to subsurface conditions, soil characteristics, settlement and seismic performance, and wetland/upland boundaries referenced in this report are derived solely from previously completed study materials. Additionally, the prior geotechnical report was prepared for planning purposes only and is not intended for final design, and the wetland delineation and any associated DSL concurrence may no longer be current and would likely require re-verification before permit applications can be submitted. Any recommendations or conclusions presented herein that rely on the prior studies carry the same limitations, assumptions, and caveats stated in those original documents.

2.0 Study Approach and Methodology

This feasibility study is based on a comprehensive and integrated methodology that combines prior technical investigations, updated analysis, and stakeholder input to evaluate the development potential of the Eastside property. The study was structured around two objectives. The primary objective was to evaluate the feasibility of a full buildout development scenario, including site preparation, infrastructure, environmental permitting, market viability, and financial performance, and to gather neighborhood feedback on that concept through a structured public outreach process. The secondary objective, pursued with remaining time following completion of the full buildout analysis, was to explore a range of reduced-footprint alternatives at a preliminary level to determine whether any warrant further evaluation. The approach was designed to ensure that relevant factors influencing feasibility, including physical conditions, environmental constraints, infrastructure requirements, market dynamics, and financial performance, were considered holistically rather than in isolation.

The study began with a thorough review of existing background materials and prior investigations related to the site. Key source documents included the Eastside Geotechnical Investigation (Foundation Engineering, 2000), the Eastside Wetland Delineation Report (Stuntzner/Ron Bruce, 2003), and previous Eastside Development Strategy planning efforts. These materials provided a foundational understanding of site conditions and constraints, which were then validated and expanded upon through updated analysis and synthesis.

Technical evaluation relied on existing fieldwork and reporting completed during previous study efforts. Subsurface conditions were characterized using previously completed borehole data, laboratory testing results, and geotechnical analyses to assess soil strength, compressibility, and settlement potential. Wetland conditions were evaluated using available delineation reports and hydrologic indicators to identify jurisdictional boundaries and regulatory implications. Infrastructure capacity was assessed through review of existing utility systems, transportation network conditions, and applicable master planning documents to determine the extent of improvements required to support development.

Building on this technical foundation, the study first developed and evaluated a full buildout development scenario representing the maximum development potential of the site under current and anticipated zoning. This scenario served as the primary basis for evaluating physical feasibility, infrastructure requirements, environmental impacts, development costs, and financial performance. The full buildout analysis established the baseline understanding of the site's feasibility gap and provided the framework against which community feedback was gathered.

Following completion of the full buildout analysis and public outreach process, several reduced-footprint alternatives were developed and evaluated at a preliminary level. These alternatives included varying residential densities, waterfront commercial configurations, and lower-impact options such as parks and open space. Each was assessed in terms of its physical feasibility, infrastructure requirements, and general cost implications. This secondary analysis was intended to identify whether any alternative development approach could meaningfully improve feasibility or better align with community preferences and was not carried to the same level of engineering detail as the full buildout scenario.

In parallel with the full buildout analysis, a market and financial analysis was conducted to determine whether potential development outcomes could be supported under current economic conditions. The market analysis examined local housing demand, pricing trends, and comparable development patterns within Coos Bay and similar coastal communities. These findings were used to establish realistic assumptions for achievable sales prices and rental rates. Comparing the cost analysis to anticipated home development costs provides clarity on whether the full buildout development is feasible.

The financial analysis translated these market assumptions into detailed cost and revenue models. Development costs were estimated for site preparation, infrastructure improvements, wetland mitigation, and vertical construction. These costs were then compared against projected revenues to evaluate overall feasibility. Sensitivity testing was conducted to assess how changes in key variables - such as construction costs, development density, or subsidy levels - would influence project viability. This step was critical in identifying the magnitude and persistence of the feasibility gap.

Community engagement was a central component of the methodology and directly informed both study objectives. A structured outreach process, including public open houses, stakeholder meetings, and written comment opportunities, was implemented to gather input from residents, local stakeholders, and

decision-makers. This process was designed to ensure transparency and to incorporate community perspectives into the evaluation. Feedback was systematically reviewed and integrated into the analysis. Community input on the full buildout scenario, particularly concerns related to traffic generation, neighborhood compatibility, and preferred land uses, directly shaped the selection of reduced-footprint alternatives evaluated under the secondary objective.

Overall, the study methodology reflects a multidisciplinary and iterative process that integrates technical analysis, market realities, financial modeling, and community input into a unified framework. The two-objective structure ensures that the full buildout scenario received detailed evaluation while also providing the City and Port with a preliminary understanding of alternative approaches that may warrant further study. This approach ensures that conclusions are grounded in both data and practical considerations, providing a reliable basis for informed decision-making regarding the future of the Eastside property.

3.0 Site Conditions and Constraints

This section builds upon the foundation of prior work while incorporating updated data, refined analytical tools, and a comprehensive evaluation framework. The assessment integrates technical engineering analysis, environmental and regulatory considerations, and detailed financial modeling to provide a complete understanding of the site's development constraints and opportunities.

3.1 Geotechnical Analysis

The geotechnical conditions of the Eastside property represent a primary barrier to development and a significant driver of project cost and risk. The site was filled in the early 1980s with dredged material from the Coos Bay shipping channel and sits above the 100-year flood elevation (9 feet), with finished grades typically at or above 20 feet. The property is bounded by the Coos River and Catching Slough on the east, Isthmus Slough on the west and south, and extensive tidal flats surrounding much of the shoreline. Interior grades are predominantly level, with steeper slopes limited to exterior berm faces that originally contained dredged fill.

3.1.1 Subsurface Conditions

The site is predominantly underlain by dredged fill material placed over soft alluvial soils. Dredge material comprises the large majority of the first 25–30 feet of soil profile. Beneath the dredge fill lies alluvial slough deposits consisting of very soft to soft silt and clayey silt, with depths reaching up to 70 feet. These subsurface conditions are characterized by low shear strength, high compressibility, and significant spatial variability. Such conditions are inherently unstable when subjected to structural loads and require careful engineering consideration.

3.1.2 Settlement Risks

The presence of loose dredge sand and soft, compressible soil creates pervasive settlement risk across the development area. Without intervention, soils underlying the site are expected to experience substantial settlement over time. Large primary consolidation settlements on the order of 12–60 inches are anticipated for typical development-scale loadings, with long-term settlements potentially continuing for a decade or more without preconsolidation. This settlement would not occur uniformly, increasing the risk of differential movement that could damage buildings, roads, and utility systems. The long-term

nature of this process complicates design, as infrastructure must accommodate ongoing ground movement.

Mitigation of settlement due to loose dredge sand may be accomplished through excavation, moisture-conditioning, and recompaction using vibratory rollers, with minimum excavation depths varying between 2-5 feet across the site. Surcharging is the preferred approach for mitigating long-term consolidation settlement of the underlying soft alluvial soil. A rolling surcharge program is recommended to limit imported fill volumes and associated hauling costs. Wick (vertical) drains may be installed to accelerate pore-pressure dissipation and shorten surcharge durations, though installation costs are substantial (estimated at $100,000 per acre).

3.1.3 Seismic Considerations

The presence of loose, saturated soils introduces high potential for liquefaction during seismic events—a critical concern in coastal Oregon. Loose sand lenses encountered in borings (notably BH-1, BH-3, BH-4) are susceptible to liquefaction under moderate to high seismic shaking (pga conditions of 0.1–0.2 g and higher), resulting in several inches of seismic-induced settlement in affected zones. Liquefaction could result in rapid ground deformation, posing serious threats to structural stability and public safety.

The elevations of loose sand layers suggest a loose sand stratum may extend west and north toward the shoreline, creating a lateral spread hazard (lateral movement of soil above a liquefied layer). Avoiding development in those areas is the most cost-effective option. If development proceeds, more extensive deep soil mixing may be required to improve liquefaction resistance and reduce lateral displacements.

3.1.4 Mitigation Requirements and Foundation Design

Addressing geotechnical challenges requires a combination of ground improvement techniques and deep foundation systems. Deep foundations (piles or drilled shafts) to competent strata are a practical approach for buildings; pile lengths may exceed 80 feet in some locations. Driven piles are anticipated to be the most economical option given deep, soft soil conditions. Alternatively, deep soil mixing (mixing soil with cement) may be considered to improve liquefaction resistance. Rammed aggregate piers are not recommended as they would likely exacerbate settlement issues.

Utilities are vulnerable to both long-term settlement and seismic deformation. Force mains, sanitary laterals, and buried services should be designed with appropriate ductility, flexible joints, redundant routing where feasible, and detailing to allow for post-settlement adjustment or localized regrading. All of which add to construction and design costs for this site.

The southeastern portion of the site (vicinity of BH-5) exhibits the most favorable soil conditions, without a deep liquefiable sand layer or apparent lateral spread hazard given its proximity of being over 900’ from the shoreline. However, development of that area would still require extensive earthwork with reprocessing of dredge sand and surcharging to reduce long-term settlement in the underlying soft alluvial soil.

If a preferred development area is identified, a targeted geotechnical investigation (borings, CPTs, groundwater/tide monitoring, and laboratory testing) will be required to quantify settlement magnitudes, liquefaction layers, and deep soil mixing/foundation sizing so that realistic schedules and order-of-magnitude costs can be developed. The costs identified within this study should not be considered to serve this same purpose.

A rough mapping of lateral spread hazard across the site has been overlayed onto the exiting site map (Appendix A). See below for anticipated ground improvements required for each area:

- Zone 1 – Ground surcharging and soil recompaction.
- Zone 2/3 – Ground surcharging, soil recompaction, deep soil mixing/deep foundations.

3.2 Wetlands and Environmental Constraints

Historic wetland delineations document a wetland mosaic across the property with wetland plant communities (OBL/FACW species such as Carex obnupta and Salix spp.), hydric soils (Udorthents and Fluvaquent–Histosol complexes), and surface saturation in depressional areas. Substantial portions of the parcel qualify as jurisdictional wetlands under state and federal regulations. Any significant redevelopment will trigger state and federal permitting requirements and the need for wetland mitigation.

3.2.1 Wetland Coverage and Classification

Two predominant wetland types are located on the site: PEM/PSS Flats wetlands and E2EM Estuarine Fringe wetlands. Potential wetlands are distributed throughout the site in low depressions and along the perimeter, with approximately 46.3 acres of the site potentially encumbered by wetland habitats (see Appendix B). Most wetlands are identified as hydrologically isolated Flats wetlands with no connection to other waters of the State; however, Estuarine Fringe wetlands are hydrologically connected to the Isthmus Slough and Coos River. A full and updated wetland delineation (not a part of this study) would be required to confirm wetland boundaries, classifications, and jurisdictional status to advance development opportunities further.

3.2.2 Regulatory Framework and Mitigation Options

Development within or adjacent to wetlands requires coordination with multiple regulatory agencies and compliance with permitting requirements. This process can be lengthy and uncertain, particularly for large or complex projects. Mitigation strategies reviewed in prior work include onsite preservation/integrated design, purchase of mitigation bank credits, and potential use of Department of State Lands (DSL) programs; each has cost and timing implications and some regulatory uncertainty for larger impacts.

The acreage of wetlands impacted by the chosen development will determine whether onsite mitigation is adequate or whether additional payment-in-lieu options must be utilized. Due to the scattered nature of wetlands across the site, limiting wetland impacts will be difficult. Outside of onsite mitigation, two primary options exist: the DSL payment-in-lieu (PIL) program and purchasing wetland bank credits.

The DSL PIL program is in the approximate range of $132,000 per acre of wetland impacts, though this is not a flat rate and increases for each additional acre impacted. DSL has not recently been supportive of projects using the PIL program for impacts greater than 0.5 acres, significantly limiting its usefulness for this site.

Purchasing wetland bank credits is a potential alternative, though challenges exist. No current wetland banks in the area cover the site; the nearest is the Wilbur Island Mitigation Bank. Use of these credits may not be accepted by agencies. If the site were able to utilize these credits, the approximate cost would be $175,000 per acre based on current pricing at the Wilbur Island Mitigation Bank, with typical annual increases of ±8 percent and does not include $25,000 of wetland fill permitting that would be needed on

top of this fee. For the basis of cost estimating within this study, $225,000 per acre was utilized as the cost per acre of wetland impact with each alternative option.

3.2.3 Implications for Development

The combined effect of wetland coverage and regulatory requirements is a significant reduction in buildable land area and an increase in both cost and project risk. These factors must be considered alongside geotechnical constraints when evaluating the site's overall suitability for residential development. Substantial portions of the parcel provide important ecological functions and are protected under state and federal regulations, limiting the extent to which they can be altered or filled for development purposes without appropriate mitigation.

3.3 Infrastructure Considerations

3.3.1 Water Supply

Water infrastructure is managed by the Coos Bay–North Bend Water Commission. Existing Eastside water connection points are located to the south and east of the site on B Street and McKay Street. B Street currently has a two-inch PVC water line stubbed at the end of the street with a 1-inch blowoff assembly. McKay Street has a six-inch AC water line.

If development were to occur on the site, connections to the existing water system would be made at B Street and McKay Street. The water system will need to be looped to ensure the required water volume and pressure utilization will be met for the site as there are already pressure and flow limitations with the existing dead end configuration. Discussions with the Coos Bay - North Bend Water Board have indicated that adequate pressure and flow could be feasible if the water system is looped.

3.3.2 Sanitary Sewer

The subject site is located within Basin EE per the City of Coos Bay Wastewater Collection System Masterplan. Current Eastside service averages 353 gpm via one pump station (No. 18) serving 142 dwellings. Planned improvements per the City's wastewater master plan for this pump station include conversion from a suction lift station to a submersible station using pumps sized for 300 gpm at 90 feet total dynamic head, a valve and meter vault, and new electronics and control upgrades as required. Pump Station No. 18 routes flow to Pump Station No. 17, which then flows to downtown Coos Bay via a force main installed in 2019.

Existing sanitary sewer depths to the south and east of the site will necessitate a new onsite pump station and force main to be installed to the City's existing Pump Station No. 18 if development improvements extend too far from the existing street stubs. Additionally, as noted in the 2018 Preliminary Engineering Report – Pump Station No. 17 Improvements (Appendix C), Pump Station No. 17 will need to be reevaluated to determine if upgrades are needed for additional capacity. Pump Station No. 18 will also need to be upgraded to provide additional capacity depending on the final lot density of the site and available capacity at the time of development.

To determine the capacity of Pump Station No. 17 and 18, several key parameters were used from the 2018 Preliminary Engineering Report – Pump Station No. 17 Improvements. Flows based on equivalent dwelling unit were assumed to be 358 gallons per day. Commercial buildings were assumed to be 0.5 gallons per day per square foot. See below for the assumed existing pump station capacities and expected sewer flows for each proposed layout.

Table 3-1: Existing Pump Station Capacity

Capacity	Pump Station 17*	Pump Station 18*
Current Capacity (gpm)	1,867	400
Current Flow Rate (gpm)	1,655	353
Available Capacity (gpm)	212	47

* Capacity/flow rate based on *Preliminary Engineering Report – Pump Station No. 17 Improvements*.

** Capacity based on City of Coos Bay *Wastewater Master Plan*. Flow rate based on *Preliminary Engineering Report – Pump Station No. 17 Improvements.*

Table 3-2: Expected Sanitary Sewer Demand

Site Layout	Total Residential Dwellings	Proposed Additional Flow (gpm)	Available Capacity (Pump Station 17/18)	
Full Build Out	450	1,119	No	No
Small Lot Residential	68	169	Yes	No
Large Lot Residential	44	110	Yes	No
Multifamily/Commercial	164*	523	No	No

*Layout includes total commercial building areas of 33,500 square feet.

3.3.3 Stormwater Management

Flat site grades drain slowly via historic channels to wetlands. No existing storm facilities or infrastructure are currently located on the study site, and no known storm outfalls discharge onto the site from adjacent development.

City of Coos Bay design standards require detention of stormwater. Additionally, with the number of wetlands on the site, additional stormwater treatment requirements will likely be needed for any wetland fill permits through DEQ/DSL. Future design would need to integrate piped conveyance, open swales, and detention facilities. A critical factor for onsite storm design will be the need to retain the functionality and hydrology patterns of existing wetlands where possible.

3.3.4 Transportation and Access

The site is isolated; transportation routes are limited by geography to one primary connection between the Coos Bay Eastside and major travel corridors serving the rest of the city. Immediate access into the site today is via unimproved segments of First Avenue connecting to D Street and Coos River Highway (OR 241). Whie there are other routes that connect north to US 101 north of the McCullough Bridge and south to US 101 near the junction with OR 42, the site is critically dependent on the US 101/OR 241 corridor capacity.

The full build out development will generate approximately 200–400 vehicle trips during peak hours, depending on final residential unit count and commercial use. A preliminary review of four key intersections along the primary access corridors identifies potential traffic impacts requiring mitigation.:

- **US 101 / OR 241 / Bunker Hill Intersection Complex**: The current highway junction involves multiple, closely spaced intersections and a coordinated signal system to serve major highway

movements that is complicated by steep grade and numerous local road connections. Congestion and queuing at the signals can extend through multiple intersections and block local street access. Reports of severe congestion and backup during morning peak hour was a repeated theme at neighborhood meetings.

Traffic volumes through the highway junction are estimated at more than 30,000 vehicles per day with peak volumes of 2,400 to 2,600 vehicles per hour. Project traffic will increase demand through this intersection and exacerbate left-turn delays and queue storage constraints.

Despite the concerns about congestion and queuing, the highway junction and nearby intersections are not identified as a safety priority (i.e., a section of roadway ranked in the worst 15 percent based on crash frequency, crash severity, and crash rates) in the Oregon Department of Transportation (ODOT) Safety Priority Index System (SPIS).

Major improvements, such as lane additions or geometric redesign are likely to be very expensive given the topography, nearby railroad viaduct, and abutting development. Improvements are likely limited to signal timing optimization and possible turn-lane extensions with an estimated cost $500K–$1M.

- **Olive Barber & OR 241 Intersection**: With priority given to the highway through traffic and stop-control for Olive Barber Road, left-turn turn movements from Olive Barber Road to OR 241 westbound can experience long delays. The site traffic is most likely to be traveling on the highway through this intersection, which will contribute to longer delays for traffic on Olive Barber Road but will not affect most travelers.

  The Coos County Transportation System Plan (TSP)[1] identifies a future traffic signal at this intersection as a medium priority project. Current costs for a signal and approach improvements typically range from $1M-$1.5M.

- **D Street & 6th Avenue:** With the Coos Bay Eastside development, the current traffic control (3-way stop at a 4-leg intersection) will need to be revisited. It does not conform with current practices and conflicts will increase with the addition of project traffic. Current volumes (600 trips/peak hour) are below signal warrant thresholds; however, project-generated traffic (200–400 trips) may approach 800–1,000 trips during the peak hours.

  Potential traffic control changes could involve a change to all-way stop with intersection approach modification; it is unlikely that a signal would be warranted. Intersection improvement costs are likely to be below $200K.

- **1st Street & D Street Offset Intersection**: Substandard geometry and grade separation create operational challenges; current traffic volumes are low. Project traffic may warrant geometric or traffic control modifications, but feasibility and cost are uncertain pending detailed analysis.

Proportionate Share Assumption. Based on project-generated trips as a percentage of total intersection volumes (25–40 percent at key intersections), the developer can expect responsibility for approximately $1M in off-site intersection improvements, with the understanding that final obligations will be

determined through traffic impact analysis and coordination with the City of Coos Bay and ODOT. Signal warrant analysis, queuing studies, and coordination with any concurrent city/county transportation master plan updates are recommended before final design. Additionally, this assumes larger scale improvements (bridge replacement) would be a shared cost with other partners.

3.3.5 Public Services

Public services of note located near the site include the Millicoma Middle School and the Eastside Boat Ramp and Parking facility.

4.0 Public Outreach and Community Feedback

4.1 Outreach Process

The study included a comprehensive outreach process designed to engage the community and gather meaningful input. This process ensured that residents and stakeholders had an opportunity to understand the project and provide feedback. Public outreach combined structured public events, stakeholder meetings, and written comment collection to ensure transparency and to gather community priorities and concerns. Outreach activities documented in project records included two public open houses, a project stakeholder meeting with City/Port officials and the consultant team, distribution of presentation materials, and collection of written comments and public testimony. Key outreach records reviewed for this section include the Open House #1 summary and public comments (March 11, 2026), the Open House #2 draft agenda (March 26, 2026), meeting minutes (March 19, 2026), and compiled public comment forms.

4.1.1 Attendance and Participation

Open House #1 (March 11, 2026) drew approximately 70–80 attendees, with 23 written comment submissions collected at or shortly after the event. The project team also held a stakeholder meeting documented in the March 19, 2025 minutes and conducted follow-up briefings with Port Commissioners and City representatives. The outreach sequence continued into late March 2026, where approximately 50 attendees gathered at a second open house focused on detailed offsite cost analysis and scenarios.

4.1.2 Key Themes from Public Comments and Meetings

Community feedback revealed several consistent themes:

- Infrastructure and Traffic Safety Concerns: The most frequently expressed concern related to transportation capacity and safety, particularly congestion on local roads and capacity constraints at US 101/OR 241 intersections. The Isthmus Slough Bridge was repeatedly called out as structurally near end-of-life and a critical constraint to increased development traffic.
- Public Services and Emergency Response: Residents noted perceived deficiencies in local police and fire services and raised concerns about emergency access during peak school-related traffic periods.
- Environmental and Site Condition Worries: Many commenters expressed objections to residential development due to the site's history as dredge fill, groundwater and flooding concerns, tsunami risk, and the prevalence of wetlands. Questions about the technical stability of the fill and the need for deep foundations or ground improvement were common.

- Preference for Alternative Uses or Partial Development: A large share of the public expressed interest in non-residential alternatives such as parks, trails, sports fields, a community center, dog park, or limited waterfront commercial uses (restaurants, trail access, fishing docks) that would generate revenue while minimizing traffic and service demands.
- Support for Housing with Conditions: Several commenters supported housing development to address community housing shortages but emphasized the need for infrastructure investments, protections against short-term rentals (Airbnb conversions), and designs that minimizes impacts on existing neighborhoods.

4.1.3 Quantitative Sentiment

Materials presented at the first open house indicated that roughly 79% of respondents were opposed to residential development while about 21% were in favor, based on event comment tallies. Written public comments and recorded meeting questions reflect substantial local opposition and a diverse set of alternative recommendations.

4.1.4 How Outreach Informed the Feasibility Analysis

Public input directly influenced the scope of alternatives analyzed in the feasibility study. Specifically, concerns about traffic and emergency access prompted a deeper assessment of intersection-level offsite costs and staging scenarios that reduce peak-trip generation. Environmental concerns reinforced the need to preserve significant wetland acreage and to evaluate mitigation options thoroughly. Community preference for recreational or limited commercial uses led the project team to include lower-impact alternative scenarios (parks, trails, small waterfront commercial) as potential Port uses should residential development prove infeasible.

5.0 Full Development Scenario and Market Analysis

The feasibility analysis demonstrates that the Eastside property is constrained by a combination of physical, regulatory, infrastructure, and economic factors that collectively limit its development potential. While the site represents one of the largest remaining undeveloped land resources within the Coos Bay urban area, these constraints drive development costs to levels that substantially exceed what the local market can support. Findings from the Johnson Economics market study reinforce this conclusion and provide critical context regarding achievable pricing, demand conditions, and realistic development expectations.

5.1 Full Development Residential Buildout

This scenario represents a comprehensive evaluation of full residential development with neighborhood-serving commercial space. It most closely reflects the site layout and development concept originally prepared in the early 2000s and represents the maximum development intensity evaluated in this study. As such, it also carries the highest infrastructure improvement requirements and the greatest exposure to the site's geotechnical, environmental, and regulatory constraints. See Appendix D for site layout.

5.1.1 Site Constraints and Opportunities

Geotechnical conditions across the site are not conducive to full development without significant ground improvement. Risk of soil liquefaction and lateral spread increases with proximity to the shoreline, with major cost implications for any development extending beyond the southeastern corner. Existing sanitary

sewer depths adjacent to the site can serve the southeast corner by gravity; any development deeper into the site will require construction of an onsite pump station.

The scattered distribution of wetlands across the site makes it difficult to avoid impacts regardless of layout configuration, increasing mitigation costs and regulatory complexity. Higher-density residential development further reduces opportunities to retain wetlands within individual lot limits, increasing per-unit wetland mitigation expenses.

5.1.2 Infrastructure Requirements

Water service will require a looped main connection to the existing system at B Street and McKay Street, with offsite improvements necessary to connect into the existing distribution network.

Sanitary sewer service will require a new onsite pump station and force main to connect to last manhole onsite that can be gravity-served, and capacity upgrades needed to Pump Stations No. 17 and 18 depending on final development density. Eight-inch gravity mains will serve the site internally. Stormwater conveyance piping, water quality treatment facilities, and detention facilities will be needed to meet City stormwater requirements.

The current City of Coos Bay Transportation System Plan (TSP) does not identify any street classification higher than Local immediately adjacent to the site. Local streets will be designed per City of Coos Bay standards. Offsite transportation improvements will likely be required at four intersections: US 101/OR 241, Olive Barber/OR 241, D Street/OR 241 (T-intersection), and the local hillside exit north of US 101.

Ground improvements will be extensive and time-consuming. The entire site will require a ground surcharge program along with recompaction of the top 5 feet of dredge soil. Development within Geotechnical Zones 2 and 3 will additionally require deep foundations or deep soil mixing to mitigate liquefaction concerns, increasing costs dramatically relative to the southeastern corner.

Current zoning allows single-family residential use. Rezoning to a Low-Density Residential (LDR) overlay would be required to accommodate multifamily components.

5.1.3 Cost Estimation Methodology

The full buildout scenario presents significant challenges for cost estimation. The scale of site preparation, the volume of onsite earthwork and infrastructure quantities, and the uncertainty associated with the rolling soil compaction program outlined in the geotechnical report collectively make a comprehensive site-wide cost estimate highly dependent on assumptions that may not hold if a developer were to proceed. Specifically, a full-site estimate would require assumptions regarding soil consolidation timelines, compaction phasing sequences, and the interdependency of grading operations across the entire property, variables that cannot be reliably quantified at a feasibility level of analysis.

It is important to note that this study did not attempt to quantify all street improvement, lot development, and site preparation costs across the entire subdivision. Instead, a more strategic and defensible approach was adopted, as described below.

A targeted first-phase development area was identified within the southeastern corner of the site, representing the most constructible and infrastructure-accessible portion of the property. This area was selected because it benefits from the most favorable geotechnical conditions, the shortest utility extension distances, and the most compact and efficient lot layout achievable on the site. The cost analysis

was then structured to answer a specific question: what is the per-lot development cost for the best-case portion of the site, inclusive of that area's proportional share of site-wide and offsite infrastructure obligations?

The per-lot cost estimate for the targeted first-phase area incorporates the following components:

- Street and utility infrastructure construction within the first-phase area
- Wetland fill and mitigation costs attributable to the first-phase area. It is assumed that overall 50% of the wetlands onsite would need to remain in place as part of the full build out scenario. Based on the assumed wetlands to be saved, it was determined that there would be approximately 45.6 acres of disturbed land on the site.
- Earthwork and ground improvement costs specific to this portion of the site
- A proportional allocation of offsite infrastructure obligations, including sanitary sewer pump station improvements, intersection improvements, and other system-level upgrades required to serve the full buildout

Offsite infrastructure costs - including traffic improvements, sanitary sewer pump station upgrades, and geotechnical ground improvements beyond the first-phase boundary - are sized to serve the full buildout of approximately 450+ residential units. The proportional share allocated to the first-phase area therefore reflects a conservative assumption, as these system-level costs would ultimately be distributed across all development phases rather than borne solely by the initial phase.

This approach provides a practical and conservative test of feasibility. If the per-lot development cost for the most efficient and compact portion of the site does not meet market thresholds, it is reasonable to conclude that subsequent phases - which face greater geotechnical constraints, longer infrastructure extensions, and higher per-lot improvement costs - would be equally or more challenging to justify financially. Conversely, this method avoids overstating costs by not requiring speculative assumptions about the full rolling compaction schedule, phasing interdependencies, or simultaneous development of the entire site.

Table 5-1: Street and Utility Construction Estimate Within First Phase Area

Cost Base Items[2]	Total Cost
Mobilization and Demolition	$200,000
Streets and Paths	$234,183
Storm Drainage	$131,473
Sanitary Sewer	$91,475
Water	$112,405
Franchise Utilities	$170,000
Erosion and Sediment Control	$50,000
Ground Improvements	$3,353,400*
Pump Station Improvements	$102,700*
Off-site Transportation Improvements	$40,800*
Wetland Mitigation	$594,000
Soft Costs	$232,047
Total	**$5,312,483**
Cost Per Unit without Contingency	**$312,499**

*See Table 5-2 for further clarification regarding line item cost

Table 5-2: Proportional Allocation of Costs Outside of Phase 1 Applied per lot

Cost Estimate Schedule	Quantity	Unit Price	Total Cost	Notes
Ground Improvements			**$3,353,400**	
Ground Surcharge	2.7 acres	$ 315,000	$850,500	1
Dredge Sand Recompaction	2.7 acres	$ 41,000	$110,700	
Deep Soil Mixing	2.7 acres	$ 886,000	$2,392,200	2
Pump Station Improvements			**$102,700**	
Pump Station No. 17 Upgrade	17 lots	$ 800	$ 13,600	3
Pump Station No. 18 Upgrade	17 lots	$ 800	$13,600	3
New On-site Pump Station	17 lots	$ 4,444	$75,500	3
Traffic (offsite)			**$40,800**	
Proportionate Share of Intersection Improvements	Lump Sum	$ 37,800	$ 37,800	4
600 feet of Roadway and Sidewalk	Lump Sum	$ 3,000	$3,000	4

Notes:

1. Unit price for ground surcharge is based on an assumed rolling surcharge program that will split the entire project site into three phases (45.6 acres developed following wetland preservation divided into 3

phases), moving fill from one phase to the next. All fill for the surcharge program is expected to be imported fill.

2. Unit price for deep soil mixing is based on a $40,000,000 estimate for the entire proposed development site. The price was then divided across the assumed disturbed area of the site to obtain a per acre cost of the site.
3. Pump station improvement costs are based on City provided bid data and a CPI adjusted pump station upgrade estimate from the Wastewater Master Plan. New onsite pump station was assumed to be $2,000,000 based on recent bids provided to the City for Pump Station No. 27 and then divided across the total number of lots to get a per lot cost basis. Pump station upgrade costs were obtained by adjusting the stated improvement costs for Pump Station No.17 in the Wastewater Master Plan from 2006 to 2026 pricing (CPI data - 62%). Similarly, the upgrade costs were then divided across the total number of lots to obtain a per lot cost. It was assumed for this exercise that the upgrades for both stations would be similar in cost.
4. Offsite traffic improvements costs are based on the proportionate share expected for the entire site ($1,000,000) and then adjusted to represent the proportionate share for the 17 lots looked at in this scenario.

5.2 Market Analysis Summary and Implications

The Johnson Economics market study (Appendix E) confirms that the Coos Bay and Coos County housing markets are characterized by persistent supply constraints and steady demand, but also by moderate pricing levels that are closely tied to local income conditions. The rental housing market, in particular, reflects a long-standing imbalance between supply and demand. Very limited multifamily construction has occurred over the past two decades, resulting in consistently low vacancy rates that have generally remained below five percent and are currently estimated at approximately 3.2 to 3.3 percent. Periods of strong rent growth, particularly between 2021 and 2023, demonstrate the market's responsiveness to constrained supply; however, rents have since stabilized at levels averaging approximately $1.27 to $1.28 per square foot. These conditions indicate clear unmet demand for rental housing, but also highlight that achievable rent levels remain insufficient to offset the unusually high development costs associated with the Eastside site.

Conditions in the for-sale housing market similarly reflect a combination of demand strength and pricing limitations. Median home prices are approximately $314,000 within the City of Coos Bay and $337,000 across Coos County as of 2025. While newly constructed homes typically command a premium over the broader market, often in the range of 40 to 50 percent, this still translates to expected new-home pricing generally in the range of approximately $450,000 to $500,000. The supply of new homes remains extremely limited, accounting for only a small share of total transactions, which suggests that demand exists but is constrained by development feasibility rather than market absorption. Homes that are delivered to the market tend to sell within relatively short timeframes, further reinforcing the presence of underlying demand. However, these pricing levels establish a clear ceiling on what the market can support and are significantly below the revenue levels required to offset development costs on the Eastside property.

[2] Cost items not included: Additional cut/fill grading, signage and striping, soft costs other than engineering services, jurisdictional fees, compaction/soil testing, home construction, land purchase cost, SDC fees.

The commercial market analysis indicates relatively stable but modest demand conditions. Recent development activity has been limited and largely concentrated along established commercial corridors, particularly near Highway 101. Vacancy rates in retail and commercial spaces are generally low, typically ranging between two and four percent, which reflects stable occupancy but not necessarily strong expansionary pressure. While the market appears capable of supporting neighborhood-serving commercial uses such as small-scale retail or restaurants, it does not demonstrate sufficient depth to support large-format or speculative commercial development at this location. As a result, any commercial component on the Eastside site would likely need to be limited in scale and carefully aligned with local demand.

5.3 Feasibility Gap

When these market conditions are compared to the cost structure associated with developing the Eastside property, a substantial and persistent feasibility gap becomes evident. Detailed cost analysis indicates that a typical single-family home on the site would need to be sold at approximately $788,000 to achieve financial feasibility under standard private development assumptions. This required price point is significantly higher than the estimated market-supported range of approximately $450,000 to $500,000 for new homes in Coos Bay. The resulting gap, on the order of $250,000 to $350,000 per unit, reflects a fundamental mismatch between development costs and achievable market values.

This disparity is driven primarily by site-specific cost factors that are largely unavoidable. Extensive geotechnical mitigation is required to address the presence of deep, compressible soils and seismic risks, necessitating ground improvement techniques and deep foundation systems. Wetland impacts further constrain development and introduce substantial mitigation costs, in addition to regulatory complexity and permitting timelines. Infrastructure requirements, including transportation improvements, utility extensions, and stormwater management systems, represent another major cost component. Together, these factors create a cost structure that is significantly higher than that of typical residential development sites and that cannot be reconciled with prevailing market conditions.

5.4 Subsidy and Financial Sensitivity

Financial sensitivity testing demonstrates that even substantial public investment would be insufficient to fully close the feasibility gap under current conditions. A subsidy equal to approximately 30 percent of per-lot development and infrastructure costs would reduce overall project costs but would still leave a large gap between required sale prices and market-supported values. When a 30 percent subsidy is applied to total development costs, including both infrastructure and vertical construction, the gap narrows considerably but remains meaningful. Under this scenario, required sale prices would still exceed typical market levels, indicating that additional subsidy, cost reductions, or revenue enhancements would be necessary to achieve feasibility.

Further analysis suggests that closing the gap entirely would likely require subsidy levels in the range of approximately 35 to 40 percent of total development cost, or alternatively, a combination of strategies that reduce costs and increase achievable revenues. Potential approaches could include reducing unit sizes, simplifying construction methods, increasing development density where feasible, or introducing alternative housing types such as rental units supported by public financing mechanisms. However, each

of these strategies presents practical limitations and does not fundamentally alter the underlying cost challenges associated with the site. As a result, the analysis indicates that private market delivery of housing on the Eastside property is not feasible without an extraordinary level of public intervention.

5.5 Overall Conclusion

The combined technical, market, and financial analyses lead to a consistent and well-supported conclusion. Although the Coos Bay housing market exhibits clear demand for additional housing, the price points that the market can support are not compatible with the cost structure required to develop the Eastside site. The site's geotechnical conditions, environmental constraints, and infrastructure requirements create a structural cost burden that cannot be offset through market revenues alone. This mismatch persists across all development scenarios evaluated in this study, indicating that it is not a function of a particular design approach but rather an inherent characteristic of the site. Accordingly, large-scale residential development on the Eastside property is not financially feasible under current conditions.

6.0 Alternative Development Scenarios

In addition to the full-buildout scenario, four lower impact alternatives were explored, including residential scenarios at varying densities, waterfront commercial options, and lower-impact alternatives such as parks and open space. These alternatives respond to public feedback, particularly concerns raised about traffic generation, neighborhood compatibility, and other community-scale impacts associated with full buildout. Our analysis of these alternatives represents a concept level evaluation that is intended to identify options that may warrant further evaluation.

6.1 Residential Development Scenarios

6.1.1 Small-Lot Single-Family Residential

This scenario focuses on small-lot single-family homes concentrated in the southeastern corner of the site, where geotechnical conditions are most stable and infrastructure connections are most feasible. The approach prioritizes lower-density development that reduces site disturbance and infrastructure burden while serving the local ownership market. See Appendix F for the preliminary site layout.

Site Constraints and Opportunities

Geotechnical conditions improve with distance from the water's edge, making the southeastern corner optimal for minimizing ground improvement costs. Positioning development along the south and east edges reduces earthwork requirements and maintains proximity to existing utilities. The scattered nature of wetlands across the site limits the ability to develop large contiguous areas without impacts; however, lower density reduces the per-lot footprint and may allow greater wetland preservation within individual lot limits. Overall, small-lot development reduces site disturbance and infrastructure demand compared to higher-density alternatives. Existing sanitary sewer depths adjacent to the site limit the developable area without construction of a new pump station.

Infrastructure Requirements

A looped water main connection to the existing system is required, with offsite improvements needed to ensure adequate capacity. Offsite sanitary sewer pump station improvements will also be required;

information provided by the City indicates that nearby pump stations are currently operating at maximum capacity. Stormwater conveyance piping, water quality treatment facilities, and detention facilities will be needed to meet City stormwater requirements.

The current City of Coos Bay Transportation System Plan (TSP) does not identify any street classification higher than Local immediately adjacent to the site. Local streets will be designed per City of Coos Bay standards. Ground improvements for this alternative will be limited to surcharging and recompaction of dredge soil. Utility infrastructure and street construction will need to incorporate flexible connections to accommodate potential soil settlement and liquefaction.

Current zoning allows single-family residential use; no rezoning is anticipated for this alternative.

Table 6-1: Alternative 1 – Small Lot Cost Assumption

Cost Base Items	Total Cost	Notes
Streets and Paths	$751,698	Development within footprint shown
Storm Drainage	$495,433	Development within footprint shown
Sanitary Sewer	$362,970	Development within footprint shown
Water	$391,955	Development within footprint shown
Mobilization and Demobilization	$510,000	
Franchise Utilities	$810,000	Assuming ±12,000 cost per lot
Wetland Mitigation	$2,332,000	Wetland fill and permitting for 10.6 acres of impact
Ground Stabilization	$3,809,200	Assumed recompaction and surcharge improvements
Erosion and Sediment Control	$107,000	Lump Sum proportion of development cost
Pump Station Improvements	$360,000	It is assumed $360,000 is the total share of pump station improvements for the project.
Off-site Transportation Improvements	$ 153,000	Assumed offsite proportion of traffic costs
Soft Costs	$ 710,020	Assumed to be 20% of estimate*
Total Cost of Base Items	**$10,793,276**	
Cost per Lot Without Contingency	**$158,725**	

* 20% of construction cost does not include ground surcharge, wetland mitigation, dredge sand recompaction, or deep soil mixing.

Market Conclusion

A per-lot site development cost of $158,725 does not produce a financially viable residential development under current Coos Bay market conditions.

Understanding the Full Cost to Deliver a Home

The per-lot figure represents only the hard costs of site development: streets, storm drainage, sanitary sewer, water, earthwork/ground improvements, wetland mitigation, pump station improvements, offsite traffic improvements, and soft costs (Table 6.1). It does not include the additional costs required to deliver a finished, sellable home to a buyer. The table below builds from the per-lot site development cost to a total estimated cost per home, using a typical 1,500 SF single-family home consistent with the assumptions in the Johnson Economics market study (April 2026).

Table 6-2: Estimated Minimum Home Sale Price, Excluding Cost of Land

Cost Category	Per Lot/Home	Basis
Site Development Hard Costs (from Table 6.1)	$158,725	AKS Estimate, 68 lots
Home Construction (1,500 SF at $220/SF)	$330,000	Johnson Economics, mid-density scenario
Builder Overhead & Profit (10% of construction)	$33,000	Johnson Economics assumption
Building Permits & Plan Review Fees	$48,000	Johnson Economics/City of Coos Bay fee schedule
Landscaping, Driveway, & Finished Site Improvements	$15,000	Typical allowance, small-lot SFR
Land Acquisition Cost	Not included	Including cost of land will increase total lot and home sale prices
Subtotal: All-In Cost to Deliver a Home	**$584,725**	
Developer Profit (15% of subtotal)	$87,709	Industry standard return for development risk
Estimated Minimum Home Sale Price	**$672,434**	

Local Market Realities

The Johnson Economics market study provides the following data points for the Coos Bay for-sale housing market:

- Median home sale price, Coos Bay (2025): $314,000
- Achievable new home price, 1,500 SF SFR: approximately $472,000
- New home premium over median: approximately 50%, already reflected in the $472,000 figure
- Average market time, Coos Bay: 59 days (indicating healthy demand, but a price-sensitive market)
- Annual price growth (past two years): 1.6% per year, indicating a flattening trend after post-COVID gains
- New home sales volume, Coos Bay: approximately 5 per year since 2020, representing only 1.5% of total home sales

The limited volume of new home sales in Coos Bay confirms that the market is small and price-sensitive. Buyers have demonstrated willingness to pay a premium for new construction, but that premium is

already captured in the $472,000 achievable price. There is no market evidence to support pricing significantly above this level.

Feasibility Gap

Although the 68-lot layout reduces the per-lot site development cost by nearly 50% compared to the Johnson Economics 17-lot scenario ($158,725 vs. $313,004), the improvement is not sufficient to close the viability gap. This is because home construction, builder overhead, fees, and developer profit represent the majority of total development cost, and these figures do not change with lot count. The site development cost would need to be reduced to approximately $46,000 per lot to bring total costs in line with achievable pricing at a 15% developer margin - a reduction of over 70% from the current estimate.

Alternatively, homes would need to sell for approximately $672,000 each to support the current cost structure. This is 43% above the achievable new home price identified by Johnson Economics and more than double the Coos Bay median home price. There is no market evidence to support this pricing level.

The Johnson Economics study concludes: *"The unusually high site development costs make either residential program unviable under current or anticipated achievable pricing... We would not expect this project to proceed under either scenario, or any other likely scenario for the foreseeable future without significant public subsidy."* The 68-lot alternative, while a meaningful improvement in per-lot efficiency, does not change this fundamental conclusion.

Recommendation

This development scenario does not support further pursuit as a market-rate residential project. Every home sold under current conditions would result in an estimated loss of approximately $200,000, before accounting for land acquisition costs. No rational private developer or homebuilder would proceed under these terms.

If the City wishes to advance residential development on this portion of the Eastside site, the following steps would be necessary:

1. Identify and quantify available public subsidy sources (e.g., urban renewal, CDBG, state housing infrastructure grants, ARPA funds) to determine whether the approximately $200,000 per-lot viability gap can be feasibly bridged.
2. Evaluate alternative land uses or phasing strategies for portions of the broader 110-acre site where geotechnical conditions and infrastructure costs may be more favorable.
3. Consider alternative housing typologies such as rental apartments or attached housing that may achieve higher density and distribute site development costs across more units, though these would require their own feasibility analysis.

Without significant public investment or a fundamental change in site development costs, this scenario is not recommended for further engineering or design investment.

6.1.2 Small-Lot Multifamily Residential (High-Density) and Commercial

This scenario combines single-family residential homes with a multifamily component consisting of 3-story walk-up apartments or similar mid-rise housing, also concentrated in the southeastern corner of the site.

The approach maximizes housing units per acre while maintaining a mixed-density character. See Appendix F for the preliminary site layout.

Site Constraints and Opportunities

Geotechnical conditions improve with distance from the water's edge, supporting the southeastern corner for multifamily development. Positioning development along the south and east edges reduces earthwork and maintains proximity to existing utility infrastructure. However, multifamily development compounds wetland constraints by requiring additional parking and circulation area, increasing the total area of disturbance. Higher density also reduces opportunities to retain wetlands within lot limits, increasing per-unit mitigation costs.

Infrastructure Requirements

A looped water main connection to the existing system is required, with offsite improvements necessary. Sanitary sewer service will require a new onsite pump station and force main to Pump Station No. 18 for portions of the site where gravity-based service cannot be achieved. Parking lots meeting applicable City requirements must be constructed for the multifamily portion. Utility infrastructure and street construction will need to incorporate flexible connections to accommodate potential soil settlement and liquefaction.

The current City of Coos Bay TSP does not identify any street classification higher than Local immediately adjacent to the site. Local streets will be designed per City of Coos Bay standards. Stormwater conveyance piping, water quality treatment facilities, and detention facilities will be needed to meet City stormwater requirements.

Current City zoning does not allow multifamily residential use beyond duplexes; rezoning to a higher-density overlay (e.g., LDR overlay) would be required to accommodate apartments or similar multifamily housing.

Market and Economic Considerations

Multifamily development can generate higher revenue per acre than single-family alternatives; however, elevated vertical construction costs and parking requirements may make unit economics challenging on a constrained site. A detailed rent-level analysis and demand assessment for 3-story walk-up product in the Coos Bay market is required to determine feasibility. A comprehensive pro forma analysis is necessary to evaluate whether achievable rents can support the cost structure of this product type.

Table 6-3: Alternative 2 – Multifamily & Commercial Cost Assumption

Cost Base Items	Total Cost	Notes
Streets and Paths	$1,446,141	Development within footprint shown
Storm Drainage	$634,871	Development within footprint shown
Sanitary Sewer	$397,760	Development within footprint shown
Water	$474,285	Development within footprint shown
Multi-family and Commercial**	$4,031,871	Site development within multifamily/commercial footprint. Does not include vertical building costs
Mobilization and Demobilization	$1,340,000	
Franchise utilities	$560,000	Lump sum estimate
Wetland mitigation	$2,970,000	13.5 acres of impact
Ground Stabilization	$10,501,200	Assumed compaction and surcharge improvements
Erosion Control	$177,000	Lump Sum of Construction Cost
Pump Station Improvements	$2,720,000	It is assumed $720,000 is the offsite share of pump station improvements and a new pump station is required for commercial portion of development
Traffic (offsite)	$368,000	Assumed offsite proportion of traffic costs
Soft cost*	$2,429,986	Assumed to be 20% of estimate
Total Base Cost	**$28,051,114**	
Cost per Unit Without Contingency	**$171,043**	

* 20% of construction cost does not include ground surcharge, wetland mitigation, dredge sand recompaction, or deep soil mixing.

** Assumed site development cost for multifamily/commercial portions of the site was $15/12 per square foot, respectively.

Market Conclusion

At a per-unit site development cost of $171,043, total development costs substantially exceed achievable revenues across all three project components. The project-wide viability gap makes this scenario unviable as a market-rate development without significant public subsidy.

Understanding the Cost Estimate

The feasibility-level cost estimate for Scenario 6.1.2 totals $28,051,114 across 164 housing units, yielding a per-unit site development cost of $171,043. This figure includes streets and paths, stormwater, sanitary sewer, water, multifamily and commercial site infrastructure, earthwork/ground surcharge, offsite traffic improvements, and engineering soft costs.

This estimate does not include:

- Home construction costs (SFR or multifamily vertical construction)
- Land acquisition
- Builder/developer overhead and profit
- Landscaping, driveways, and finish improvements
- Additional cut/fill grading, signage, striping, compaction testing
- Jurisdictional fees

The sections below build the full development cost and compare it to achievable market revenues for each of the three project components.

For-sale Small-Lot Single-Family Homes (56 Lots, 1,500 SF Homes)

Using the Johnson Economics mid-density assumptions and a typical 1,500 SF home:

Table 6-4: Alternative 2 – Multifamily & Commercial Cost Assumption

Cost Category	Per Home	Source / Basis
Site Development Hard Costs (pro-rata share)	$171,043	AKS estimate ($28.05M / 164 units)
Home Construction (1,500 SF x $220/SF)	$330,000	Johnson Economics, mid-density scenario
Builder Overhead and Profit (10% of construction)	$33,000	Industry standard
Building Permits / Plan Review	$48,000	Johnson Economics, Coos Bay fee schedule
Landscaping, Driveway, and Finish Improvements	$15,000	Typical allowance, small-lot SFR
Land Acquisition	TBD	Not included; increases gap further
Subtotal - All-In Cost	**$597,043**	
Developer Profit (15%)	$89,556	Industry standard return for risk
Estimated Minimum Home Sales Price	**$686,599**	

Table 6-5: Single-family Residential Viability Summary

Metric	Value
Total Cost to Deliver a Finished Home	$686,599
Achievable Sale Price (Johnson Economics)	$472,005
Shortfall Per Home	($214,594)
Value as % of Cost	68.7%
Total SFR Shortfall (56 homes)	**($12,017,266)**

Even without developer profit, the all-in cost of approximately $597,043 per home exceeds the achievable price by ±$125,000 (value as % of cost = 79.1%). A viable project typically requires value as a percent of

cost at or above 100% before developer profit, and approximately 115% when a reasonable developer return is included.

Multifamily Rental Apartments (9 Buildings, 108 Units)

The Johnson Economics market study indicates new rental units in Coos Bay could command a 50-60% premium over the current average lease rate of $1.27/SF, yielding approximately $1.91 to $2.03/SF for new product. The study's achievable rent range is $1,321 to $2,096 per month, with an average unit size of 830 SF.

Table 6-6: Revenue Analysis (Per Building, 12 Units)

Revenue Item	Monthly	Annual
Average Achievable Rent/Unit (midpoint: $1,709)	$1,709	$20,508
Gross Potential Rent (12 units)	$20,508	$246,096
Less: Vacancy (5%)	($1,025)	($12,305)
Less: Operating Expenses (35% of EGI)	($6,819)	($81,827)
Net Operating Income (NOI)	**$12,664**	**$151,964**
Total NOI (108 units)	**$113,973**	**$1,367,679**

Table 6-7: Cost Analysis (Per Building)

Cost Category	Per Building	Source / Basis
Vertical Construction	$3,000,000	Estimate
Pro-Rata Site Development ($171,043 x 12 units)	$2,052,516	AKS estimate
Permits (12 units x $20,500)	$576,000	Coos Bay fee schedule
Developer Overhead (10% of construction)	$300,000	Industry standard
Total Development Cost Per Building	**$5,928,516**	

Table 6-8: Cost Analysis (All 9 Buildings)

Cost Category	Total (9 Buildings)	Source / Basis
Vertical Construction	$27,000,000	$3,000,000 x 9 buildings
Pro-Rata Site Development	$18,472,644	$171,043 x 108 units
Permits	$5,184,000	$48,000 x 108 units
Developer Overhead	$2,700,000	10% of construction
Total MF Development Cost	**$53,356,644**	

Table 6-9: Multifamily Capitalized Value vs. Cost

Metric	Per Building	All 9 Buildings
Annual NOI	$151,964	$1,367,679
Capitalized Value at 6.5% Cap Rate	$2,337,908	$21,041,215

Total Development Cost	$5,928,516	$53,356,644
Shortfall	**($3,590,608)**	**($32,315,429)**
Value as % of Cost	**39.4%**	**39.4%**

At a 6.5% capitalization rate (typical for a secondary/rural Oregon market), the stabilized value of the entire multifamily component is roughly 39% of the cost to build it. A developer would lose approximately $3.6 million per building, or $32.3 million across all nine buildings. Even at an aggressive 5.0% cap rate, the total capitalized value would be short of targets.

Rents would need to reach approximately $3,500 to $4,000 per month per unit to support the cost structure at a 6.5% cap rate. This is 67-91% above the Johnson Economics achievable range and well outside the Coos Bay rental market.

Commercial Component (6 Buildings, 33,500 SF)

The Johnson Economics study recommends only small-scale, neighborhood-serving commercial (coffee shop, small grocery, professional office) and explicitly advises against larger or speculative retail. Achievable lease rates are estimated at $3,900 to $4,033 per month (NNN) for small commercial spaces.

Table 6-10: Commercial Revenue Analysis

Revenue Item	Monthly	Annual
Achievable Lease Revenue (6 spaces, avg. $3,967/mo)	$23,800	$285,600
Less: Vacancy (5%)	($1,190)	($14,280)
Effective Gross Income	**$22,610**	**$271,320**
Less: Management/Reserves (10% of EGI, NNN lease)	($2,261)	($27,132)
Net Operating Income	**$20,349**	**$244,188**

Table 6-11: Commercial Capitalized Value

Metric	Value
Annual NOI	$244,188
Capitalized Value at 7.0% Cap Rate	$3,488,400

While the commercial component adds some project value, the Johnson Economics study cautions that the Eastside site does not benefit from highway access and is in a primarily residential neighborhood. Speculative retail is not recommended. The commercial component is best viewed as a neighborhood amenity that supports residential demand rather than a significant revenue driver.

It is worth noting that the Teakwood Plaza, built in 2024 along Highway 101, already has vacancies. The Eastside site's interior neighborhood location, without highway visibility or pass-through traffic, limits the achievable commercial tenant base to neighborhood-serving uses only. Filling 33,500 SF of commercial space in this location represents a significant absorption challenge for the Coos Bay market.

Table 6-12: Project-wide Viability Summary

Component	Units/Buildings	Est. Total Cost	Est. Total Value	Gap
For-sale SFR	56 homes	$38.4M	$26.4M	($12.0M)
Multi-family	108 units / 9 bldgs	$53.4M	$21.0M	($32.3M)
Commercial	6 bldgs / 33,500 SF	Incl. in site costs	$3.5M	Nominal
Project Total	164 units + commercial	~$91.8M	~$50.9M	~($40.8M)
Value as % of Cost				**55.5%**

The project-wide value-to-cost ratio of 55.5% means that for every dollar invested in this development, only 55 cents of value is created. This is before any allocation for land acquisition, which would widen the gap further.

Feasibility Gap

All three revenue components—single-family homes, apartments, and commercial space—fail to cover their respective development costs. This shortfall cannot be resolved simply by changing the product mix among for-sale homes, multifamily, and commercial uses; the gap is structural rather than a matter of allocation.

The per-unit site development cost of $171,043, while 45% lower than the $313,000 per-lot figure in the Johnson Economics 17-lot scenario, does not close the gap. Vertical construction, extensive earthwork within the commercial area, overhead, and developer profit constitute the majority of total development cost, so lower site costs alone are insufficient to reach financial viability.

On the for-sale side, home prices would need to exceed $686,000 for a 1,500 SF residence to attract private investment in the single-family component. This is approximately 45% above the achievable market price and well outside the range supported by current Coos Bay market data. For multifamily, rents would need to be in the $3,500–$4,000 per month range to support the cost structure, which is nearly double the Johnson Economics achievable range and not supportable in the local market.

The commercial component also carries substantial risk: 33,500 SF of interior-location retail without highway access presents significant absorption concerns, particularly given existing vacancy at highway-fronting properties such as Teakwood Plaza. Additionally, required rezoning for multifamily beyond duplexes introduces regulatory risk and timeline uncertainty, and 13.5 acres of wetland within the development area add mitigation cost exposure and permitting complexity. Given these factors, private developers and lenders would not proceed with a project whose stabilized value is only 55% of total development cost, whereas typical lender thresholds require value-to-cost ratios of 100% or higher before allowing developer profit.

Recommendation

This development scenario does not warrant further pursuit as a market-rate residential and commercial project. Every home/apartment sold under the current market conditions would result in a loss of

~~$215,000 per lot and $3,590,000 per multifamily apartment building. The viability gap across the project~~ is too large to bridge through product mix optimization alone.

If the City wishes to advance a mix of residential single/multifamily and commercial development on this portion of Eastside site, the following steps would be necessary:

1. Identify and quantify available public subsidy sources (e.g., urban renewal, CDBG, state housing infrastructure grants, ARPA funds) would be required to bridge the viability gaps of $215,000 and $3,590,000.
2. Evaluate alternative land uses or phasing strategies for portions of the broader 110-acre site where geotechnical conditions and infrastructure costs may be more favorable.

Without significant public investment or a fundamental change in site development costs, this scenario is not recommended for further engineering or design investment.

6.1.3 Large-Lot Single-Family Residential

This scenario explores large-lot (2 to 5+ acre) single-family homes with lot frontage extending to the waterfront and homes clustered in the southeastern corner of the site. The approach prioritizes lower density and preservation of open space while targeting the high-end ownership market. See Appendix F for the preliminary site layout.

Site Constraints and Opportunities

Geotechnical conditions improve with distance from the water's edge, supporting this location for residential construction. Positioning development along the south and east edges reduces earthwork and maintains infrastructure proximity. Lower density increases opportunities to retain wetlands within lot limits, reducing per-unit wetland mitigation costs. However, large homes and reduced lot yield increase development cost per lot, potentially limiting market feasibility.

Infrastructure Requirements

A looped water main connection to the existing system is required, with offsite improvements necessary to reach existing connection points. Gravity sanitary sewer mains will be adequate to service the entire site; no new onsite pump station is required. However, capacity improvements to Pump Stations 17 and 18 will be required. Stormwater conveyance piping, water quality treatment facilities, and detention facilities will be needed to meet City stormwater requirements.

The current City of Coos Bay TSP does not identify any street classification higher than Local immediately adjacent to the site. Local streets will be designed per City of Coos Bay standards. Current City zoning does not allow lots exceeding 7,500 square feet; rezoning to a lower-density overlay (e.g., LDR overlay) would be required to accommodate larger lot sizes.

Table 6-13: Alternative 3 – Large Lot Cost Assumption

Cost base items total:	Total cost	Notes
Streets and paths	$918,985	Development within footprint shown
Storm drainage	$580,127	Development within footprint shown
Sanitary sewer	$384,240	Development within footprint shown
Water	$462,475	Development within footprint shown
Mobilization and Demobilization	$670,000	Lump sum estimate
Franchise Utilities	$440,000	Lump sum estimate
Wetland Mitigation	$2,948,000	13.5 acres of impact
Ground Stabilization	$6,236,400	Assumed compaction and surcharge improvements
Erosion and Sediment Control	$130,000	Lump sum estimate
Pump Station Improvements	$360,000	Proportional pump station improvements of $360,000 assumed
Traffic (offsite)	$103,000	Assumed offsite proportion of traffic costs.
Soft cost	$809,765	Assumed to be 20% of estimate
Total cost base estimate	**$14,042,992**	
Cost per unit without contingency	**$319,159**	

* 20% of construction cost does not include ground surcharge, wetland mitigation, dredge sand recompaction, or deep soil mixing.

Market Conclusion

At a per-unit site development cost of $319,159, total development costs substantially exceed achievable revenues. The viability gap makes this scenario unviable as a market-rate development without significant public subsidy.

Understanding the Cost Estimate

The feasibility-level cost estimate for Scenario 6.1.3 totals $14,042,992 across 44 housing units, yielding a per-unit site development cost of $319,159. This figure includes streets and paths, stormwater, sanitary sewer, water, earthwork/ground surcharge, offsite traffic improvements, and engineering soft costs.

This estimate does not include:

- Home construction costs
- Land acquisition
- Builder/developer overhead and profit
- Landscaping, driveways, and finished improvements
- Additional cut/fill grading, signage, striping, compaction testing
- Jurisdictional fees

The sections below build the full development cost and compare it to achievable market revenues.

Key Takeaway

At a per-lot site development cost of $319,159, total development costs exceed achievable sale prices across both the large-lot estate tier and the standard-lot tier. The project-wide viability gap of approximately $7.5 million, combined with unproven demand for $2M+ homes in Coos Bay, makes this scenario financially unviable without significant public subsidy or a fundamental shift in the local luxury market.

Table 6-14: Scenario Parameters

Parameter	Value
Total Lots	44
Large Lots (2+ acres)	18
Standard Lots (1/4+ acre)	26
Total Developed Area	Per site layout
Total Hard Cost (Site Development)	$14,042,992
Cost Per Lot (without contingency)	$319,159

Large-Lot Estate Homes (18 Lots, 2+ Acres Each)

These lots target the premium ownership market with waterfront or near-waterfront positioning. Using the Johnson Economics low-density assumptions (3,000 SF home, $1,132,800 achievable price):

Table 6-15: Scenario Parameters

Cost Category	Per Home	Source / Basis
Site Development Hard Costs	$319,159	AKS estimate ($14.04M / 44 lots)
Home Construction (3,000 SF x $275/SF)	$825,000	Premium construction, estate-quality finishes
Builder Overhead and Profit (10%)	$82,500	Industry standard
Building Permits / Plan Review	$90,667	Johnson Economics, low-density scenario
Landscaping, Driveway, and Finish Improvements	$45,000	Large-lot allowance, extended driveways
Land Acquisition	TBD	Not included; increases gap further
Subtotal - All-In Cost	**$1,362,326**	
Developer Profit (15%)	$204,349	Industry standard return for risk
Estimated Minimum Home Sales Price	**$1,566,675**	

Table 6-16: Viability Check - Large Lots

Metric	Value
Total Cost to Deliver a Finished Home	$1,566,675
Achievable Sale Price (Johnson Economics)	$1,132,800
Shortfall Per Home	**($433,875)**
Value as % of Cost	**72.3%**

Even without developer profit, the all-in cost of ±$1,362,326 exceeds the achievable price by $229,526 (value as % of cost = 83.1%). Additionally, Johnson Economics' achievable price of $1,132,800 is itself aspirational for the Coos Bay market. Key risk factors are discussed further within the Economic Study.

Standard-Lot Single-Family Homes (26 Lots, 1/4+ Acre Each)

These lots target the mid-density ownership market. Using the Johnson Economics mid-density assumptions (1,500 SF home, $472,005 achievable price):

Table 6-17: Viability Check - Large Lots

Cost Category	Per Home	Source / Basis
Site Development Hard Costs	$319,159	AKS estimate ($14.04M / 44 lots)
Home Construction (1,500 SF x $220/SF)	$330,000	Johnson Economics, mid-density scenario
Builder Overhead and Profit (10%)	$33,000	Industry standard
Building Permits / Plan Review	$48,000	Johnson Economics, Coos Bay fee schedule
Landscaping, Driveway, and Finish Improvements	$15,000	Typical allowance
Land Acquisition	TBD	Not included; increases gap further
Subtotal - All-In Cost	**$745,159**	
Developer Profit (15%)	$111,774	Industry standard return for risk
Total Required Revenue Per Home	**$856,933**	

Table 6-18: Viability Check - Standard Lots

Metric	Value
Total Cost to Deliver a Finished Home	$856,933
Achievable Sale Price (Johnson Economics)	$472,005
Shortfall Per Home	**($384,928)**
Value as % of Cost	**55.1%**

The standard-lot tier performs worse than the large-lot tier on a value-to-cost basis because the $319,159 per-lot site development cost represents a much larger share of the total cost for a smaller, less expensive home. Even without developer profit, the all-in cost exceeds the achievable price.

Table 6-19: Scenario-wide Summary

Component	Lots	Est. Total Cost	Est. Total Value	Gap
Large-Lot Estate Homes (2+ acres)	18	$28.2M	$20.4M	($7.8M)
Standard-Lot SFR (1/4+ acre)	26	$22.3M	$12.3M	($10.0M)
Project Total	**44**	**$50.5M**	**$32.7M**	**($17.8M)**
Value as % of Cost				**64.8%**

Note: Total cost includes developer profit at 15%. Total value uses Johnson Economics achievable pricing. No land acquisition cost is included.

Sensitivity Analysis

Table 6-20: Large-Lot Tier Break Even (Including 15% Developer Profit)

Scenario	Required Change
Increase home sale prices	Homes must sell at $1,566,675 each (38% above achievable)
Reduce per-lot site development cost	Must drop to ±$103,000/lot (68% reduction from $319,159)
Reduce home construction cost	Must drop to $131/SF (52% reduction; not realistic)

Table 6-21: Standard-Lot Tier Break Even (Including 15% Developer Profit)

Scenario	Required Change
Increase home sale prices	Homes must sell at $856,933 each (82% above achievable)
Reduce per-lot site development cost	Must drop below $0/lot (mathematically impossible at current construction costs)

The standard-lot tier cannot achieve viability through site development cost reductions alone. Even at $0 per-lot site development cost, home construction costs, fees, overhead, and profit ($537,774) still exceed the achievable price of $472,005 when developer profit is included.

Comparison of Scenarios

The table below compares the large-lot scenario to the mid- and low-density scenarios.

Table 6-22: Comparison of Three Residential Development Scenarios

Metric	Mid-Density (17 lots)	Low-Density (9 lots)	Scenario 6.1.3 (44 lots)
Lots	17	9	44
Site Development Cost/Lot	$313,004	$591,229	$319,159
Total Development Cost/Home	$724,004	$1,367,562	$745,159 - $1,362,326
Achievable Home Price	$472,005	$1,132,800	$472,005 - $1,132,800
Value as % of Cost	65.2%	82.8%	55.1% - 72.3%

Feasibility Gap

Neither the large-lot nor the standard-lot component achieves financial viability. The project-wide value-to-cost ratio of 64.8% means that for every dollar invested, only $0.65 of value is created, leaving a substantial shortfall against typical lender and developer thresholds.

The large-lot estate market in Coos Bay is unproven and presents particular risk. Absorption of 18 homes priced above $1.1 million in a market where the median home price is $314,000 would represent a significant mismatch between product and prevailing demand.

Given the magnitude of the value gap and the unproven high-end demand, the project as currently configured carries elevated market and financial risk and would not attract typical private development or lending without material changes.

Recommendation

This development scenario does not warrant further pursuit as a market-rate residential and commercial project. Every home sold under the current market conditions would result in a loss of $385,000 per standard lot and $434,000 per large lot. The viability gap across the project is too large to bridge through product mix optimization alone.

If the City wishes to advance a mix of residential this portion of Eastside site, the following steps would be necessary:

1. Identify and quantify available public subsidy sources (e.g., urban renewal, CDBG, state housing infrastructure grants, ARPA funds) would be required to bridge the viability gaps of $385,000 and $434,000.
2. Evaluate alternative land uses or phasing strategies for portions of the broader 110-acre site where geotechnical conditions and infrastructure costs may be more favorable.
3. A targeted luxury market study would be required before any further investment in the large-lot concept. Johnson Economics notes that demand for homes in the $2M to $3M range at this location "is uncertain and requires validation."

6.2 Waterfront Commercial Development

The City has expressed interest in waterfront commercial development that could generate revenue while serving community needs. This scenario positions commercial uses along the waterfront to attract tenants such as restaurants and comparable small-scale commercial operators.

6.2.1 Site Constraints and Opportunities

Geotechnical conditions for waterfront commercial development are challenging. Proximity to the water's edge increases soil stabilization risks and lateral spread hazards, necessitating extensive ground improvements and deep foundation systems for larger commercial buildings. The current commercial zoning area is located at a lower elevation and represents one of the primary locations for potential onsite wetland mitigation.

Restricting potential tenants to restaurants and other comparable small-scale commercial uses helps avoid high-traffic generators. Community feedback consistently opposed large-format retailers such as Costco and Home Depot due to traffic and neighborhood impacts. Small-scale restaurants have off-peak traffic profiles and lower infrastructure and parking demand, making them more compatible with the site's constraints and community preferences.

6.2.2 Infrastructure and Zoning Requirements

With development located at the northwest corner of the site, a pump station will be required to provide sanitary sewer service. Water infrastructure will require a longer connection from existing lines, potentially necessitating a booster pump to provide adequate pressure. Local streets will be provided per City of Coos Bay design standards.

Current City zoning allows commercial uses; however, it is recommended that development occur farther east of the existing commercial zoning area to retain potential wetland mitigation areas and reduce geotechnical risks by positioning development farther from the shoreline.

6.2.3 Market and Economic Considerations

Local leadership has expressed interest in grocery anchors, with WinCo (requiring 9 to 11 acres) identified as potentially feasible. Large-format retailers such as Costco and Home Depot are flagged as infeasible due to traffic and neighborhood concerns. Small-scale restaurants have off-peak traffic profiles and lower infrastructure and parking demand.

Detailed economic analysis is required to assess rent per square foot, tenant demand, and the revenue tradeoff versus non-revenue options such as parks and trails. The commercial market in Coos Bay is characterized by stable but modest demand, with low vacancy rates (2 to 4 percent) indicating stable occupancy but not necessarily strong expansionary pressure. Any commercial component should be carefully aligned with demonstrated local demand and designed to minimize traffic impacts.

6.3 Parks, Open Space, and Recreational Uses

Public outreach feedback consistently indicated strong community support for parks, trails, and open space on the Eastside property. This section evaluates the feasibility and implications of dedicating the site or significant portions of it to recreational and environmental conservation uses.

6.3.1 Site Constraints and Opportunities

Given the challenging geotechnical and infrastructure constraints of the site, several community members suggested that lower-impact uses such as parks, open space, and trails may represent a more appropriate alternative. These uses would minimize the need for extensive ground disturbance, deep foundations, and infrastructure investment while providing public amenities and environmental benefits.

Parks and open space uses are compatible with the site's wetland resources and could be designed to enhance rather than diminish ecological function. Trails and recreational facilities could provide public access to the waterfront while avoiding intensive development in areas with poor soil conditions or significant environmental constraints.

6.3.2 Infrastructure and Zoning Requirements

Open space and related uses demand significantly lower infrastructure investment relative to residential and other urban uses. Stormwater management, utilities, and site access can be designed at a scale appropriate to recreational use rather than intensive development. However, the current zoning is designed for small-lot residential development and would need to be changed to accommodate predominant use of the site for parks and open space.

6.3.3 Alignment with City Priorities and Financial Constraints

The City of Coos Bay Parks Master Plan and FY 2025-2026 Adopted Budget provide critical context for evaluating the feasibility of parks and open space as a primary use for the Eastside property. The Parks Master Plan documents the City's vision for recreational amenities and identifies priorities for park development and maintenance across the community. However, the Adopted Budget indicates that the City does not have resources to acquire, design, permit, construct, or maintain a park or open space facility on the Eastside site.

This funding constraint is significant. The City's budget reflects limited discretionary resources available for capital projects beyond essential services. The Parks Improvement Fund, which historically has been used to accumulate donations and match grant funds for park improvements, currently carries restricted balances of approximately $51,000 for Choshi Gardens improvements. While the City has successfully leveraged grants (such as the $2 million ODOT Safe Routes to School Program match), the scale of investment required to develop, permit, and maintain a comprehensive parks facility on the Eastside property - including site preparation, ground improvement, trail construction, and long-term maintenance - substantially exceeds available City resources.

Additionally, a parks-only use does not align with the Port's primary objectives for the site. The Oregon International Port of Coos Bay's Strategic Business Plan emphasizes the Port's role in diversifying its revenue base and generating sustainable income streams to support core maritime capital needs. A parks-only use would not generate revenue for the Port and would represent an opportunity cost relative to the Port's strategic priorities for transforming underutilized assets into productive, revenue-generating uses.

However, parks and open space could be incorporated as complementary elements within a mixed-use development strategy. A scenario that combines limited residential or commercial uses with significant open space, trails, and recreational amenities could provide community benefits while generating sufficient revenue to support Port objectives and offset public investment in site preparation and infrastructure.

7.0 Summary of Findings, Next Steps, and Final Statement

7.1 Summary of Findings

The Eastside property represents one of the largest undeveloped land holdings within the Coos Bay urban area. However, the convergence of geotechnical constraints, extensive wetland encumbrances, infrastructure limitations, and local market conditions renders large-scale residential development financially infeasible under current conditions.

This conclusion holds across all development scenarios evaluated in this study.

Table 7-1: Scenario Comparison Summary

Scenario	Units	Viability
Full Development	400+ lots	Not viable largely due to expanded geotechnical impacts when extending into zones 2 and 3 and offsite transportation costs
Small Lot Residential Southeast Corner (Sec. 6.1.1)	68 Lots	Not viable even with reduced per lot development cost due to vertical construction cost overall and wetland impacts
Mixed Use - MFR & Commercial (Sec. 6.1.2)	MFR units + commercial	Not viable. Largely due to cost of vertical construction, wetland impacts, and added geotechnical impacts for the commercial development
Large-Lot Residential (Sec. 6.1.3)	44 lots	Not viable due to similar reasons above. Wetland impacts, and viability of vertical cost of construction is limiting

Waterfront Commercial (Sec. 6.2)	N/A	Not viable due to geotechnical impacts within zones 2 and 3 as well as infrastructure cost to extend sewer to this portion of the site
Parks and Open Space (Sec. 6.3)	N/A	Funding not available for acquisition from the city and has long term maintenance challenges

Key findings that drive these conclusions:

- **Geotechnical costs dominate.** Ground improvement (surcharging, recompaction, and deep soil mixing) accounts for 40-65% of site development costs depending on the scenario. These costs are driven by the site's history as a dredge disposal area and cannot be meaningfully reduced without limiting development to the southeastern corner of the property.
- **Wetland mitigation adds significant cost and regulatory risk.** Approximately 46.3 acres of the site are potentially encumbered by wetland habitats. At an estimated mitigation cost of $225,000 per acre of impact, wetland-related expenses range from $594,000 (smaller impact) to nearly $3.0M for larger development footprints. DSL's reluctance to approve payment-in-lieu for impacts greater than 0.5 acres and the absence of a local mitigation bank with confirmed service area coverage introduce additional uncertainty.
- **Infrastructure requirements are substantial.** All scenarios require water system looping, sanitary sewer pump station upgrades (Stations 17 and 18), new onsite pump station construction for development beyond the southeast corner, stormwater facilities, and offsite transportation improvements at up to four intersections.
- **Market pricing cannot absorb the cost structure.** The median home price in Coos Bay is $314,000. Achievable new-home pricing ranges from approximately $472,000 (mid-density, 1,500 SF) to $1,132,800 (low-density, 3,000 SF estate). In every scenario, the all-in cost to deliver a finished home exceeds the achievable sale price by 18% to 82%. Multifamily rental economics show a similar gap, with stabilized property values reaching only 39% of development cost.
- **Commercial uses are limited.** The site's interior neighborhood location, lack of highway visibility, and existing vacancy at highway-fronting retail (Teakwood Plaza) suggest limited commercial potential to small-scale, neighborhood-serving uses only. Commercial revenue is insufficient to materially offset residential viability gaps.

7.2 Feasibility Conclusion

Large-scale residential development on the Eastside property is not financially feasible under current market conditions, cost structures, or reasonably foreseeable near-term changes in either.

This conclusion is not driven by any single constraint but by the cumulative effect of all constraints acting together. Even the most favorable portion of the site (the southeastern corner, Geotechnical Zone 1) produces a value-to-cost ratio of only 65%, well below the 100%+ threshold required to attract private investment. Scenarios that extend development into Zones 2 and 3 perform worse due to escalating ground improvement costs and longer infrastructure extensions.

The viability gap cannot be closed through product mix changes alone. Shifting between single-family, multifamily, and commercial uses redistributes costs but does not reduce them. The fundamental issue is

that site preparation costs - which are largely fixed regardless of product type - consume a disproportionate share of total development budget, leaving insufficient margin for vertical construction, overhead, profit, and land acquisition.

7.3 Recommendations

The recommendations below are organized into three tiers based on timeline and decision sequence. All recommendations are presented as recommended actions only for Port and City consideration.

7.3.1 Tier 1: Near-Term Actions (0-6 Months)

These actions require no significant capital investment and are intended to establish a decision framework for the property's future.

Table 7-2: Near-Term Action Recommendations

No.	Action	Lead	Purpose
1.1	Formally evaluate whether the Eastside property's residential land use designation should be reconsidered through the City's comprehensive plan update or a plan amendment process.	City	Current zoning assumes residential viability that this study does not support. Aligning the plan designation with actual site conditions avoids misdirecting future planning resources.
1.2	Conduct a highest-and-best-use workshop with Port staff, City staff, and key stakeholders to identify and screen alternative use concepts based on the findings of this study.	Port/City	Redirect planning energy toward uses that are compatible with site constraints rather than continuing to test residential scenarios that have been shown to be infeasible.
1.3	Quantify the subsidy gap in terms that funding agencies can evaluate. Prepare a summary table showing the per-unit and total subsidy required for each scenario, cross-referenced to eligible funding sources (urban renewal, CDBG, state housing infrastructure grants, ARPA, USDA Rural Development, Oregon Housing and Community Services programs).	City/Port	If the City or Port wishes to preserve a residential option, the subsidy requirement must be clearly defined before pursuing grant applications. The current gap ranges from approximately $125,000 to $434,000 per lot/unit depending on scenario.

7.3.2 Tier 2: Medium-Term Actions (6-18 Months)

These actions involve targeted investigation or planning work and should be pursued only after Tier 1 decisions are made.

Table 7-3: Medium-Term Action Recommendations

No.	Action	Lead	Purpose
2.1	If residential development remains under consideration, commission a targeted geotechnical investigation within the southeastern corner to refine settlement magnitudes, liquefaction potential, and ground improvement costs for that specific area.	Port/AKS	Current cost estimates are based on prior studies and feasibility-level assumptions. Refined data could narrow the cost range and either confirm or adjust the viability gap for the most favorable portion of the site.

No.	Action	Lead	Purpose
2.2	Commission an updated wetland delineation for the full property or if cost prohibitive, focus on the SE portion of the property.	Port/AKS	The existing delineation data is dated. An updated delineation is required to confirm jurisdictional boundaries, support any future permitting, and determine whether onsite mitigation banking is a viable strategy.
2.3	If a parks/open space alternative advances, identify potential funding sources (Oregon Parks and Recreation Department grants, Land and Water Conservation Fund, private conservation easements) and estimate long-term maintenance obligations.	City Parks/Port	Community preference for parks and trails was strong, but the City's current budget does not support acquisition, development, or maintenance of a new park on this site. A funding strategy must precede any commitment.
2.4	Coordinate with ODOT and the City's TSP update process to determine whether planned transportation improvements (US 101/OR 241, Olive Barber/OR 241, D Street/OR 241) could be advanced independently of Eastside development, potentially reducing the proportional cost burden on future site users.	City / ODOT	Offsite transportation costs are allocated proportionally to Eastside development in all scenarios. If these improvements are funded through other mechanisms, the per-unit cost burden decreases.

7.3.3 Tier 3: Contingent Actions (18+ Months, Condition-Dependent)

These actions should be pursued only if specific preconditions are met.

Table 7-4: Contingent Action Recommendations

No.	Action	Precondition	Purpose
3.1	Develop a phased development master plan for the southeastern corner (Phase 1 area) with refined cost estimates, a grading and surcharge schedule, and a permitting timeline.	Tier 2.1 geotechnical data confirms costs within a viable range, AND a committed public subsidy source is identified that closes the per-unit gap.	A phased approach starting with the most favorable area is the only development strategy with potential to reach viability, but only with confirmed subsidy and refined cost data.
3.2	Initiate rezoning and plan amendment applications for the preferred development or alternative use concept.	Tier 1.1 and 1.2 are complete, and a preferred use has been selected by the Port and City.	Regulatory approvals have long lead times. Initiating this process early avoids delays if a viable use concept is identified.
3.3	Issue an RFQ/RFP for a development partner if a subsidized residential scenario is pursued.	Subsidy commitments are secured, geotechnical and wetland data are updated, and a phased master plan is complete.	Private developer engagement should not occur until the project's financial structure is defined and the subsidy gap is addressed. Premature market outreach risks reputational damage and developer fatigue.

Strategic Considerations for the Port

The Port's Strategic Business Plan identifies the Eastside property as suited to housing or other non-commercial uses and emphasizes revenue diversification, workforce support, and environmental stewardship. The feasibility findings do not eliminate the property's strategic value but do reframe how that value can be realized.

- **Revenue generation through residential development is not achievable in the near term.** The Port should not plan capital budgets or maritime investment strategies around anticipated Eastside residential revenue.
- **Workforce housing objectives may be better served at other locations.** If the Port's goal is to support housing for maritime, processing, and rail-related workers, partnering with the City on housing initiatives at sites with lower development costs may produce more units per public dollar invested.
- **The property remains a long-term asset.** Market conditions, construction costs, available subsidies, and regulatory frameworks will change over time. Preserving optionality by avoiding irreversible commitments (e.g., long-term leases for incompatible uses) while pursuing low-cost interim uses is a prudent strategy.

7.3 Limitations and Disclaimers

This study was commissioned to provide an updated assessment of development feasibility under current conditions. AKS was not engaged to perform new geotechnical investigations, land surveying, or natural resource fieldwork. All site-specific findings related to subsurface conditions, soil characteristics, settlement and seismic performance, and wetland/upland boundaries are derived solely from previously completed study materials.

Cost estimates presented in this report are feasibility-level and are intended to support planning-level decision-making. They should not be used for budgeting, financing, or construction procurement without further refinement through detailed design and updated site investigation.

Market analysis and achievable pricing are based on the Johnson Economics market study (April 2026) and reflect conditions as of that date. Market conditions are subject to change, and any future development decisions should be informed by updated market data at the time of implementation.

All recommendations are presented as recommended actions. Final approval of any development strategy, land use change, or public investment rests with the Port Commission, City Council, and other applicable decision-making authorities.

7.4 Final Statement

The Eastside property remains one of the largest undeveloped land holdings within the Coos Bay urban area and a significant long-term asset for both the City and the Port. This study confirms that large-scale residential development is not financially viable under current conditions, with value-to-cost ratios ranging from 55% to 83% across all scenarios evaluated. The viability gap is structural, driven by the cumulative effect of geotechnical remediation, wetland mitigation, and infrastructure costs that exceed

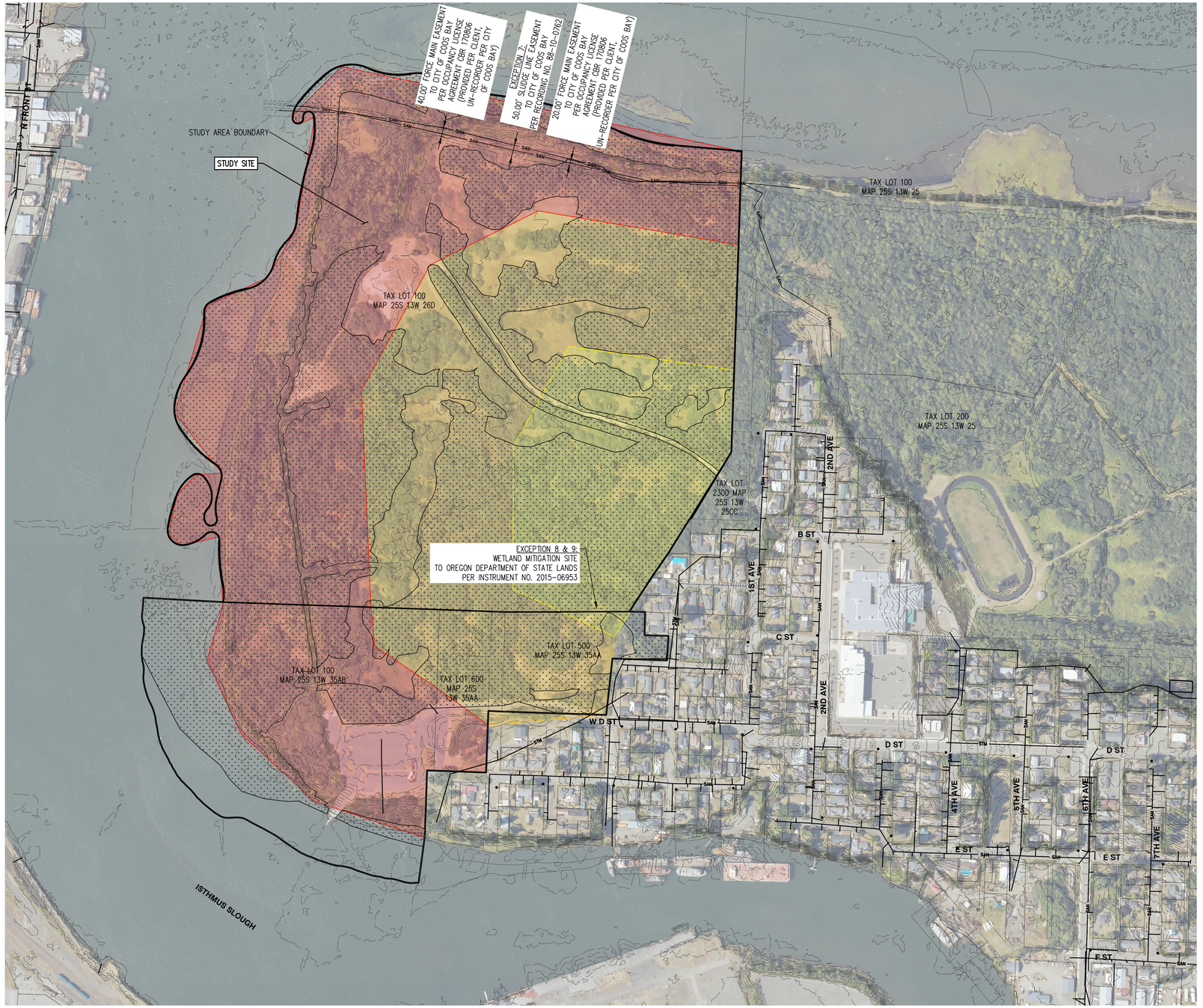
what the local housing market can absorb, and it cannot be closed through changes in product type, density, or site layout alone.

These findings do not diminish the property's strategic value. They do, however, reframe how that value should be pursued. The path forward requires the City and the Port to align on a realistic land use direction, whether that involves targeted alternative uses, long-term preservation of development optionality, or a combination of both. Decisions should be guided by the tiered action framework outlined in Section 7.2, beginning with a joint work session to establish shared priorities and a formal evaluation of the property's comprehensive plan designation.

The community engagement process reinforced that residents value the Eastside property and have clear preferences for its future, including environmental stewardship, public access, and compatibility with the surrounding neighborhood. Any strategy that moves forward should reflect those priorities while remaining grounded in the financial and physical realities documented in this report.

This study provides the technical, financial, and community-informed foundation needed to make that decision with confidence. The next step belongs to the City and the Port.

Appendix A: Existing Site Map

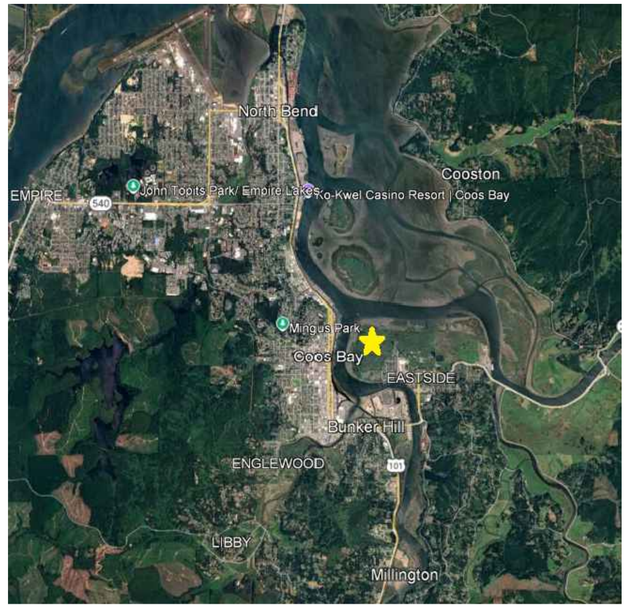


LEGEND

- FIRE HYDRANT
- SITE BOUNDARY LINE
- STORM DRAIN LINE
- SANITARY SEWER LINE
- EXISTING GROUND CONTOUR (2 FT)
- EXISTING GROUND CONTOUR (10 FT)
- WETLAND
- ZONE 1 LATERAL SPREAD HAZARD
- ZONE 2 LATERAL SPREAD HAZARD
- ZONE 3 LATERAL SPREAD HAZARD

NOTES:

1. THIS MAP IS BASED ON RESEARCHED DOCUMENTS, NO FIELD WORK WAS CONDUCTED. MAP TO BE USED FOR PLANNING PURPOSES ONLY. BOUNDARIES SHOWN ARE BASED ON COUNTY GIS TAX LOT INFORMATION AND ARE CONSIDERED APPROXIMATE. LIMITED SURVEY RECORDS WITHIN THE AREA.
2. HORIZONTAL DATUM: A LOCAL DATUM PLANE BASED ON OREGON STATE PLANE COORDINATE SYSTEM OF 1983, OREGON SOUTH 3602 NAD83(2011) EPOCH 2010.00
3. VERTICAL DATUM: NAVD 88. CONTOURS ARE SHOWN AT A 1.00 FOOT INTERVAL FROM 2009 DOGAMI LIDAR DATA.
4. FLOODPLAIN BOUNDARY IS PER GRAPHICAL OVERLAY OF FEMA MAP NUMBER 41011C032E WITH AN EFFECTIVE DATE OF MARCH 17, 2014.
5. EASEMENTS SHOWN ARE BASED ON A REVIEW OF TICOR TITLE COMPANY OF OREGON ORDER NUMBER: 360626048176 WITH A EFFECTIVE DATE OF: MARCH 2, 2026:
6. EXCEPTIONS NOT MAPPED; EXCEPTIONS 5 AND 6 BASED ON EXISTING CONDITIONS PLAN.



VICINITY MAP
NTS

N

SCALE: 1"= 250 FEET
250 0 50 125 250
ORIGINAL PAGE SIZE: 22" x 34"

DATE: 04/10/2026 AKS JOB: 12975

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ENGINEERING · SURVEYING · NATURAL RESOURCES
FORESTRY · PLANNING · LANDSCAPE ARCHITECTURE

SITE EXHIBIT

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

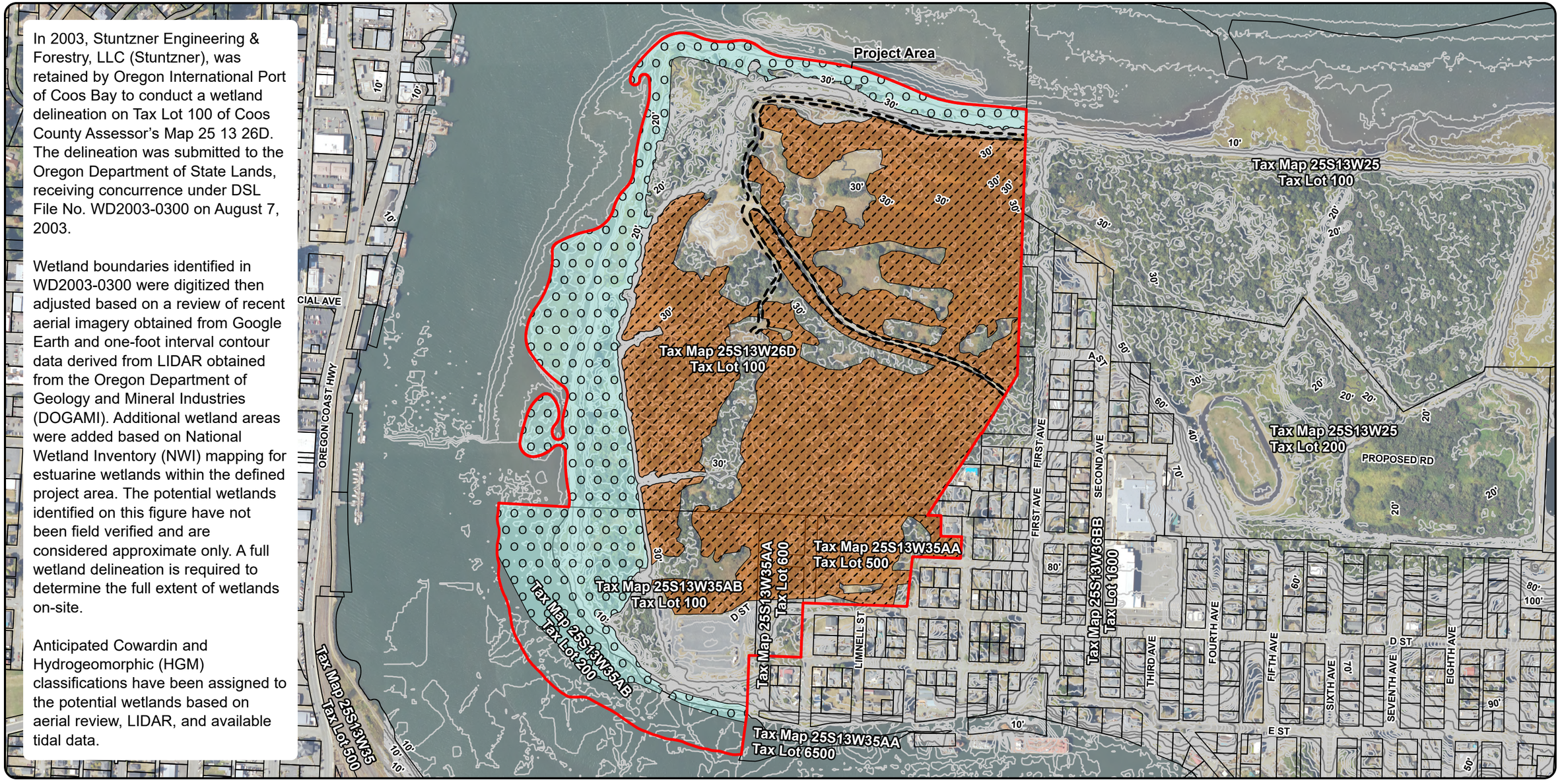
CITY OF COOS BAY
COOS BAY, OR

Appendix B: Existing Wetlands Map

In 2003, Stuntzner Engineering & Forestry, LLC (Stuntzner), was retained by Oregon International Port of Coos Bay to conduct a wetland delineation on Tax Lot 100 of Coos County Assessor's Map 25 13 26D. The delineation was submitted to the Oregon Department of State Lands, receiving concurrence under DSL File No. WD2003-0300 on August 7, 2003.

Wetland boundaries identified in WD2003-0300 were digitized then adjusted based on a review of recent aerial imagery obtained from Google Earth and one-foot interval contour data derived from LIDAR obtained from the Oregon Department of Geology and Mineral Industries (DOGAMI). Additional wetland areas were added based on National Wetland Inventory (NWI) mapping for estuarine wetlands within the defined project area. The potential wetlands identified on this figure have not been field verified and are considered approximate only. A full wetland delineation is required to determine the full extent of wetlands on-site.

Anticipated Cowardin and Hydrogeomorphic (HGM) classifications have been assigned to the potential wetlands based on aerial review, LIDAR, and available tidal data.



This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Source: 2024 Aerial Photograph obtained from Oregon Statewide Imagery Program (OSIP). Contours derived from LiDAR obtained from DOGAMI (2009).Tax lot boundaries obtained from Coos County GIS database.

Legend

- Potential E2EM, Estuarine Fringe Wetland
- Potential PEM/PSS, Flats Wetland
- Project Area
- Approximate On-site Road
- Coos County Taxlots
- Contours (1')
- Contours (10')

Exhibit A
Wetland Feasibility Map

Job:12975
CoCoos Bay Planning
Services Feasibility Study

N
0 250 500
Feet

AKS Engineering & Forestry, LLC
12965 SW Herman RD, STE 100
Tualatin, OR 97062
P:503.563.6151 | aks-eng.com

Print Date: 1/29/2026

Project: 12975

Appendix C: Preliminary Engineering Report – Pump Station No. 17 Improvements

City of Coos Bay
Coos County, Oregon

PRELIMINARY ENGINEERING REPORT
PUMP STATION NO. 17 IMPROVEMENTS

SEPTEMBER 2018





The Dyer Partnership
Engineers & Planners, Inc.

Project No. 187.24

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City of Coos Bay

Coos County, Oregon

Preliminary Engineering Report
Pump Station No. 17 Improvements

September 2018

Project No. 187.24



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SECTION 1:

INTRODUCTION

SECTION 1: INTRODUCTION

Project Need and Purpose

This Preliminary Engineering Report addresses the proposed improvements to the City of Coos Bay's Pump Station No. 17 (PS No. 17). The updates and improvements to this station are intended to bring the pump station into compliance with the Oregon Department of Environmental Quality (DEQ) pump station design criteria and correct deficiencies identified in the City's *Wastewater Collection System Master Plan* (HBH Consulting Engineers, January 2006).

The primary goals of PS No. 17 improvements include:

- Provide additional capacity for future growth
- Replace submersible pumps
- Increase pumping system reliability
- Provide a reliable Diesel Backup System (DBS)

The Preliminary Engineering Report proposes: rehabilitation of an existing wet well with two new submersible pumps, replacement of an existing electrical building, a new diesel backup system, new pump controls, new alarm and telemetry communication devices, new rolling gantry crane, a new security fence, new wet well piping, new header piping, new flow meter, new force main, and minor site improvements.

Existing Pump Station

Pump Station No. 17 was originally constructed in 1963 and updated in 1999. There pump station currently operates with two submersible pumps located in a round 8.5 foot diameter concrete wet well. The pumps include two 25 Horse Power (HP) ABS Pumps controlled by Variable Frequency Drives (VFDs). Pumps 1 and 2 have a capacity of 700 gallons per minute (gpm) at 81.5 feet of total dynamic head each. The pump header piping, valves, and various fittings are located above grade.

An existing concrete building houses the controls and electrical equipment. The building's roof is leaking, which can cause corrosion of metals inside the building. The generator is located outside under a shelter.

The existing pump station building has a motor control center mounted to the interior wall. The control panel is actuated by a Milltonics HydroRanger Multi-Purpose Level Controller with Transducer. The pump station has an auto dialer that sends alarms to the operations staff. Alarms include low wet well level, high wet well level, power failure, Pump 1 and 2 failure, and seal water failure. All alarms are automatically triggered.

Power to the station is provided by an aerial power drop from a power pole adjacent to the station. Backup power consists of one 80 kW (240V) Onan Diesel-Powered Backup Generator with an automatic transfer switch. Fuel consumption is measured at 6.1 gallons per hour with a fuel capacity of 173 gallons.

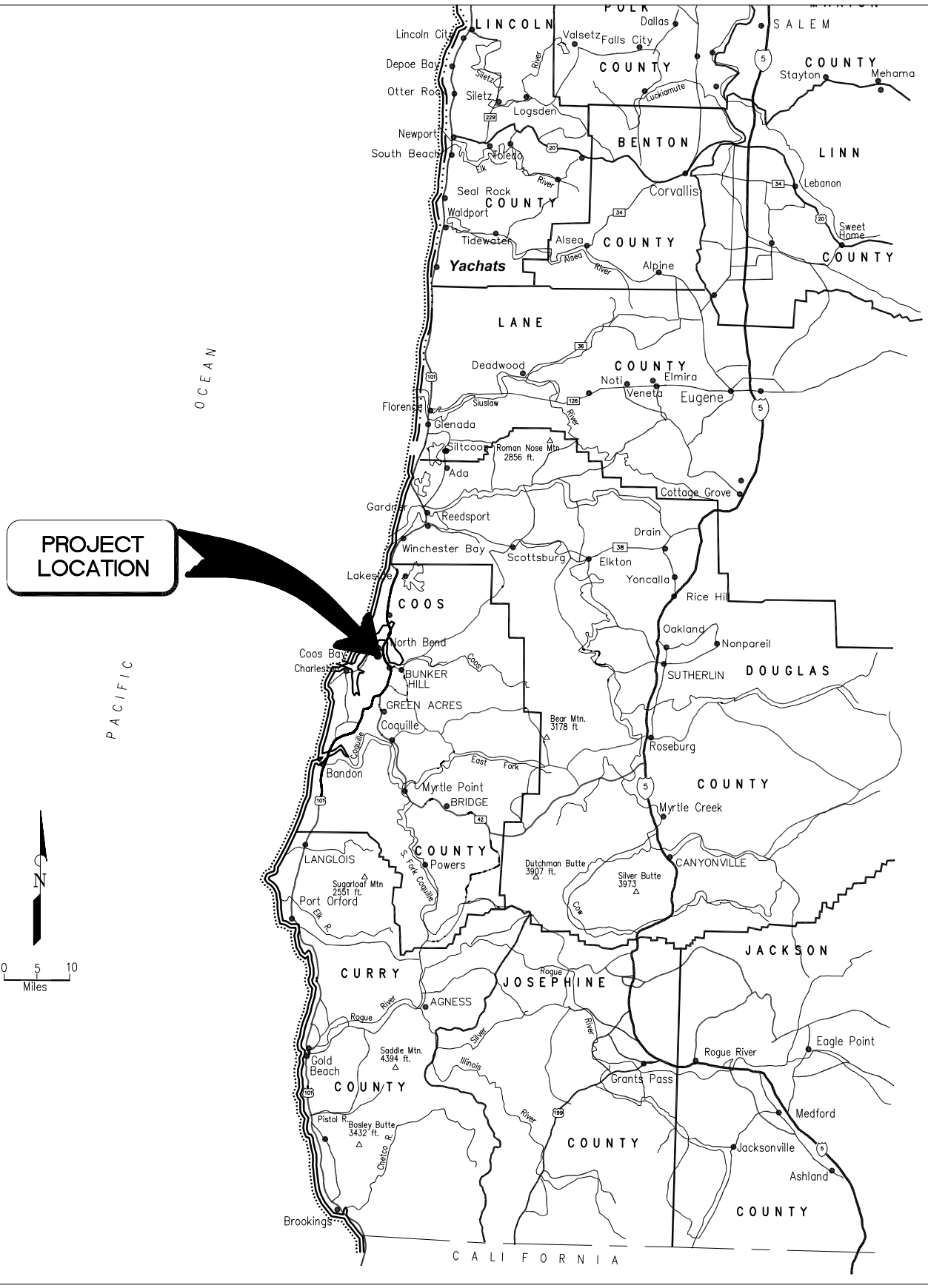
The station is equipped with a GAST Model 2032 Blower to aerate the wet well. The blower increases the dissolved oxygen content in the force main to prevent hydrogen sulfide formation. The blower is rated at ½ HP, 2 cubic feet per minute (cfm), and at 4 pounds per square inch (psi).

Existing Force Main

The existing pump station utilizes above grade header piping that transitions from above grade to below-grade at the edge of the station. From the edge of the pump station, the force main conveys wastewater flows to the south along Coos River Highway and then to the west under the Isthmus Sough near the Coos River Highway Bridge; through an 8-inch diameter asbestos cement force main constructed in 1973. Beyond the Coos River Highway Bridge, the force main increases in size from 8-inch diameter to 10-inch diameter, and conveys wastewater flows to the Bunker Hill Pump Station (BHPS) force main, where flows are combined and the force main upsizes to a 12-inch diameter pipe. From the merge of BHPS and PS No. 17 the 12-inch diameter force main conveys wastewater flows to the northwest, under Coal Bank Slough, around Lucky Loggers RV Park, west across Ingersoll Avenue, and then north along 1st Street. The force main discharges at a manhole located on 1st Street, where the pipe conveys flows through a gravity system and into Pump Station No. 2 (PS No. 2) wet well located in front of Farr's True Value off of Highway 101 North.

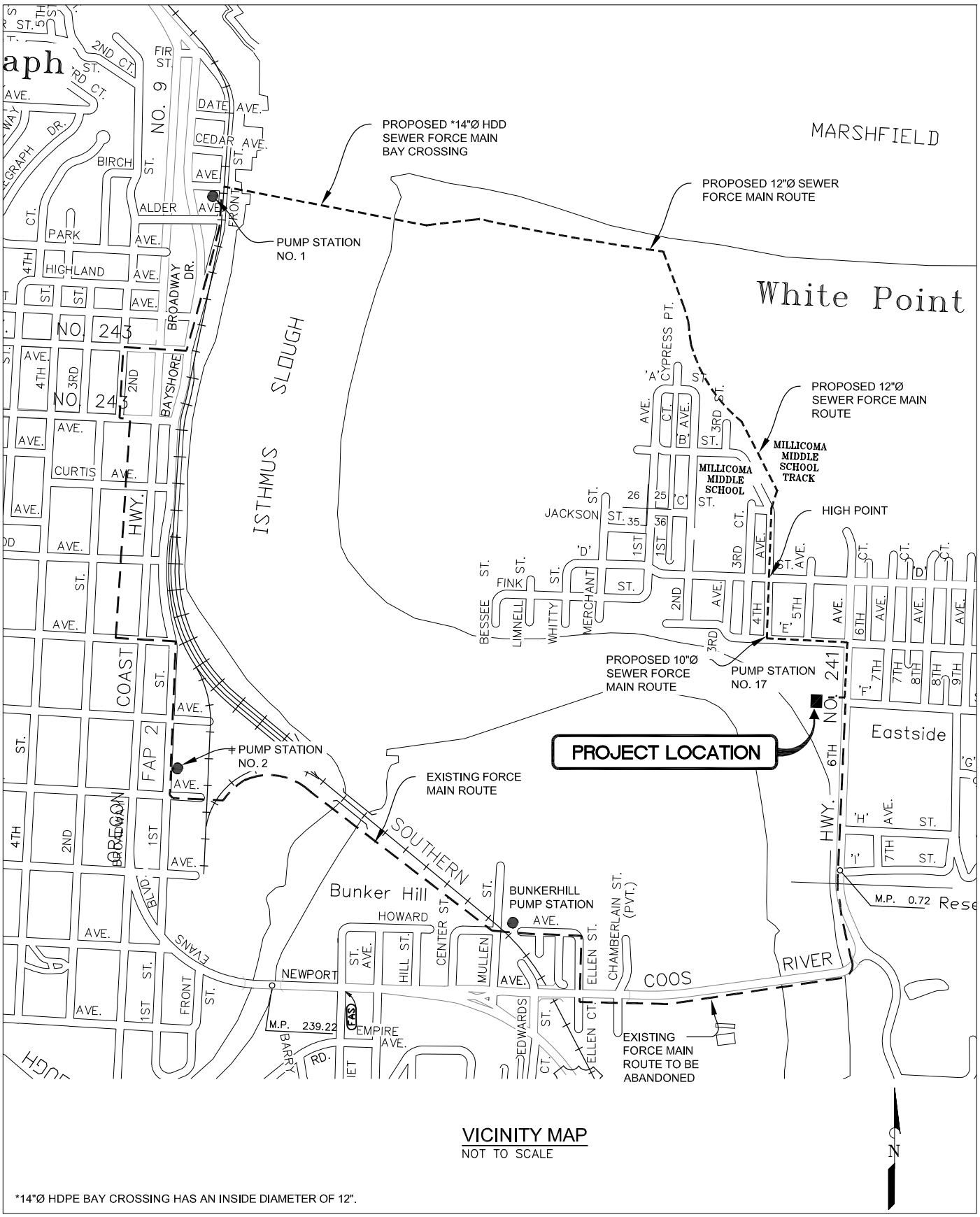
Project Location and Figures

The City of Coos Bay and Jacobs (CH2M Hill-OMI) operate PS No. 17, which is located at 6th Avenue near the intersection of F Street. Refer to Figure 1.1 - Location Map and Figure 1.2 - Vicinity Map for the project locations. The pump station serves the majority of the Eastside system. From the pump station, the force main conveys flows as described in the existing force main section above.



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF COOS BAY*** ***PUMP STATION NO. 17 IMPROVEMENTS***	FIGURE NO. ***1.1***
DATE: JUNE 2018 PROJECT NO.: 187.24	***LOCATION MAP***	

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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF COOS BAY*** ***PUMP STATION NO. 17 IMPROVEMENTS***	FIGURE NO. ***1.2***
DATE: JUNE 2018	***VICINITY MAP***	
PROJECT NO.: 187.24		

SECTION 2:

ALTERNATIVE ACTIONS

SECTION 2: ALTERNATIVE ACTIONS

Alternative 1

The City of Coos Bay could take "No Action" on the existing pump station. Under the "No Action" alternative with the current pumping capacity: operational and maintenance difficulties, structural integrity of the existing force main, and other deficiencies present high operational costs and risks for the City. The costs and risks are anticipated to increase over time under the "No Action" alternative. The "No Action" alternative is not recommended.

Alternative 2

The second alternative includes increasing PS No. 17 capacity and inversion lining of the existing force main across the Isthmus Slough to meet the projected peak instantaneous flows. The alternative will address the pump capacity and PS No. 17 force main issues. However, the pipe velocity will be approximately 15 feet per second (fps), which exceeds the maximum recommended pipe velocity. At the calculated velocity, pipe erosion and abrasion will be significantly increased. Determining feasibility of lining will require a complete shutdown of the force main to televise the existing pipe and to complete construction. This alternative would require major bypass pumping for the site, which will add additional costs to the project.

If this alternative is chosen there is also potential that surcharging and overflows could occur upstream of PS No. 2 as it has inadequate capacity to handle the additional flows conveyed from PS No. 17. This alternate would trigger a need for increasing the pumping capacity at PS No. 2 and BHPS due to capacity issues.

The total cost estimate for this project would be well over $2,000,000. However, this estimate does not include costs associated with increasing pump station capacities at PS No. 2 or BHPS to handle increased flows.

Alternative No. 2 is not feasible based on a budgetary basis, risk, and does not satisfy DEQ requirements. See Appendix A for a map of the route.

Alternative 3

The rehabilitation of PS No. 17 and installation of a new force main to Pump Station No. 1 (Long Route) would include: building renovations, new pump controls, new pump valves and piping, new DBS pump, and two new submersible pumps located in the existing wet well. The alternative route for the force main and cost estimate is shown in Appendix A. The alternative route would require larger pumps due to a higher elevation and longer force main profile than the primary route.

The total cost estimate for this project is $4,212,800. Alternative 3 was not selected as the primary route because it is much longer and is not cost effective compared to the proposed route, but is a viable option if the City of Coos Bay cannot procure the necessary easements for the preferred route.

Alternative 4

The rehabilitation of PS No. 17 and installation of a new force main to Pump Station No. 1 (Short Route) would include: building renovations, new pump controls, new pump valves and piping, new DBS pump, and two new submersible pumps located in the existing wet well. The alternative route for the force main

is shown in Figure 1.2. The Alternative 4 route would require smaller pumps than Alternative 3, due to a lower elevation profile and shorter force main route.

Alternative 4 is the preferred route. The total cost estimate for this project is $3,815,600.

Proposed Improvements

Alternate 4 was chosen as the primary route because it is shorter and more economical than the other alternatives and will have less environmental impacts than the other routes.

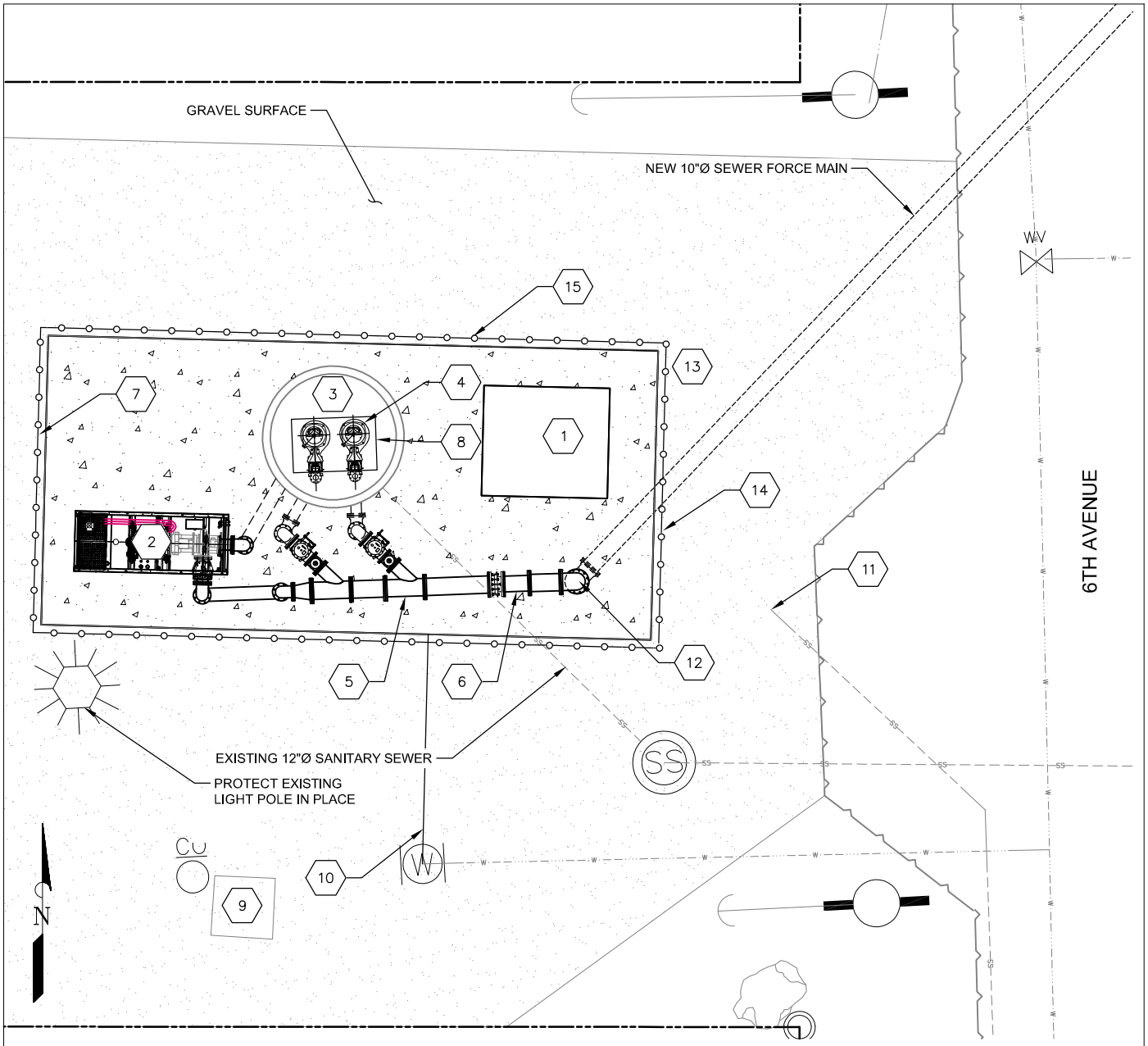
The site plan for PS No. 17 is shown in Figure 2.1 and shows planned improvements as follows:

- New non-clog submersible sewage pumps to replace the existing pumps
- New DBS pump system as backup
- New discharge pump piping inside the wet well
- New header piping (valves, pipes, flow meter, and pressure gauge)
- New lid and water-tight access hatch in the existing rehabilitated wet well
- New controls
- New electrical building
- New rolling gantry crane for removal of the submersible sewage pumps
- New chemical feed system for hydrogen sulfide control
- New chain link fence
- New electrical service upgrade
- New miscellaneous site improvements
- New force main

The pump station will have a duplex pump configuration. The hydraulic capacity of the pump station will be sized to handle a Peak Instantaneous Flow (PIF) of 1,792 gpm. Two new submersible pumps will each be 45 HP and the station will have a firm capacity of 1,867 gpm at 111 feet of total dynamic head in the new force main. All of the pumps will operate on three-phase, 480-volt power. A redundant DBS pump system will be installed for redundancy and backup. The DBS pump will be sized to accommodate PIF flows.

Auxiliary pump equipment, including telemetry, control panel, and electrical components, will be housed inside the new electrical building.

The existing main utility power (service and transformer) will be upgraded by Pacific Power to handle new pumps.



KEY NOTES:

1. NEW CONTROL BUILDING
2. NEW DIESEL POWERED BACK-UP PUMP
3. REHABILITATE EXISTING WET WELL
4. NEW DUPLEX SUBMERSIBLE 45 HP PUMPS
5. NEW 10"Ø PIPING HEADER, WITH NEW VALVES AND PRESSURE GAUGES
6. NEW FLOW METER
7. NEW 16' DOUBLE SWING GATE
8. NEW WET WELL LID & HATCH
9. EXISTING ELECTRICAL VAULT TO BE REMOVED
10. NEW WATER SERVICE FROM EXISTING WATER METER TO PS.
11. EXISTING 8"Ø SEWER FORCE MAIN. ABANDON IN PLACE
12. CONNECTION FOR NEW 10"Ø SEWER FORCE MAIN.
13. NEW CT AND METER BASE. LOCATION TBD.
14. NEW 3' WIDE GATE
15. NEW 8' TALL SECURITY FENCE

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF COOS BAY*** ***PUMP STATION NO. 17 IMPROVEMENTS***	FIGURE NO. ***2.1***
DATE: JUNE 2018 PROJECT NO.: 187.24	***PRELIMINARY SITE PLAN***	

\\Dyer2\h\dyer-part\AAprojects\187 Coos Bay\187.24 PS 17 Design & Const. Mgmt\DWG\PREDESIGN\NEW PUMP STATION.dwg

Flow Projection

Little flow data is available for PS No. 17. Current and projected flows were calculated based on data from *Wastewater Collection System Master Plan* (HBH Consulting Engineers, 2006) and *Facilities Plan for Wastewater Treatment Plant No. 1* (West Yost Associates, July 2008). To analyze the flows contributing to PS No. 17, the existing wastewater flow rates for each upstream collection basin were calculated. The collection system basins contributing to PS No. 17 are: Basins EE, FF, GG, and HH as defined in the *Wastewater Collection System Master Plan* (WWMP). For the purpose of calculating the wastewater flows in each basin, aerial photos and zoning maps were used to define the number of residential and non-residential properties in each collection system basin.

According to the 2011 through 2015 US Census data, the City of Coos Bay had an average number of 2.28 persons per household. Equivalent Dwelling Units (EDU) were calculated for the collection system basins. Each residential housing unit counts as one EDU. The *Facilities Plan for Wastewater Treatment Plant No. 1* (West Yost Associates, July 2008) lists the Average Dry Weather Flow (ADWF) at 157 gallons per capita per day. Therefore, it is further calculated that each EDU has an ADWF of 358 gallons. A peaking factor of ten (10), as identified in the *Facilities Plan*, was applied to the ADWF to obtain the PIF for each basin. Therefore, the PIF is equal to ten (10) times the ADWF. Table 2.1 contains a summary of the calculated PIF for each basin. Pump Station No. 17 has a (2018) calculated PIF of 2.38 Million Gallon per Day (MGD), or 1,655 gpm.

TABLE 2.1
CURRENT (2018) PUMP STATION NO. 17 FLOWS

	Current (2018) EDU					
Basin	**Res.**	**Non-Res.**	**Flow per EDU**	**ADWF (MGD)**	**Peaking Factor**	**PIF (MGD)**
EE	122	20	358	0.05	10	0.51
FF	34	5	358	0.01	10	0.14
GG	239	88	358	0.12	10	1.17
HH	151	7	358	0.06	10	0.57
Total	**546**	**120**		**0.24**		**2.38**

To project future wastewater flows, a growth rate was applied to the current number of EDUs within each collection system basins. A conservative population growth rate of 0.4 percent from Portland State University (See Appendix N) was chosen to calculate future flows for this study area. The population growth rate and EDU growth rate are directly linked, and share the same value. Table 2.2 shows the EDU projections for each of the Eastside collection system basins.

TABLE 2.2
EDU GROWTH PER BASIN

Year	Basin EE EDU	Basin FF EDU	Basin GG EDU	Basin HH EDU
2018	142	39	327	158
2020	143	39	330	159
2025	146	40	336	162
2030	149	41	343	166
2035	152	42	350	169
2038	154	42	354	171
Growth	12	3	27	13

Calculated projected flows to PS No. 17 were evaluated by the total projected growth within the service area. The projected growth was then equally distributed amongst the basins, and then projected based on a function of flow per EDU, which is directly proportional to projected growth. The available EDU growth rate was established by examining aerial photos, and determining how many undeveloped lots were remaining within each basin.

Projected flows per basin were calculated by multiplying the flow per EDU by the total number of EDUs within each basin. The wastewater flows from each basin above (Basin EE, FF, GG, and HH) are ultimately pumped to PS No. 17. Table 2.3 contains a summary of the calculated PIF for each basin. Pump Station No. 17 has a projected PIF of 2.58 MGD, or 1,792 gallons per minute (gpm).

TABLE 2.3
PROJECTED (2038) PUMP STATION NO. 17 FLOWS

	Future (2038) EDU					
Basin	**Res.**	**Non-Res.**	**Flow per EDU**	**ADWF (MGD)**	**Peaking Factor**	**PIF (MGD)**
EE	129	25	358	0.06	10	0.55
FF	35	7	358	0.02	10	0.15
GG	265	89	358	0.13	10	1.27
HH	164	7	358	0.06	10	0.61
Total	**593**	**128**		**0.26**		**2.58**

A schematic of the collection system basins, pump stations of the Eastside area, route to Wastewater Treatment Plant No. 1, and existing and future flows rates of each pump station from the WWMP is shown in Appendix F.

Pump Station No. 18 and Pump Station No. 19 are pumped directly to PS No. 17 with existing flows of 353 gpm and 490 gpm, respectively. The flow from Basin GG, which conveys sewer flows directly to PS No. 17, is 813 gpm. The total of the above flow rates is 1,656 gpm in the WWMP.

Pump Station No. 18 and Pump Station No. 19 projected flows are 547 gpm and 578 gpm, respectively. The flow from Basin GG which conveys sewer flows directly to PS No. 17 was projected to be 905 gpm. The total of the above projected flow rates is 2,026 gpm in the WWMP.

The projected flow totals of 1,792 and the WWMP projected flows are 2,026 gpm. The variances in projected flows to each basin are contributed to the fact that the growth rates are lower than anticipated growth rates in the WWMP. It is also not clear if the undeveloped International Port of Coos Bay property had plans to develop land in Basin EE during the WWMP study. Currently, the Port of Coos Bay does not have plans to develop Basin EE. If Basin EE was developed by the Port of Coos Bay, the pump station will need to be revaluated in order to accommodate flows from Basin EE.

Currently, PS No. 17 has a design capacity of 700 gpm. Although the PS No. 17 is capable of running two pumps at once, the capacity can only be determined using one pump, because the second pump is a required redundant pump. The current design capacity of 700 gpm is not sufficient to handle existing or future PIF of the station.

The City plans to place a meter at the existing PS No. 17 this winter to monitor flows and collect data since it is not currently metered. The data will allow the Engineer and City to check flows and revaluate pump sizes prior to installing new pumps at the pumps station. However, it is not anticipated that pump size will change.

Pump Selection

The primary intent of the pump selection process is to provide the City of Coos Bay with high-quality submersible pumps capable of handling a wide range of influent conditions. Oregon DEQ recommends that design flows are based on 20 years from the expected initiation date of the proposed project operations. The 20 year planning period will be from 2018 to 2038.

Pump Station No. 17 has a projected PIF of 1,792 gpm in year 2038. In addition to meeting future PIF, the pump station must also be designed to meet low summertime flows or ADWF, which will be approximately 167 gpm in 2018 and 179 gpm in 2038.

Evaluation of numerous pump configurations for the pump station and discussions with City staff led to the selection of the following pumps.

One 45 HP jockey pump was selected and has the capability of pumping 1,320 gpm at 94 feet of total head. Variable speed pump drives will be utilized during times of low flow and the pumps can be turned down as low as 40 Hertz, which is capable of pumping at less than ADWF flows. However, the VFD curve provided by Xylem, in Appendix C, indicates that the pumps cannot be operated at 40 Hertz because the pump curve is below the system curve at that speed. The lower pump range will be adjusted accordingly at start up to accommodate low flows. Pump Station No. 17 will be programmed to pump to a percentage of full speed range relative to the wet well level until the wet well reaches the Pumps Off Set point. The higher the wet well level the faster the pump speed and the lower the wet well, the slower the pump speed. When flows exceed the capacity of one jockey pump, the additional flows will be pumped with two 45 HP pumps. With two 45 HP pumps operating, the pump station capacity will be 1,867 gpm at 111 feet of total head. All pumps will discharge into a new single force main and the pumps will alternate after each cycle.

To meet DEQ redundancy requirements, a DBS pump will be installed with a pumping capacity of 2,250 gpm at 125 total feet of head. The DBS pump has variable speed drives that can be turned down to handle low flows.

Standby Power System

Pump Station No. 17 has an existing generator in place for standby power. However, it is old and may not be adequately sized to meet the electrical loading requirement of the new pump station equipment and

controls. The DEQ standards require the provision of a backup power capable of operating a pump station at its full design capacity during an extended power outage. This may be accomplished through a number of methods, including a secondary power feed to the station, an onsite standby generator, provisions to connect a portable backup generator, or a DBS. The recommended option is to install a new DBS. This will allow the City to reuse the existing wet well.

Electrical Systems and Controls

A new building will house the new electrical and control panels for the pump station. The pump panel will contain the pump starters, variable frequency drives, telemetry, auto dialer, and controls. The new electrical system will ensure safe and reliable operation for the pump station equipment and controls. The new electrical equipment and loads has been tentatively established based on the proposed improvements, and are summarized in Table 2.4.

TABLE 2.4
SUMMARY OF ELECTRICAL EQUIPMENT AND LOADS

Electrical Item Description	Pump Station No. 17	
	Voltage Type	Total Electrical Load
Submersible Pumps (Two 45 HP Pumps)	480 VAC	70 kW
Lights/Outlets/Miscellaneous	120 VAC	2 kW
Operator Interface Panel	120 VAC	20 W
Power Supply	120 VAC	100 W
PLC	120 VAC	5 W
Modem	120 VAC	2 W
I/O Modules	120 VAC	30 W
Level Transducer	120 VAC	25 W
Total Tentative Electrical Loads		**72.18 kW**

Piping System

All existing piping within the wet well and above grade piping will be replaced with new piping. The new discharge piping system outside the wet well is above grade, ideal for maintenance and inspection.

Sewage Overflow Location

Currently, PS No. 17 does not have a sewage overflow system and construction of a new overflow system is not proposed. The initial overflow point is located at the wet well or a manhole south of the wet well. The wet well would discharge into a ditch to the north of the pump station and the manhole south of the wet well would discharge to a tributary of Isthmus Slough located at 6th Avenue and the north end of a bridge crossing the tributary, 272 feet south of the pump station at Isthmus Slough River Mile 13.15.

Hydraulic Calculations

The pump station has two flow regimes.

Regime 1 (0 gpm to 2,500 gpm), the friction losses downstream of the high point (Elevation 71 feet) are overcome by the elevation head for all pumping rates between 0 gpm and 2,500 gpm. The hydraulics for

this pumping rate range is controlled by the total dynamic head condition between the pump station and the high point only, due to the force main profile.

Regime 2 (2,500 gpm and greater), the friction losses downstream of the high point exceed the elevation head. The hydraulics for pumping rate range that exceeds 2,500 gpm is controlled by the total dynamic head condition along the entire pipe alignment. Wastewater will flow under pressure along the entire force main profile in this regime.

Since PIF flows are less than 2,500 gpm the pump station hydraulics are controlled by flow Regime 1 only. All friction losses downstream of the high point do not need to be accounted for in the system curve calculations. System curve and calculations are located in Appendix B.

Additional hydraulic calculations for the new pump station are located in Appendices C and D. Pump curves, head loss calculations, and all other calculations can be found in these appendices.

Washdown Water Supply

An existing potable water supply to the station will be utilized for wash down of the PS No. 17. New washdown piping, hose bibs, and fixtures will be provided upon project completion.

SECTION 3:

OPERATIONAL CONSIDERATIONS

SECTION 3: OPERATIONAL CONSIDERATIONS

Pump Cycle Calculations

The wet well operating points shall be designed to avoid excessive pump starts. The maximum number of pump starts occurs when the inflow is equal to fifty percent of the pump's design capacity. This method will provide the maximum number of pump starts per hour, which will ensure compliance with the pump manufacturer's recommendations. The number of pump starts based on the proposed wet well operating points is presented in Table 3.1. Additional calculations can be found in Appendix D.

TABLE 3.1
ESTIMATED PUMP CYCLE TIME

Estimated Pump Cycle Time	
Wet Well Diameter (ft)	8.5
Bottom of Wet Well Elevation (ft)	-6.6
12" Gravity Sewer Inlet Elevation (ft)	0.28
Low Level Elevation (ft)	-5.0
Pump Off Elevation (ft)	-4.5
Pump 1 (Lead) On Elevation (ft)	-0.5
Pump 1 & 2 (Lead, Lag) On Elevation (ft)	0.5
2018 ADWF (gpm)	167
2038 ADWF (gpm)	179
2038 PIF (gpm)	1,792
Vol. per ft. of Wet Well (gal/ft)	424.5
Pump 1 - Pump Cycles per Hour @ ADWF	2.73
Pump 1 - Pump Cycles per Hour @ 50% Capacity	5.83
Pump 1 & 2 - Pump Cycles per Hour @ 100% Capacity	1.99

Table 3.1 calculations assume one duty pump will handle summer flows. Pump 1 and Pump 2 will be programmed to alternate with each wet well draw down cycle. When flows for Pump 1 exceed design capacity; Pump 2 will start and run simultaneously with Pump 1. These calculations assume constant speed pumps; however, each pump will be equipped with VFDs, which will allow the pumps to run at variable speeds. By operating at a variable speeds it will be possible to significantly extend the time between pump starts.

The maximum VFD turndown for each pump is 40 Hertz. It may be feasible to turn the VFD down lower than 40 Hertz and not have any ragging issues; however, it is not desirable at that point as the curve is too far left. The impellers will self-clean every cycle, at either 40 Hertz or 60 Hertz. The torque will remain constant during the cleaning cycle.

Wet Well Buoyancy

The existing wet well was in good condition when evaluated and will be re-used. The existing wet well lid will be removed and replaced with a new lid for safety and access to pumps. Improvements include new pipe penetrations, and pump bases. The inlet baffle and existing fillets will be evaluated during final design. The Contractor will take necessary measures as required to dewater around the existing wet well during replacement of the lid to mitigate buoyancy forces.

Force Main Evaluation and Reroute

The existing 8-inch AC force main that is routed across Isthmus Slough near the Eastside Bridge is well over 50 years old, and requires replacement. According to Foundation Engineering Inc., installing a new pipe by horizontal direction drilling across the bay adjacent to PS No. 17 is not recommended due to soft soil conditions that have a high potential for frac-out, which results in "drilling mud" being injected into the slough. Also, it may be difficult for the drillers to maneuver the drill head through soft bay mud at this location.

The proposed improvements are to convey flows directly to Pump Station No. 1, bypassing Pump Station No. 2 and BHPS. This would reduce peak flows in the force main that PS No. 17, Pump Station No. 2, and BHPS currently share. Reducing peak flows and loadings at each of these pump stations will relieve capacity issues and reduce head pressures, as each are currently at or near pumping capacities.

The proposed pump station will utilize a new 8-inch above grade header piping that transition to a combined 10-inch diameter above grade header pipe that transitions to a 10-inch diameter below grade force main at the edge of the station. From the edge of the pump station the new 10-inch diameter force main will convey wastewater flows to the north along Coos River Highway, to the west along E Street, to the north along 4th Avenue, and to the high point located at 4th Avenue and D Street.

From the high point located at the 4th Avenue and D Street the force main is upsized to a 12-inch diameter pipe that conveys flows along 4th Avenue to a gravel road leading down to the Millicoma Middle School track. From the Millicoma Middle School track the 12-inch diameter force main will convey wastewater flows parallel to the track and to the north along an existing pedestrian path that leads to the north side of the Millicoma Dike. From the Millicoma Dike the force main will convey wastewater flows west along the dike, parallel to an existing 6-inch diameter sludge line owned and used by the City. At the northwest edge of the existing dike the 12-inch diameter force main will transition to a 14-inch HDPE force main (12-inch inside diameter) and will be horizontal directional drilled under Isthmus Slough and terminate at to the west side of Front Street along Birch Avenue in a new manhole. From the new manhole the existing 8-inch and 12-inch gravity sewer lines that convey flows along Birch Avenue and Front Street will be upsized to an 18-inch gravity sewer line and connected to the first manhole outside of Pump Station No. 1.

Foundation Engineering provided borings and geotechnical investigations outlined in Appendix L. Staheli Trenchless Consultants provided consulting for the horizontal directional drilling across Isthmus Slough and determined the route was feasible. Their findings are outlined in Appendix M.

The force main design criteria for current and projected flows are summarized in Table 3.2. The calculations are based on average pump cycles per hour and the volume pumped per cycle at average daily conditions. Detailed calculations are located in Appendix D.

TABLE 3.2
FORCE MAIN DESIGN CRITERIA

Existing Force Main Design Criteria		**New Force Main Design Criteria**	
Length of 8-inch AC FM (ft)	2,716	Length of 10-inch FM (ft)	1,620
Length of 10-inch FM (ft)	2,414	Length of 12-inch FM (ft)	4,255
Length of 12-inch FM (ft)	3,280	Length of 14-inch HDPE FM (ft)	2,125
Total Volume (gal)	36,209	Volume (gal)	42,676
Velocity through 8-inch FM (fps)	4.47	Maximum Velocity through 10-inch FM (fps) @ 2038 PIF	7.60
Discharge Location	PS 2	Discharge Location	PS 1
Discharge Elevation (ft)	-	Approximate Discharge Elevation (ft)	5
High Point (ft)	-	High Point (ft)	71
Sulfide Control System	Yes	Sulfide Control System	Yes
Volume Pumped per Cycle (gal) @ ADWF	2,230	Volume Pumped per Cycle (gal) @ ADWF	1,960
Pump Cycles per Hour	4.49	Pump Cycles per Hour	5.48
Number of Cycles to Fill Force Main	16.24	Number of Cycles to Fill Force Main	21.78
Average Detention Time	216.82	Average Detention Time	238.41

SECTION 4:

DOWNSTREAM/GRAVITY SEWER EVALUATION

SECTION 4: DOWNSTREAM/GRAVITY SEWER EVALUATION

The new force main will discharge into an upsized gravity system outside of Pump Station No. 1. The existing 8-inch and 12-inch gravity sewer lines that covey flows along Birch Avenue and Front Street will be upsized to an 18-inch gravity sewer line and connected to the first manhole outside of Pump Station No. 1 to accommodate increased flows from the new force main route.

Hydrogen Sulfide Testing and Mitigation

The new force main is anticipated to have detention times in excess of 30 minutes during times of low flow. The force main will be treated with a chemical feed system to ensure the wastewater does not become septic or create hydrogen sulfide (H_2S) issues.

Chemical Feed Sulfide Control System

A chemical feed hydrogen sulfide control system will include calcium hypochlorite, nitrate, or hydrogen peroxide. Oregon DEQ Standards state that H_2S concentration should not exceed 0.1 mg/L at all times. A chemical feed system will require space to house the equipment, chemical tote and metering pump. The use of this system will also require additional labor to operate and maintain the system. Chemical dosing to control H_2S production will depend on wastewater characteristics. The data to size this system is not readily available. Chemical feed would be injected into the first manhole upstream from the wet well. A copy of a quote and information for a new TriOxyn Dosing System is provided in Appendix G.

SECTION 5:

ADDITIONAL DESIGN CONSIDERATIONS

SECTION 5: ADDITIONAL DESIGN CONSIDERATIONS

Protection from Flooding Events

The Federal Emergency Management Agency (FEMA) map and *Flood Insurance Study* (Federal Emergency Management Agency, March 2014) provided in Appendix E shows that the PS No. 17 is within the flood zone boundary AE with a base 100-year flood elevation of 12.60 feet (NAVD 88) and a 500-year flood elevation of 13.30 (NAVD 88). The existing wet well hatch was measured at 13.50 feet and the finish floor of the existing building was measured at an elevation of 13.00 feet (NAVD 88).

The new wet well hatch and control building finish floor shall be set at 14.60 feet, two feet above the 100-year floodplain; and 1.30 feet above the 500-year floodplain.

The vertical datum that The Dyer Partnership used for surveying was based off the ORGN Network.

Storm Drainage Facilities

No storm drain facilities are located onsite.

Bypassing and Emergency Operations

An overflow event for the new pump station will be highly unlikely, since the combined capacities of the new pumps will handle more than the anticipated PIF. In addition to the increased pump flows, the pump station will have a DBS for redundancy. If an overflow event were to occur, sewage would overflow from the wet well or a manhole located to the south of the wet well. The sewage would spill into a ditch located to the north of the pump station. If unmitigated, a spill could flow directly into Isthmus Slough. This overflow would be diluted due to the significant stormwater flow typical during overflow events.

An overflow event would provoke immediate response by the City, because the pump station level controls would notify the City of a high wet well level. The City would have adequate time to respond and implement overflow control measures. During an overflow event and during times of high flow and rain, the spill could possibly enter into Isthmus Slough. The City may not be equipped to handle this type of mitigation due to the large flows involved. The control strategy is to treat the high wet well level as if it were the Sanitary Sewer Overflow (SSO) elevation. Allowing the staff the time it needs to respond to the alarm. The staff would follow DEQ requirements for spill control and reporting. The design of the pump station improvements will provide excellent normal and emergency operational modes, and will provide the necessary alarms to ensure safe operation.

Alarm System

The proposed improvements include installation of an emergency alarm system incorporating a visual light at the station and an auto dialer telephone system. The alarm system will have a battery powered backup source. A preliminary list of alarm conditions includes:

1. Overflow
2. High Water Level
3. Low Water Level
4. Both Pumps On
5. High Temperature
6. Seal Failure (moisture sensor)
7. Power Outage

SECTION 6:

PROPOSED SEQUENCE OF WORK

SECTION 6: PROPOSED SEQUENCE OF WORK

There are users currently connected to PS No. 17; therefore, the existing pump station must be bypassed for construction. The following provides a proposed sequence of work:

1. Provide submittals and pothole existing site utilities to verify locations.
2. Install a new DBS pump system and utilize for bypass pumping.
3. Pump wastewater with new DBS system from the first manhole upstream of the existing wet well into the existing force main until construction is complete.
4. Install temporary bypass pumping equipment as required.
5. Remove existing pumps and piping from existing wet well and demolition of the existing electrical building.
6. Improve the existing wet well and install new electrical building.
7. Install new pump system and piping.
8. Connect new pump station to new force main.
9. Test and start up new pump station.
10. Remove temporary bypass pumping equipment.
11. Restore site.

SECTION 7:

CONSTRUCTION INSPECTION

SECTION 7: CONSTRUCTION INSPECTION

Inspection services would be provided in accordance with the Engineer's Contract with the City. The Engineer will certify the completed project as being constructed in accordance with the intent of the Plans and Specifications.

SECTION 8:

OPERATION AND MAINTENANCE MANUALS

SECTION 8: OPERATIONS AND MAINTENANCE MANUALS

The City anticipates contracting and design with the Engineer for services that include the production of an Operations and Maintenance (O&M) Manual. The O&M manual will be completed in accordance with the DEQ schedule requirements. The O&M manuals for the pumps and controls will be provided by the pump supplier.

SECTION 9:

DESIGN DATA SUMMARY

SECTION 9: DESIGN DATA SUMMARY

The following table summarizes the design data for the pump station improvements. See Appendix D for detailed calculations.

TABLE 9.1
PUMP STATION DESIGN DATA

Category	Details
Pump Station Type	Duplex Submersible
Pump Type	Variable Speed Non-Clog
Pump Station Firm Capacity	2 Pumps Simultaneously: 1,867 gpm @ 111 ft TDH
Pump HP (each)	Pumps 1 & 2: 45 hp
Capacity (each)	Pumps 1 & 2: 1,320 gpm @ 93 ft TDH
Diesel Backup System (DBS) Capacity	2,250 gpm @ 125 TDH
Level Control Type	Pressure Transducer, Float Switches for Backup
Overflow Point	First Manhole Upstream of Wet Well
Overflow Elevation (ft)	13.03
Overflow Discharge Point	Isthmus Sough (River mile 13.15)
Top of Wet Well Elevation (ft)	13.5
Bottom of Wet Well Elevation (ft)	-6.6
New Force Main Length (ft)	8,000
Average Time to Overflow @ 2018	79.53 min @ 167 gpm (ADWF)
Average Time to Overflow @ 2038	74.20 min @ 179 gpm (ADWF)
Station Voltage	480V - 3 Phase
Alarm Telemetry Type	Auto Dialer
EPA Reliability Class	Class I
Hydrogen Sulfide Treatment	Chemical Feed System

SECTION 10:

COST ESTIMATE

SECTION 10: COST ESTIMATE

Table 10.1 provides a preliminary engineering cost estimate for the major components associated with this project. The total pump station engineering construction cost estimate is $2,725,100. A breakdown of pump station rehabilitation and force main improvement costs are provided in Appendix A.

TABLE 10.1
PRELIMINARY ENGINEERING COST ESTIMATE

City of Coos Bay 5/18/2018
Pump Station No. 17 Improvements

Pump Station and Force Main Improvements - Alternative 4

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Construction Facilities & Temporary Controls	LS	1	$ 140,000	$ 140,000
2	HDD Equipment Mobilization	LS	1	$ 150,000	$ 150,000
3	Demolition & Site Preparation	LS	1	$ 60,000	$ 60,000
4	AC Pavement Removal and Replacement	TONS	500	$ 150	$ 75,000
5	10-inch C900 DR 18 - Force Main - Rock Backfill	LF	1,570	$ 70	$ 109,900
6	12-inch C900 DR 18 - Force Main - Rock Backfill	LF	650	$ 85	$ 55,250
7	12-inch C900 DR 18- Force Main - Native Backfill	LF	3,500	$ 65	$ 227,500
8	14-inch HDPE DR 11 - Force Main - HDD	LF	2,200	$ 475	$ 1,045,000
9	18-inch Sanitary Sewer Pipe	LF	220	$ 200	$ 44,000
10	12-inch Elbows	EA	40	$ 1,200	$ 48,000
11	12-inch Restrained Joint Couplings	EA	5	$ 1,500	$ 7,500
12	12-inch Plug Valves	EA	2	$ 5,000	$ 10,000
13	12-inch Combination Air Release Valves	EA	3	$ 3,000	$ 9,000
14	48-inch Manhole	EA	2	$ 8,500	$ 17,000
15	Field Connection to Existing Structure	LS	1	$ 5,000	$ 5,000
16	Vault Rehabilitation	LS	1	$ 6,000	$ 6,000
17	Relocation of Existing Utilities	LS	1	$ 20,000	$ 20,000
18	Landscaping and Restoration	LS	1	$ 15,000	$ 15,000
19	Pump Station Rehabilitation	LS	1	$ 680,950	$ 680,950

Construction Subtotal	**$ 2,725,100**
Engineering	$ 545,020
Contingency	$ 408,765
Administration	$ 81,753
Easement	$ 35,000
Environmental	$ 20,000
Total Project Cost	**$ 3,815,600**

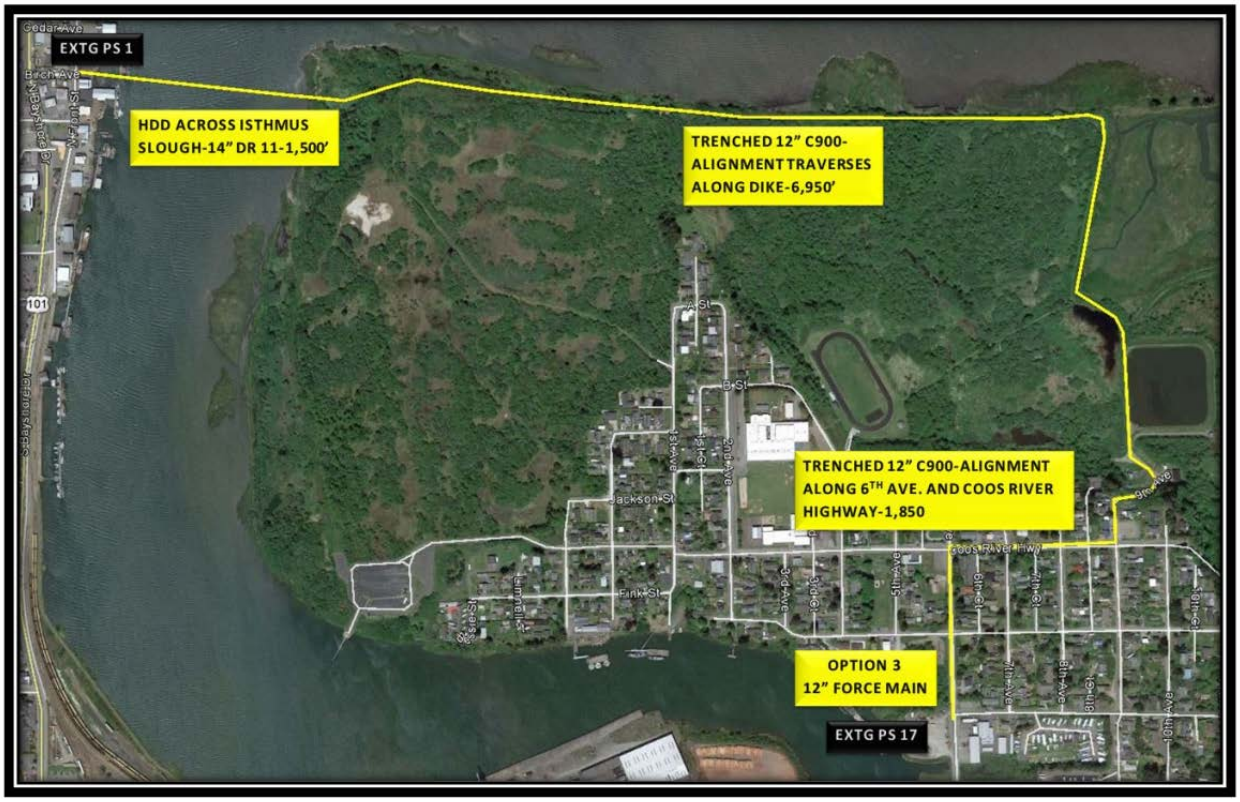
APPENDICES

APPENDIX A: Pump Station Alternatives

ALTERNATIVE 2
INCREASE PS NO. 17 CAPACITY AND INVERSION LINE THE EXISTING FORCE MAIN
ROUTE MAP



ALTERNATIVE 3
REHABILITATION OF PS NO. 17 AND INSTALL A NEW FORCE MAIN TO PS NO. 1 (LONG ROUTE)
ROUTE MAP



ALTERNATIVE 3
REHABILITATION OF PS NO. 17 AND INSTALL A NEW FORCE MAIN TO PS NO. 1 (LONG ROUTE)
PUMP STATION AND FORCE MAIN IMPROVEMENTS - COST ESTIMATE

City of Coos Bay 8/1/2018

Pump Station No. 17 Improvements

Pump Station and Force Main Improvements - Alternative 3

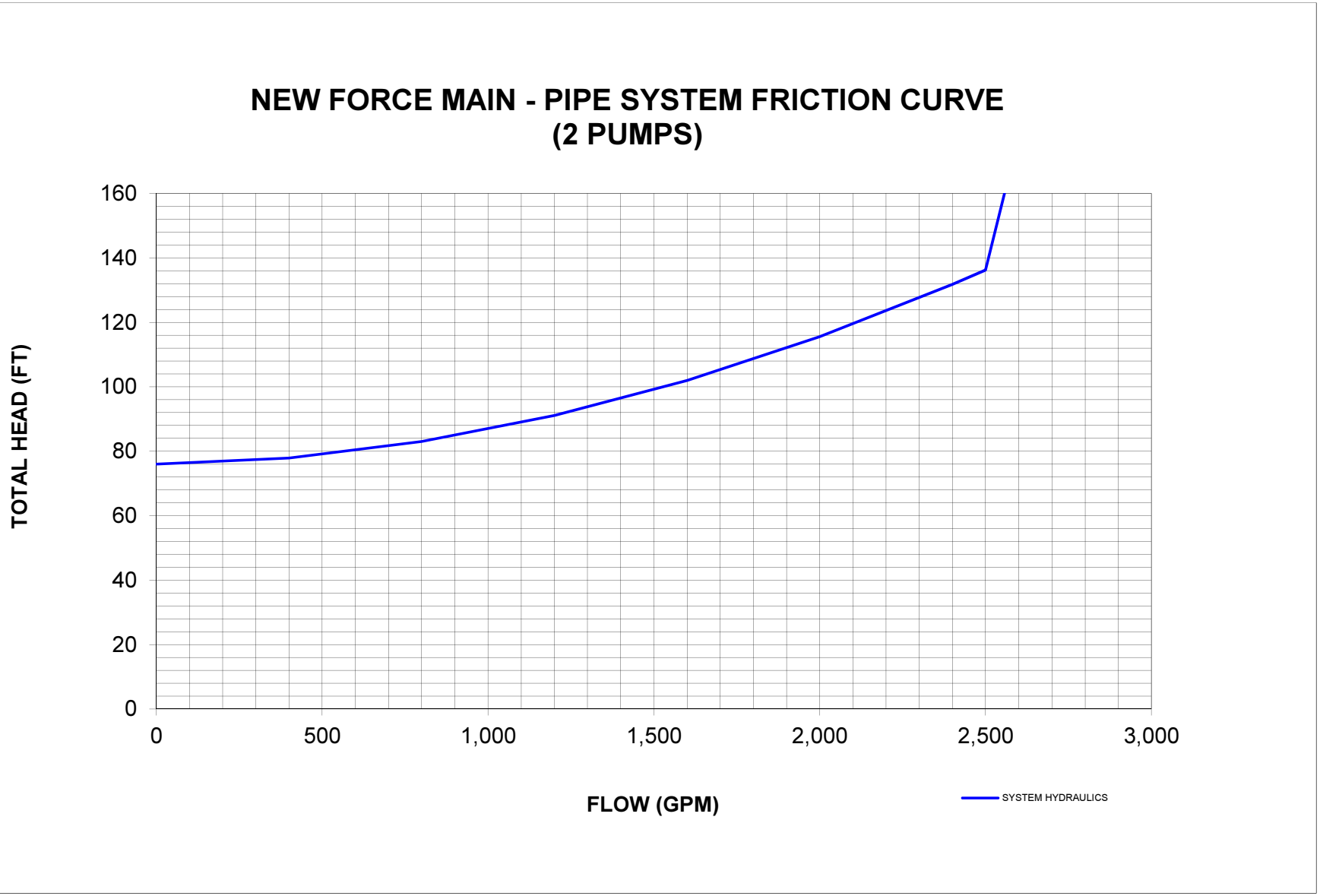
Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Construction Facilities & Temporary Controls	LS	1	$ 160,000	$ 160,000
2	HDD Equipment Mobilization	LS	1	$ 150,000	$ 150,000
3	Demolition & Site Preparation	LS	1	$ 60,000	$ 60,000
4	AC Pavement Removal and Replacement	TONS	850	$ 150	$ 127,500
5	10-inch C900 DR 18 - Force Main - Rock Backfill	LF	1,900	$ 70	$ 133,000
6	12-inch C900 DR 18 - Force Main - Rock Backfill	LF	1,370	$ 85	$ 116,450
7	12-inch C900 DR 18- Force Main - Native Backfill	LF	5,300	$ 65	$ 344,500
8	14-inch HDPE DR 11 - Force Main - HDD	LF	2,200	$ 475	$ 1,045,000
9	18-inch Sanitary Sewer Pipe	LF	220	$ 200	$ 44,000
10	12-inch Elbows	EA	35	$ 1,200	$ 42,000
11	12-inch Restrained Joint Couplings	EA	5	$ 1,500	$ 7,500
12	12-inch Plug Valves	EA	2	$ 5,000	$ 10,000
13	12-inch Combination Air Release Valves	EA	3	$ 3,000	$ 9,000
14	48-inch Manhole	EA	2	$ 8,500	$ 17,000
15	Field Connection to Existing Structure	LS	1	$ 5,000	$ 5,000
16	Vault Rehabilitation	LS	1	$ 6,000	$ 6,000
17	Relocation of Existing Utilities	LS	1	$ 20,000	$ 20,000
18	Landscaping and Restoration	LS	1	$ 15,000	$ 15,000
19	Pump Station Rehabilitation	LS	1	$ 700,950	$ 700,950

Construction Subtotal	**$ 3,012,900**
Engineering	$ 602,580
Contingency	$ 451,935
Administration	$ 90,387
Easement	$ 35,000
Environmental	$ 20,000
Total Project Cost	**$ 4,212,800**

ALTERNATIVE 4
REHABILITATION OF PS NO. 17 AND INSTALL A NEW FORCE MAIN TO PS NO. 1 (SHORT ROUTE)
PUMP STATION REHABILITATION COST ESTIMATE

City of Coos Bay					5/18/2018
Pump Station No. 17 Improvements					
Pump Station Rehabilitation Cost Estimate - Alternative 4					
Item	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
1	Const. Facilities & Temporary Controls	LS	1	$ 75,000	$ 75,000
2	Demolition & Site Preparation	LS	1	$ 40,000	$ 40,000
3	Existing Building Demolition	LS	1	$ 25,000	$ 25,000
4	New Control Building	LS	1	$ 50,000	$ 50,000
5	Pumps, Rails, and Bases	LS	1	$ 100,000	$ 100,000
6	Pump Controls	LS	1	$ 125,000	$ 125,000
7	Diesel Backup System (DBS)	LS	1	$ 93,000	$ 93,000
8	DBS Piping and Mechanical	LS	1	$ 18,000	$ 18,000
9	Wet Well Rehabilitation	LS	1	$ 5,000	$ 5,000
10	New Wet Well Lid and Hatch	LS	1	$ 12,000	$ 12,000
11	Miscellaneous Piping and Mechanical	LS	1	$ 50,000	$ 50,000
12	Flow Meter	LS	1	$ 10,000	$ 10,000
13	Rolling Gantry Crane	LS	1	$ 3,500	$ 3,500
14	Chemical Feed System	LS	1	$ 35,000	$ 35,000
15	Miscellaneous Flatwork Concrete	SF	750	$ 15	$ 11,250
16	New Fencing	LF	120	$ 60	$ 7,200
17	Electrical Service Upgrade	LS	1	$ 21,000	$ 21,000
			Construction Subtotal		**$ 680,950**

APPENDIX B: System Curve Calculations


NEW FORCE MAIN - PIPE SYSTEM FRICTION CURVE
(2 PUMPS)
TOTAL HEAD (FT)
160
140
120
100
80
60
40
20
0
0
500
1,000
1,500
2,000
2,500
3,000
FLOW (GPM)
SYSTEM HYDRAULICS

City of Coos Bay
PUMP STATION 17 HYDRAULICS
Project No. 187.24
6/5/18

New Force Main - 2 Pump System

PIPE SYSTEM TOTAL DYNAMIC HEAD

1. EQUATIONS AND LOSS COEDDICIENTS

Description: The following calculations represent the total dynamic head for the proposed pump station and pipe system. The Hazen-Williams equation for major head loss is used for all straight sections of pipe per EQ#1. Minor losses take the traditional form per EQ#2.

FRICTION LOSS COEFFICIENT TABLE

Item of Friction Loss	K or C value
Entrance	0.05
Straight Pipe New HDPE	140
Straight Pipe New DI	140
Straight Pipe New PVC	145
Straight Pipe AC	120
Exit Loss	1
Thru Flow Tee	0.26
Wye	0.6
90 Bend	0.4
45 Bend	0.2
22.5 Bend	0.15
11.25 Bend	0.1
Gate Valve	0.1
Check Valve	1
Plug Valve	0.25
6" x 8" Reducer	0.6
8" x 10" Reducer	0.6
10" x 12" Reducer	0.6

EQ#1 - Hazen Williams Major Loss

$$H_f = \frac{.002082L*\left(\frac{100}{C}\right)^{1.852}*Q^{1.852}}{D^{4.8655}}$$

EQ#2 - Minor Loss

$$h_L = K\frac{v^2}{2g}$$

2. PIPE SYSTEM HEAD LOSS CALCULATIONS

INPUT VALUES

Pump Flow (gpm)
1867

FRICTION HEAD LOSS

	Item No.	Flow gpm	Item of Friction Loss	Diameter in.	K or C value	Length ft.	Velocity fps	# of Items	Friction Head, ft.
Prior to High Point	1	934	Entrance	6	0.05		10.6	2	0.17
	2	934	90 Bend	6	0.4		10.6	2	1.39
	3	934	6" x 8" Reducer	8	0.6		6.0	2	0.66
	4	934	Straight Pipe New DI	8	140	12	6.0	2	0.34
	5	934	90 Bend	8	0.4		6.0	2	0.44
	6	934	Straight Pipe New DI	8	140	3	6.0	2	0.08
	7	934	90 Bend	8	0.4		6.0	2	0.44
	8	934	Straight Pipe New DI	8	140	6	6.0	2	0.17
	9	934	90 Bend	8	0.4		6.0	2	0.44
	10	934	Check Valve	8	1		6.0	2	1.10
	11	934	Plug Valve	8	0.25		6.0	2	0.28
	12	934	Wye	8	0.6		6.0	2	0.66
	13	934	8" x 10" Reducer	8	0.6		6.0	2	0.66
	14	1867	Straight Pipe New DI	10	140	16	7.6	1	0.27
	15	1867	90 Bend	10	0.4		7.6	1	0.36
	16	1867	Straight Pipe New DI	10	140	6	7.6	1	0.10
	17	1867	90 Bend	10	0.4		7.6	1	0.36
	18	1867	Straight Pipe New DI	10	140	10	7.6	1	0.17
	19	1867	45 Bend	10	0.2		7.6	1	0.18
	20	1867	Straight Pipe New PVC	10	145	78	7.6	1	1.25
	21	1867	45 Bend	10	0.2		7.6	1	0.18
	22	1867	Straight Pipe New PVC	10	145	362	7.6	1	5.82
	23	1867	90 Bend	10	0.4		7.6	1	0.36
	24	1867	Straight Pipe New PVC	10	145	320	7.6	1	5.15
	25	1867	45 Bend	10	0.2		7.6	1	0.18
	26	1867	Straight Pipe New PVC	10	145	13	7.6	1	0.21
	27	1867	45 Bend	10	0.2		7.6	1	0.18
	28	1867	Straight Pipe New PVC	10	145	298	7.6	1	4.79
	29	1867	90 Bend	10	0.4		7.6	1	0.36
	30	1867	Straight Pipe New PVC	10	145	495	7.6	1	7.96
Downstream of High Point	31	1867	10" x 12" Reducer	10	0.6		7.6	2	1.08
	32	1867	Straight Pipe New PVC	12	145	396	5.3	1	2.62
	33	1867	45 Bend	12	0.2		5.3	1	0.09
	34	1867	Straight Pipe New PVC	12	145	45	5.3	1	0.30
	35	1867	22.5 Bend	12	0.15		5.3	1	0.07
	36	1867	Straight Pipe New PVC	12	145	73	5.3	1	0.48
	37	1867	11.25 Bend	12	0.1		5.3	1	0.04
	38	1867	Straight Pipe New PVC	12	145	131	5.3	1	0.87
	39	1867	45 Bend	12	0.2		5.3	1	0.09
	40	1867	Straight Pipe New PVC	12	145	115	5.3	1	0.76
	41	1867	45 Bend	12	0.2		5.3	1	0.09
	42	1867	Straight Pipe New PVC	12	145	18	5.3	1	0.12
	43	1867	45 Bend	12	0.2		5.3	1	0.09
	44	1867	Straight Pipe New PVC	12	145	406	5.3	1	2.69
	45	1867	22.5 Bend	12	0.15		5.3	1	0.07
	46	1867	Straight Pipe New PVC	12	145	95	5.3	1	0.63
	47	1867	22.5 Bend	12	0.15		5.3	1	0.07
	48	1867	Straight Pipe New PVC	12	145	55	5.3	1	0.36
	49	1867	22.5 Bend	12	0.15		5.3	1	0.07
	50	1867	Straight Pipe New PVC	12	145	39	5.3	1	0.26
	51	1867	45 Bend	12	0.2		5.3	1	0.09
	52	1867	Straight Pipe New PVC	12	145	242	5.3	1	1.60
	53	1867	22.5 Bend	12	0.15		5.3	1	0.07
	54	1867	Straight Pipe New PVC	12	145	64	5.3	1	0.42
	55	1867	45 Bend	12	0.2		5.3	1	0.09
	56	1867	Straight Pipe New PVC	12	145	48	5.3	1	0.32
	57	1867	45 Bend	12	0.2		5.3	1	0.09
	58	1867	Straight Pipe New PVC	12	145	275	5.3	1	1.82
	59	1867	45 Bend	12	0.2		5.3	1	0.09
	60	1867	Straight Pipe New PVC	12	145	73	5.3	1	0.48
	61	1867	45 Bend	12	0.2		5.3	1	0.09
	62	1867	Straight Pipe New PVC	12	145	36	5.3	1	0.24
	63	1867	22.5 Bend	12	0.15		5.3	1	0.07
	64	1867	Straight Pipe New PVC	12	145	312	5.3	1	2.07
	65	1867	45 Bend	12	0.2		5.3	1	0.09
	66	1867	Straight Pipe New PVC	12	145	85	5.3	1	0.56
	67	1867	22.5 Bend	12	0.15		5.3	1	0.07
	68	1867	Straight Pipe New PVC	12	145	123	5.3	1	0.81
	69	1867	22.5 Bend	12	0.15		5.3	1	0.07
	70	1867	Straight Pipe New PVC	12	145	62	5.3	1	0.41
	71	1867	11.25 Bend	12	0.1		5.3	1	0.04
	72	1867	Straight Pipe New PVC	12	145	67	5.3	1	0.44
	73	1867	45 Bend	12	0.2		5.3	1	0.09
	74	1867	Straight Pipe New PVC	12	145	58	5.3	1	0.38
	75	1867	45 bend	12	0.2		5.3	1	0.09
	76	1867	Straight Pipe New PVC	12	145	40	5.3	1	0.26
	77	1867	45 Bend	12	0.2		5.3	1	0.09
	78	1867	Straight Pipe New PVC	12	145	33	5.3	1	0.22
	79	1867	45 Bend	12	0.2		5.3	1	0.09
	80	1867	Straight Pipe New PVC	12	145	437	5.3	1	2.89
	81	1867	45 Bend	12	0.2		5.3	1	0.09
	82	1867	Straight Pipe New PVC	12	145	905	5.3	1	5.99

City of Coos Bay
PUMP STATION 17 HYDRAULICS
Project No. 187.24
6/5/18
PIPE SYSTEM TOTAL DYNAMIC HEAD

New Force Main - 2 Pump System

	83	1867	45 bend	12	0.2		5.3	1	0.09
	84	1867	Straight Pipe New HDPE	11.3	140	2125	6.0	1	20.12
	85	1867	90 Bend	12	0.4		5.3	1	0.17
	86	1867	Straight Pipe New PVC	12	145	22	5.3	1	0.15
	87	1867	Exit Loss	12	1		5.3	1	0.44

TOTAL PS 17 to High Point (ft) (Flow < 2,500 gpm)	34.74
TOTAL Hight Point to PS 1 (ft)	51.99
TOTAL PS 17 to PS 1 (ft) (Flow > 2,500 gpm)	86.74

STATIC HEAD	
Wetwell All Pumps Off (NAVD 88)	-5.0
FORCE MAIN HIGH POINT EL	71.0
STATIC HEAD	76.0

All pumps off

3. 2 PUMPS SYSTEM TOTAL DYNAMIC HEAD LOSS AT VARIOUS FLOW RATES

TOTAL DYNAMIC HEAD LOSS
10-inch Force Main Only

PUMPING gpm	FRICTION HEAD (ft)	STATIC HEAD (ft)	TDHL (ft)
0	0.00	76.0	76.0
400	1.91	76.0	77.9
800	7.03	76.0	83.0
1,200	15.1	76.0	91.1
1,600	25.97	76.0	102.0
2,000	39.56	76.0	115.6
2,400	55.81	76.0	131.8
2,500	60.28	76.0	136.3
2,800	185.19	76.0	261.2

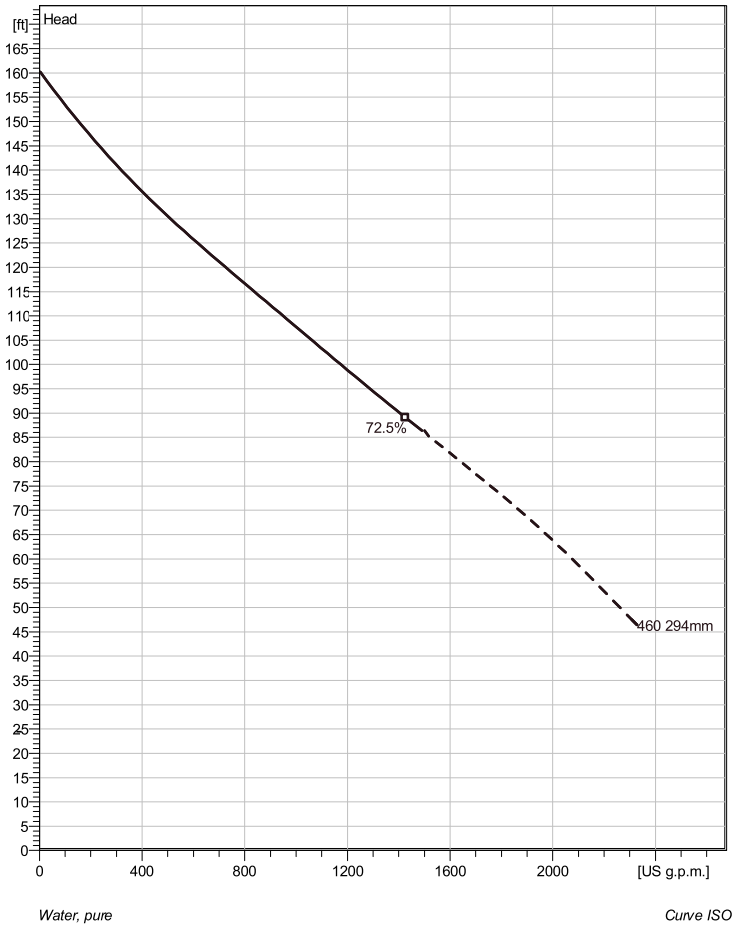
FLOW (GPM)	TDHL (FT)
1867	110.74
Design Flow	**1792**

TOTAL PS 17 to High Point (ft)

APPENDIX C: Submersible and DBS Pump Curves

NP 3202 HT 3~ 460

Technical specification



Water, pure *Curve ISO*



Note: Picture might not correspond to the current configuration.

General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

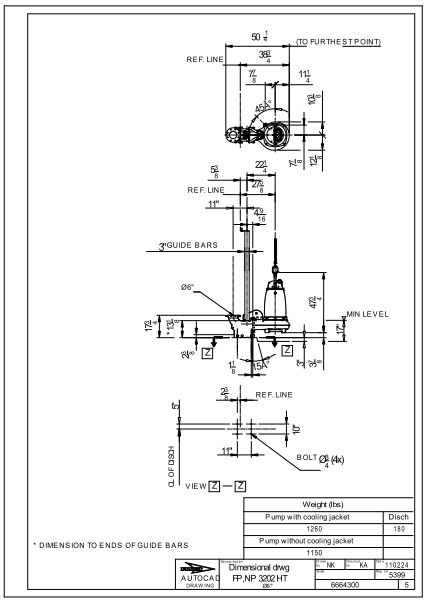
Impeller material	Hard-Iron ™
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	7 7/8 inch
Impeller diameter	294 mm
Number of blades	2

Motor

Motor #	N3202.095 30-19-4AA-W 45hp FM
Stator variant	4
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	45 hp
Rated current	51 A
Starting current	315 A
Rated speed	1770 rpm
Power factor	
1/1 Load	0.91
3/4 Load	0.89
1/2 Load	0.82
Motor efficiency	
1/1 Load	90.5 %
3/4 Load	91.5 %
1/2 Load	91.5 %

Configuration

Installation: P - Semi permanent, Wet



Project	Project ID	Created by	Created on	Last update
			6/5/2018	

NP 3202 HT 3~ 460

Performance curve

Pump

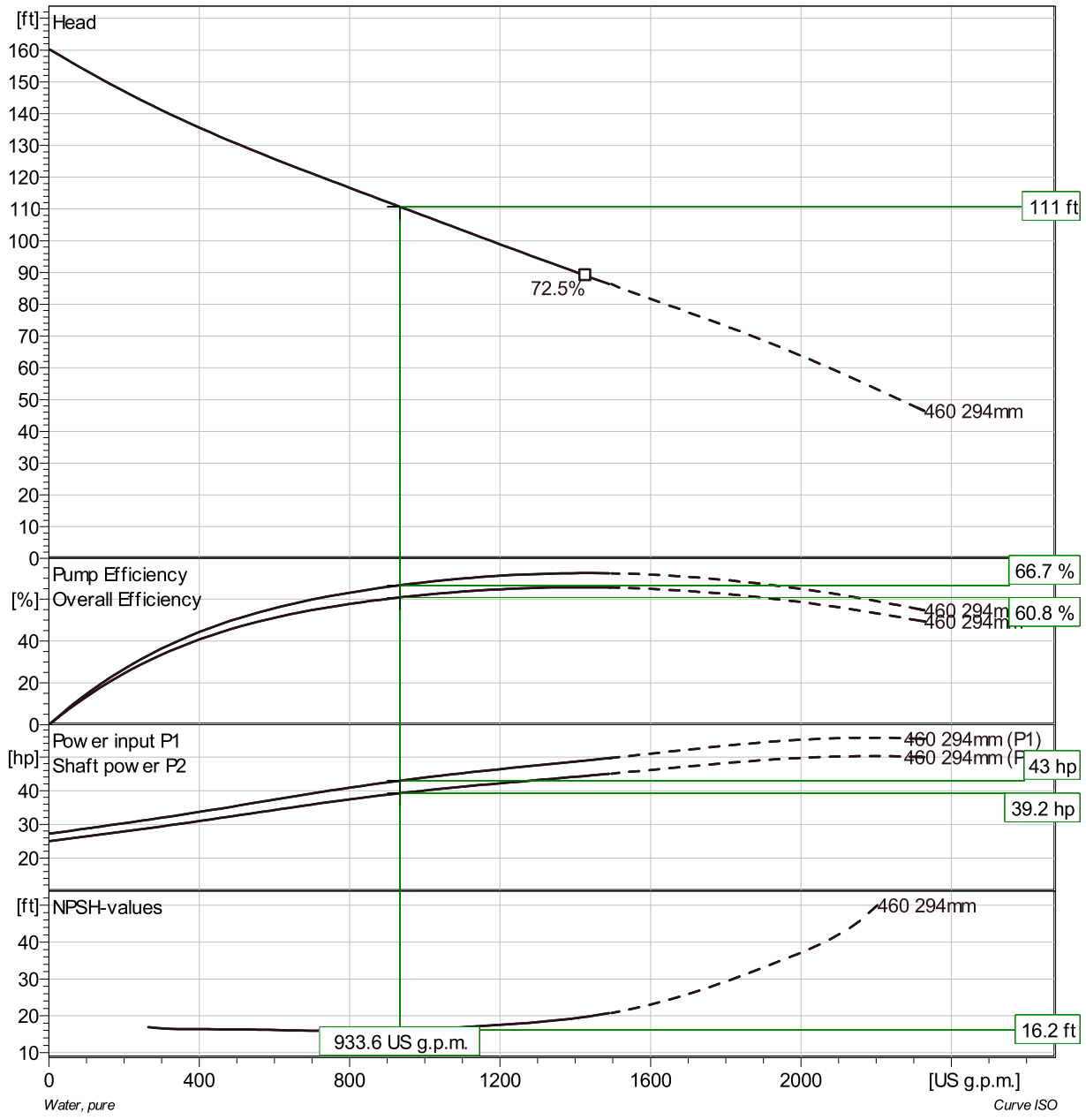
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	200 mm
Impeller diameter	11 9/16"
Number of blades	2

Motor

Motor #	N3202.095 30-19-4AA-W 45hp
Stator variant	4
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	45 hp
Rated current	51 A
Starting current	315 A
Rated speed	1770 rpm

Power factor	
1/1 Load	0.91
3/4 Load	0.89
1/2 Load	0.82

Motor efficiency	
1/1 Load	90.5 %
3/4 Load	91.5 %
1/2 Load	91.5 %

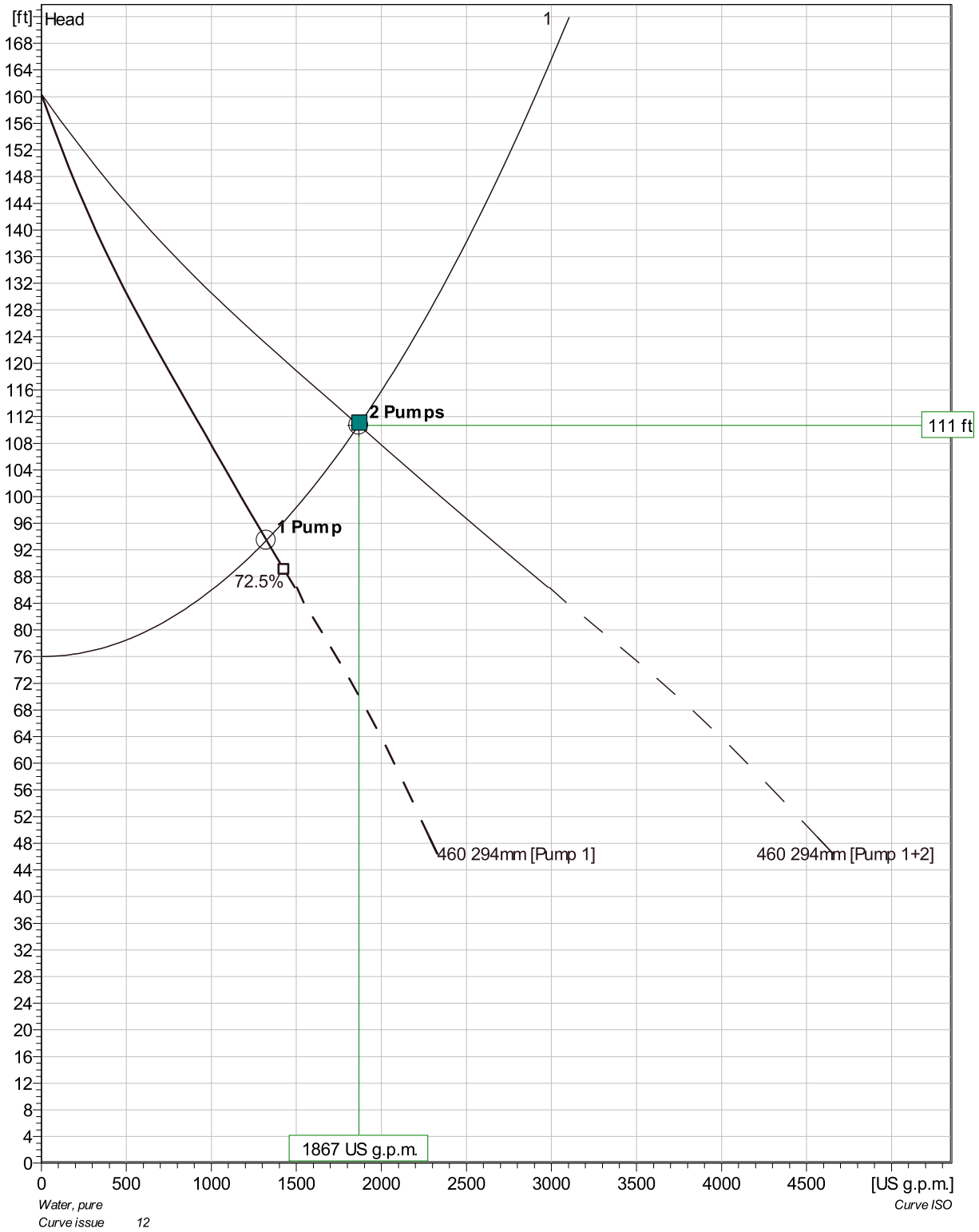


Duty point		Guarantee
Flow	Head	
938 US g.p.m.	111 ft	No

Project	Project ID	Created by	Created on	Last update
			6/5/2018	

NP 3202 HT 3~ 460

Duty Analysis

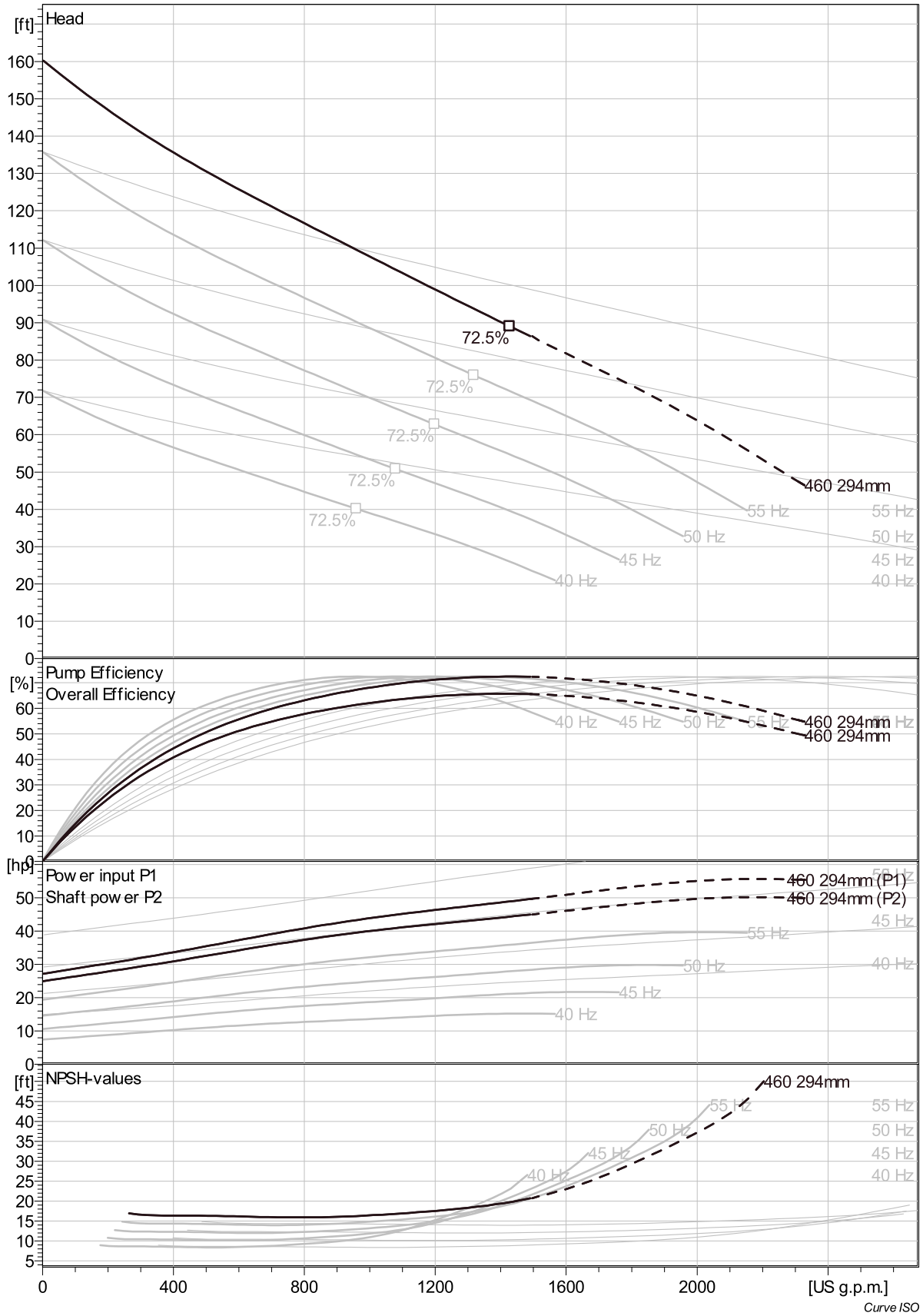


Pumps running /System	Individual pump Flow	Head	Shaft power	Total Flow	Head	Shaft power	Pump eff.	Specific energy	NPSHre
2 / 1	934 US g.p.m.	111 ft	39.2 hp	1870 US g.p.m.	111 ft	78.5 hp	66.7 %	572 kWh/US MG	16.2 ft
1 / 1	1320 US g.p.m.	93.5 ft	43.4 hp	1320 US g.p.m.	93.5 ft	43.4 hp	72.2 %	444 kWh/US MG	18.5 ft

Project	Project ID	Created by	Created on	Last update
			6/5/2018	

NP 3202 HT 3~ 460

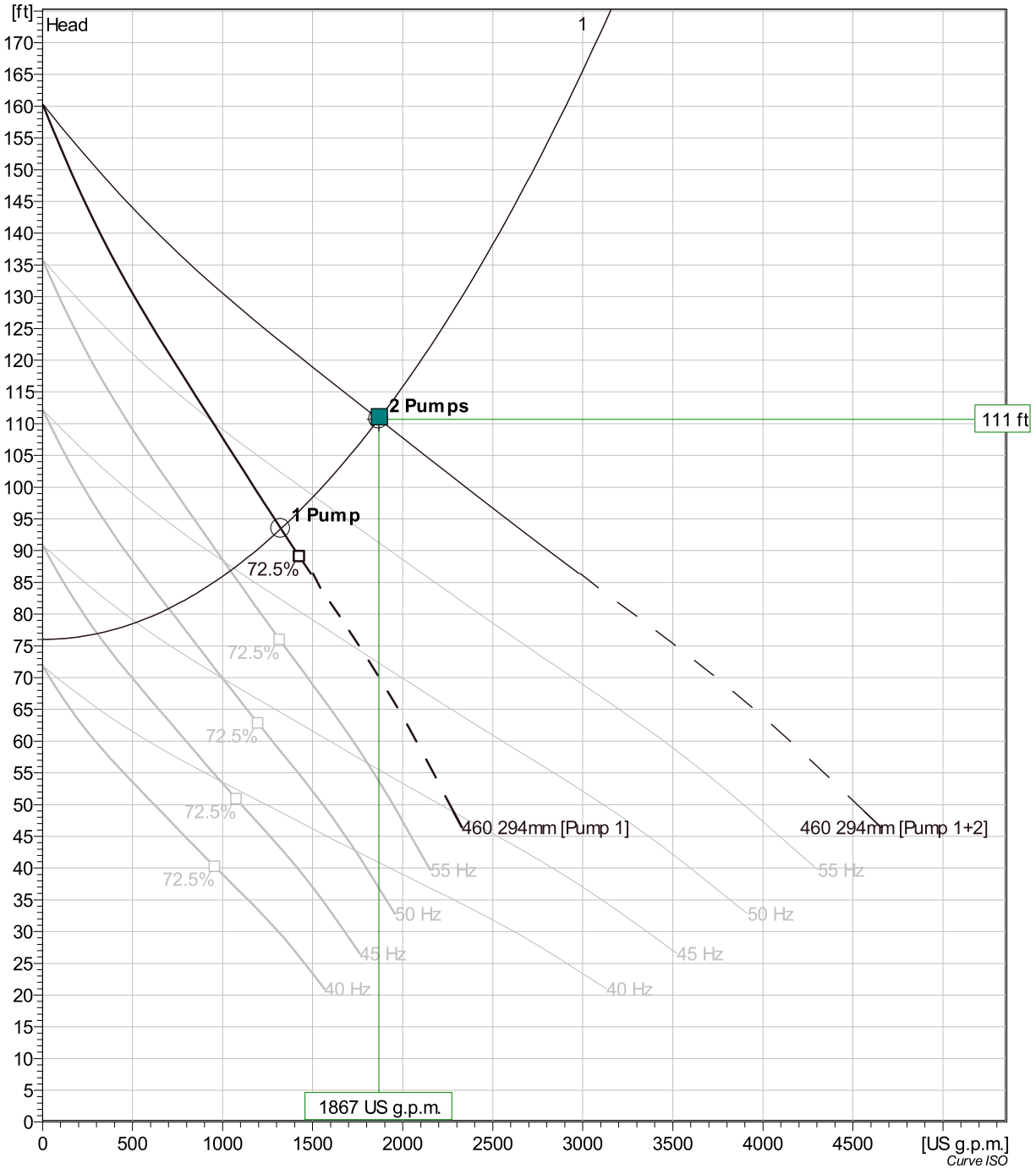
VFD Curve



Project	Project ID	Created by	Created on	Last update
			6/5/2018	

NP 3202 HT 3~ 460

VFD Analysis

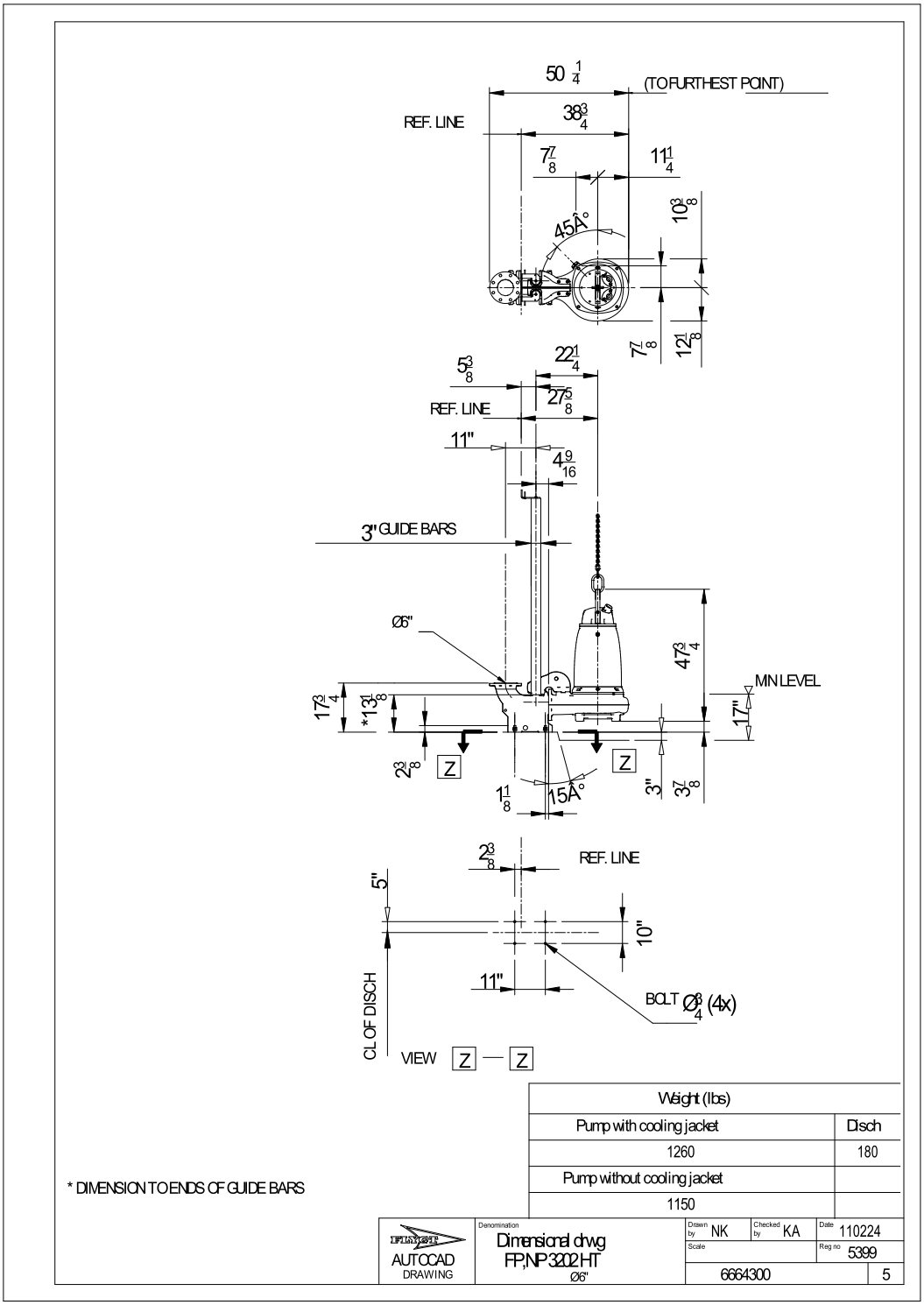


Pumps running /System	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hyd eff.	Specific energy	NPSHre
2 / 1	59.7 Hz	934 US g.p.m.	111 ft	39.2 hp	1870 US g.p.m.	111 ft	78.5 hp	66.7 %	572 kWh/US MG	16.2 ft
2 / 1	55 Hz	753 US g.p.m.	98.6 ft	29.5 hp	1510 US g.p.m.	98.6 ft	59.1 hp	63.6 %	530 kWh/US MG	14 ft
2 / 1	50 Hz	531 US g.p.m.	87.2 ft	20.5 hp	1060 US g.p.m.	87.2 ft	41 hp	57.2 %	525 kWh/US MG	12.1 ft
2 / 1	45 Hz	260 US g.p.m.	78.7 ft	12.9 hp	520 US g.p.m.	78.7 ft	25.8 hp	40.2 %	686 kWh/US MG	10.4 ft
2 / 1	40 Hz									
1 / 1	59.7 Hz	1320 US g.p.m.	93.5 ft	43.4 hp	1320 US g.p.m.	93.5 ft	43.4 hp	72.2 %	444 kWh/US MG	18.5 ft
1 / 1	55 Hz	1040 US g.p.m.	86.8 ft	32.6 hp	1040 US g.p.m.	86.8 ft	32.6 hp	70.3 %	422 kWh/US MG	15 ft
1 / 1	50 Hz	701 US g.p.m.	80.9 ft	22.4 hp	701 US g.p.m.	80.9 ft	22.4 hp	64.2 %	435 kWh/US MG	12 ft
1 / 1	45 Hz	304 US g.p.m.	76.9 ft	13.3 hp	304 US g.p.m.	76.9 ft	13.3 hp	44.6 %	607 kWh/US MG	10.4 ft
1 / 1	40 Hz									

Project	Project ID	Created by	Created on	Last update
			6/5/2018	

NP 3202 HT 3~ 460

Dimensional drawing



Weight (lbs)	
Pump with cooling jacket	Disch
1260	180
Pump without cooling jacket	
1150	

* DIMENSION TO ENDS OF GUIDE BARS

FLYGT AUTOCAD DRAWING	Denomination: Dimensional dwg FP,NP3202HT Ø6"	Drawn by: NK	Checked by: KA	Date: 110224
		Scale:		Reg no: 5399
		6664300		5

Project	Project ID	Created by	Created on	Last update
			6/5/2018	

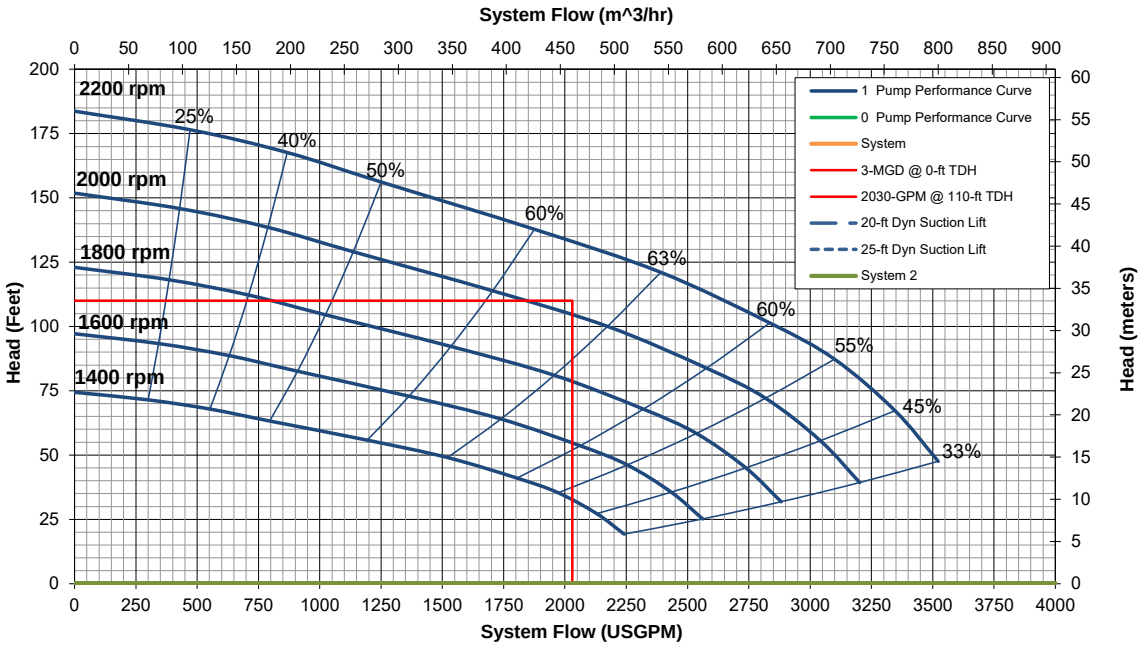
GODWIN DRI-PRIME® CD225M
ONE (1) PUMP | SYSTEM CURVE
COOS BAY #17
COOS BAY, OR

CD225M

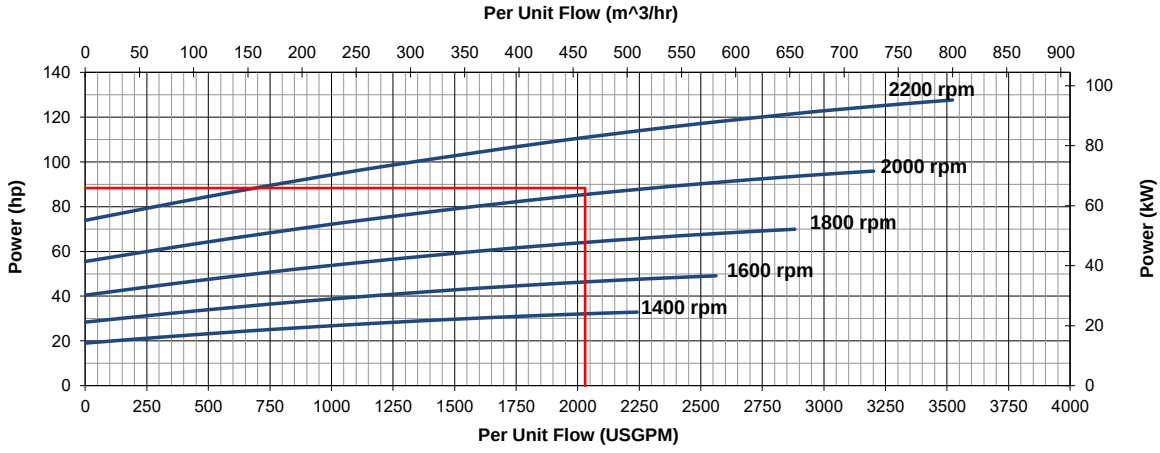
Suction Lift: 15-ft
Suction Pipe: TBD - minimum 10" pipe

Discharge Head: TBD
Discharge Pipe: Provided TDH was 110-ft including suction lift of 15-ft

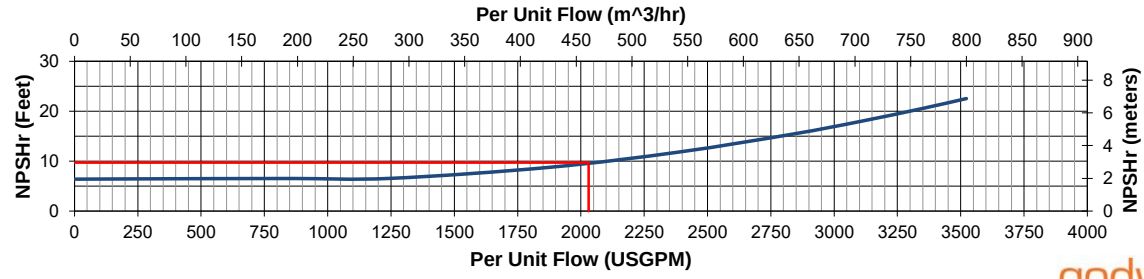
Performance - 290 mm Impeller | Variable Speed Curve



Power



NPSHr



CD225M Dri-Prime® Pump

The Godwin Dri-Prime CD225M pump offers flow rates to 3240 USGPM and has the capability of handling solids up to 3.0" in diameter.

The CD225M is able to automatically prime to 28' of suction lift from dry. Automatic or manual starting/stopping available through integral mounted control panel or optional wireless-remote access.

Indefinite dry-running is no problem due to the unique Godwin liquid bath mechanical seal design. Solids handling, dry-running, and portability make the CD225M the perfect choice for dewatering and bypass applications.



Features and Benefits

- Simple maintenance normally limited to checking fluid levels and filters.
- Dri-Prime (continuously operated Venturi air ejector priming device) requiring no periodic adjustment. Optional compressor clutch available.
- Extensive application flexibility handling sewage, slurries, and liquids with solids up to 3.0" in diameter.
- Dry-running high pressure liquid bath mechanical seal with high abrasion resistant solid silicon carbide faces.
- Close-coupled centrifugal pump with Dri-Prime system coupled to a diesel engine or electric motor.
- All cast iron construction (stainless steel construction option available) with cast steel impeller.
- Also available in a critically silenced unit which reduces noise levels to less than 70 dBA at 30'.
- Standard engine John Deere 4045TF285 (T3 Flex). Also available with John Deere 4045HFC92 (IT4).

Specifications

Suction connection	8" 150# ANSI B16.5
Delivery connection	8" 150# ANSI B16.5
Max capacity	3240 USGPM †
Max solids handling	3.0"
Max impeller diameter	11.4"
Max operating temp	176°F*
Max pressure	73 psi
Max suction pressure	73 psi
Max casing pressure	110 psi
Max operating speed	2200 rpm

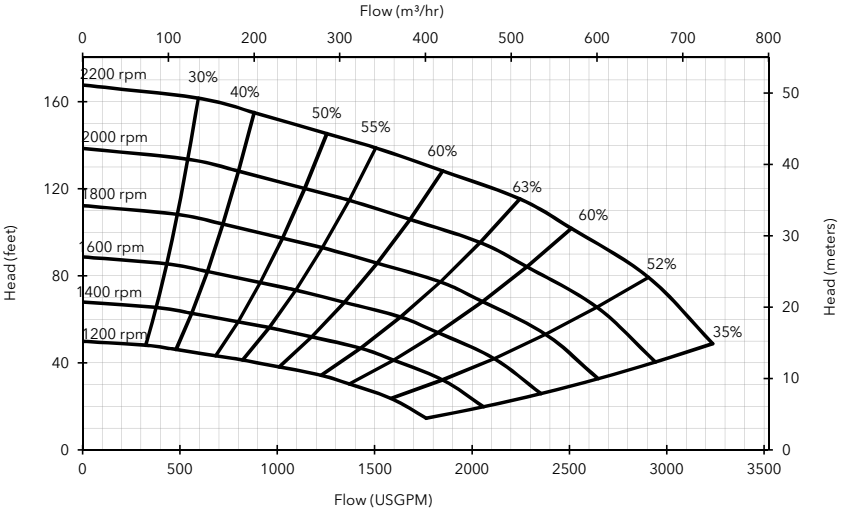
* Please contact our office for applications in excess of 176°F.

† Larger diameter pipes may be required for maximum flows.

Please contact the factory or office for further details. A typical picture of the pump is shown. All information is approximate and for general guidance only.

godwin
a xylem brand

Performance Curve



Materials

Pump casing & suction cover	Cast iron BS EN 1561 - 1997
Wearplates	High Chromium Cast Iron HC403:1977
Pump Shaft	Carbon steel BS 970 - 1991 817M40T
Impeller	Cast Steel BS3100 A5 Hardness to 200 HB Brinell
Non-return valve body	Cast iron BS EN 1561 - 1997
Mechanical seal	Silicon carbide face; Viton elastomers; Stainless steel body

Engine option 1

John Deere 4045TF285 (T3 Flex), 99 HP @ 2200 rpm

Impeller diameter 11.4"

Pump speed 2200 rpm

Suction Lift Table

Total Suction Head (feet)	Total Delivery Head (feet)				
	42	70	101	121	137
	Output (USGPM)				
10	3148	2906	2325	-	-
15	2906	2543	2058	1695	-
20	1695	1695	1695	1453	-
25	1211	1211	1211	969	387

Fuel capacity: 100 US Gal

Max Fuel consumption @ 2200 rpm: 5.8 US Gal/hr

Max Fuel consumption @ 1800 rpm: 5.0 US Gal/hr

Weight (Dry): 4,440 lbs

Weight (Wet): 5,160 lbs

Dim.: (L) 155" x (W) 76" x (H) 93"

Performance data provided in tables is based on water tests at sea level and 20°C ambient. All information is approximate and for general guidance only. Please contact the factory or office for further details.

Engine option 2

John Deere 4045HFC92 (IT4), 99 HP @ 2200 rpm

Impeller diameter 11.4"

Pump speed 2200 rpm

Suction Lift Table

Total Suction Head (feet)	Total Delivery Head (feet)				
	42	70	101	121	137
	Output (USGPM)				
10	3148	2906	2325	-	-
15	2906	2543	2058	1695	-
20	1695	1695	1695	1453	-
25	1211	1211	1211	969	387

Fuel capacity: 100 US Gal

Max Fuel consumption @ 2200 rpm: 5.4 US Gal/hr

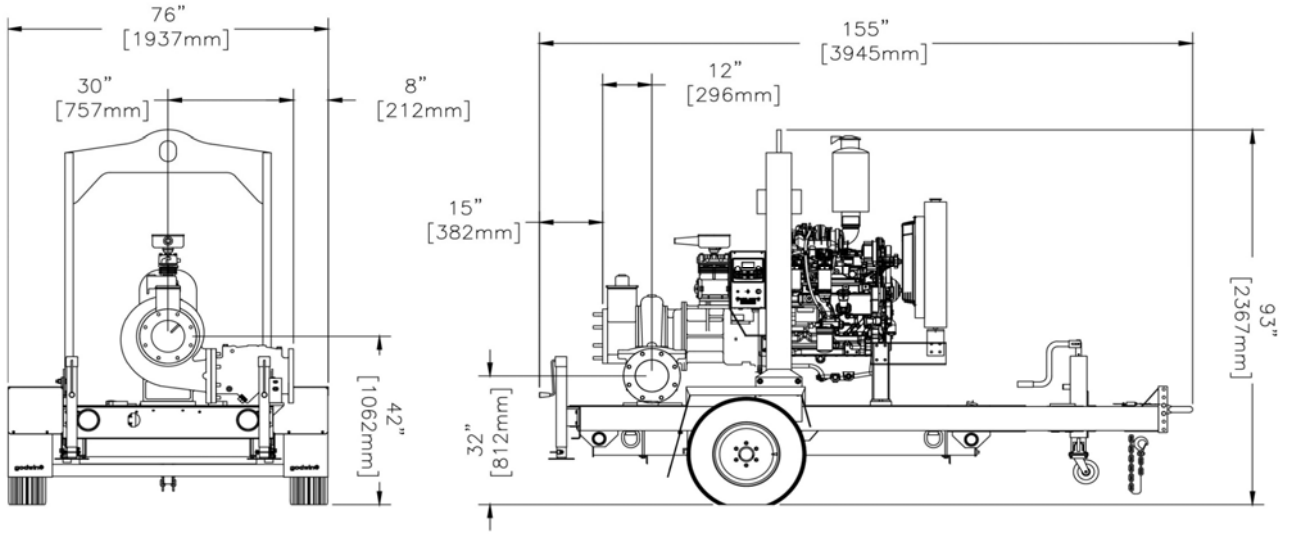
Max Fuel consumption @ 1800 rpm: 4.8 US Gal/hr

Weight (Dry): 4,680 lbs

Weight (Wet): 5,400 lbs

Dim.: (L) 155" x (W) 76" x (H) 93"

Performance data provided in tables is based on water tests at sea level and 20°C ambient. All information is approximate and for general guidance only. Please contact the factory or office for further details.



xylem
Let's Solve Water

84 Floodgate Road
Bridgeport, NJ 08014 USA
(856) 467-3636 . Fax (856) 467-4841
Email: sales@godwinpumps.com

Reference number : 95-1015-3000
Date of issue : February 26, 2014
Issue : 5

www.godwinpumps.com

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APPENDIX D: Miscellaneous Pump, Force Main & Wet Well Calculations

City of Coos Bay
Pump Station No. 17 Improvements
Project No. 187.24
3/20/18

Force Main Calculations

Existing 1 Pump Force Main @ ADWF (2018)		**Notes**
Area of existing well section (sf)	56.75	Assume Throughout wet well
Design wet well operation range (ft)	4.00	Assume same as operation depth
Total wet well operational volume (gal)	1,697.81	
Length of 8-inch FM (ft)	2,716	
Length of 10-inch FM (ft)	2,414	
Length of 12-inch FM (ft)	3,280	
Volume of 8-inch FM (gal)	7,092	
Volume of 10-inch FM (gal)	9,848	
Volume of 12-inch FM (gal)	19,269	
Total Volume (gal)	36,209	
Velocity of 8-inch FM (ft/s)	4.47	Assume 8 inch for conservative estimate
Pump 1 Design flow rate (gpm)	700.0	Existing 25 hp single pump
Start up ADWF (gpm)	167.0	Year 2018 flows
Time to pump out (min)	3.19	
Time to Fill (min)	10.17	
Pump cycle time base on ADWF (min)	13.35	
Pump cycles per hour (cycles/hr)	4.49	
Actual volume pumped per cycle (gal)	2,229.77	
Number of Cycles to fill force main (cycles)	16.24	
Detention time (min)	**216.82**	

1 Pump - New Force Main @ ADWF (2018)		**Notes**
Area of wet well Section (sf)	56.75	
Design wet well operation range (ft)	4.00	
Total wet well operational volume (gal)	1,697.81	
Length of 10-inch FM (ft)	1,620	
Length of 12-inch FM (ft)	4,255	
Length of 14-inch HDPE FM (ft)	2,125	
Volume of 10-inch FM (gal)	6,609	
Volume of 12-inch FM (gal)	24,997	
Volume of 14-inch HDPE FM (gal)	11,070	
Total Volume (gal)	42,676	
Velocity of 10-inch FM (ft/s)	5.47	Assume 10 inch for conservative estimate
Pump 1 Design flow rate (gpm)	1340.0	Proposed 45 hp pump
Start up ADWF (gpm)	167.0	Year 2018 flows
Time to pump out (min)	1.45	
Time to Fill (min)	10.17	
Pump cycle time base on ADWF (min)	11.61	
Pump cycles per hour (cycles/hr)	5.17	
Actual volume pumped per cycle (gal)	1,939.53	
Number of Cycles to fill force main (cycles)	22.00	
Detention time (min)	**255.55**	

1 Pump - New Force Main @ ADWF (2038)		**Notes**
Area of wet well Section (sf)	56.75	
Design wet well operation range (ft)	4.00	
Total wet well operational volume (gal)	1,697.81	
Length of 10-inch FM (ft)	1,620	
Length of 12-inch FM (ft)	4,255	
Length of 14-inch HDPE FM (ft)	2,125	
Volume of 10-inch FM (gal)	6,609	
Volume of 12-inch FM (gal)	24,997	
Volume of 14-inch HDPE FM (gal)	11,070	
Total Volume (gal)	42,676	
Velocity of 10-inch FM (ft/s)	5.47	Assume 10 inch for conservative estimate
Pump 1 Design flow rate (gpm)	1340.0	Proposed 45 hp pump
Start up ADWF (gpm)	179.0	Year 2038 flows
Time to pump out (min)	1.46	
Time to Fill (min)	9.48	
Pump cycle time base on ADWF (min)	10.95	
Pump cycles per hour (cycles/hr)	5.48	
Actual volume pumped per cycle (gal)	1,959.58	

City of Coos Bay
Pump Station No. 17 Improvements
Project No. 187.24
3/19/18

Pump Cycle Calculations

1 Pump @ ADWF		**Notes**		
Area of Wet Well Section (sf)	56.75		Diameter Wet Well	8.5
Operational Depth (ft)	4.00		Pumps Off:	-4.5
Operational Volume (cf)	226.98		Lead Pump On:	-0.5
Total Wet Well Operational Volume (gal)	1,698			
Design Flow (gpm)	179	Projected ADWF		
Pump 1 Capacity (gpm)	1,320			
Time to Fill Operational Volume (min)	9.48	With Pumps Off		
Pump Flow Volume (gpm)	1,320			
Net Outflow From Wet Well (gpm)	1,141.00	Net Outflow is Pump Flow Minus Max Pump Output		
Time to Empty Wet Well (min)	1.49	One Pump On		
Starts Per Hour	5.47			
Starts Per Hour (Alternating Pumps)	**2.73**			

Pump Cycle Calculations

1 Pump - Half Capacity		**Notes**		
Area of Wet Well Section (sf)	56.75		Diameter Wet Well	8.5
Operational Depth (ft)	4.00		Pumps Off:	-4.5
Operational Volume (cf)	226.98		Lead Pump On:	-0.5
Total Wet Well Operational Volume (gal)	1,698			
Design Flow (gpm)	660	Half Capacity		
Pump 1 Capacity (gpm)	1,320			
Time to Fill Operational Volume (min)	2.57	With Pumps Off		
Pump Flow Volume (gpm)	1,320			
Net Outflow From Wet Well (gpm)	660.00	Net Outflow is Pump Flow Minus Max Pump Output		
Time to Empty Wet Well (min)	2.57	One Pump On		
Starts Per Hour	11.66			
Starts Per Hour (Alternating Pumps)	**5.83**			

Pump Cycle Calculations

Pump 1 & 2 - 100% Capacity		**Notes**		
Wet Well Fill Rate - Pumps Off			Design Flow (gpm)	1792
Operational Depth (ft)	4.00		Diameter Wet Well (ft)	8.5
Operational Volume (cf)	226.98		Area of Wetwell Section (sf)	56.75
Total Wet Well Operational Volume (gal)	1,698		Pumps Off elev. (ft):	-4.5
Design Flow (gpm)	1,792	Projected PIF	Lead Pump On elev (ft):	-0.5
Time to Fill Operational Volume (min)	0.95	With Pumps Off	Lead Pump On elev (ft):	0.5
Wet Well Fill Rate - Pump 1 On				
Operational Depth (ft)	1.00			
Operational Volume (cf)	56.75			
Total Wet Well Operational Volume (gal)	424			
Pump Flow Volume (gpm)	1,320			
Pump 1 On - Operational Volume (min)	0.90	With Pump 1 On		
Wet Well Fill Rate - Pump 1 and 2 On				
Operational Depth (ft)	5.00			
Operational Volume (cf)	283.73			
Total Wet Well Operational Volume (gal)	2,122			
Pump 1 + 2 Flow Volume (gpm)	1,867	Full Capacity Pump Station		
Pump 1 + 2 On - Operational Volume (min)	28.30	With Pump 1 + 2 On		
Total Cycle Time (min)	30.14			
Starts Per Hour	**1.99**			

City of Coos Bay
Pump Station No. 17 Improvements
Project No. 187.24
3/20/18

Time to Overflow

Pump Station Wet Well		**Notes**
Inside wet well diameter (ft)	8.5	
Area of existing well section (sf)	56.745	Assume total wet well uniform
Key Elevations (ft)		
Top of Wet Well	9.5	Above the overflow point
Bottom of Wet Well	-6.6	
12-inch inlet at Wet Well	0.28	
Manhole Upstream of PS Invert elevation	13	Assumed Overflow Point
Assumed Outlet at Each Manhole	0.4333	Average manhole depth
Capacity of Existing Collection System		
Existing Wet Well (gal)	6834	
8-inch upstream sewer pipe (gal)	2089	Length of pipe = 200 East + 600 South feet
10-inch upstream sewer pipe (gal)	816	Length of pipe = 200 feet North
48-inch upstream manhole (gal)	3544	3 manholes
Total Capapacity (gal)	13282	
Flows		
Average Dry Weather Flow at startup (ADWF)	167	
Average Dry Weather Flow at 2034 (ADWF)	179	
Time to Overflow		
Existing time to overflow at ADWF (min)	79.53	at 167 gpm
2018 Start up time to overflow at ADWF (min)	79.53	at 167 gpm
2038 time to overflow at ADWF (min)	74.20	at 179 gpm

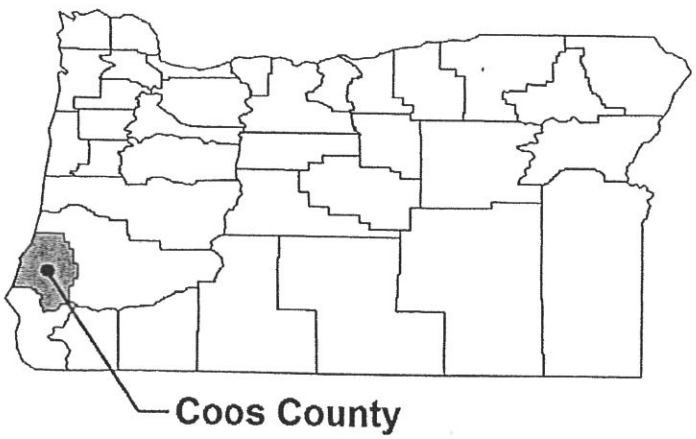
APPENDIX E: Flood Plain Map

FLOOD INSURANCE STUDY



COOS COUNTY, OREGON
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
BANDON, CITY OF	410043
COOS BAY, CITY OF	410044
COOS COUNTY (UNINCORPORATED AREAS)	410042
COQUILLE, CITY OF	410045
LAKESIDE, CITY OF	410278
MYRTLE POINT, CITY OF	410047
NORTH BEND, CITY OF	410048
POWERS, CITY OF	410049



Revised:
March 17, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
41011CV000B

Table 8. Summary of Elevations (continued)

Flooding Source	Peak Water Surface Elevations (Feet NAVD88) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Pacific Ocean				
Bandon Profile 12	--	--	32.8	34.1
Bandon Profile 13	--	--	36.2	40.4
Bandon Profile 14	--	--	31.5	32.9
Bandon Profile 15	--	--	22.2	23.7
Bandon Profile 16	--	--	20.8	22.1
Bandon Profile 17	--	--	20.8	22.0
Bandon Profile 18	--	--	20.6	21.9
Bandon Profile 19	--	--	30.6	31.3
Bandon Profile 20	--	--	26.7	29.3
Bandon Profile 21	--	--	31.6	32.1
Coos Bay				
South Slough	10.4	11.0	11.2	11.7
Ponding in the City of Coos Bay	11.2[1]	12.3[2]	12.6[2]	13.3[2]
West corporate limit of North Bend	11.2	11.8	12.1	12.6
Pony Slough	11.3	12.0	12.2	12.8
North Slough	11.5	12.1	12.4	13.0
Haynes Inlet	11.5	12.1	12.4	13.0
Southeast corporate limit of North Bend	11.6	12.3	12.6	13.3
Isthmus Slough at downtown Coos Bay	11.7	12.3	12.6	13.3
Isthmus Slough at Millington	11.8	12.4	12.7	13.4
Coalbank Slough	11.9	12.5	12.8	13.4
Coos River	12.3	13.1	13.5	14.5
North Tenmile Lake				
At City of Lakeside	21.8	23.2	23.8	25.0
Tenmile Lake				
At City of Lakeside	21.8	23.2	23.8	25.0
Blossom Creek				
City of Coos Bay	8.6[3]	11.6[4]	12.6[2]	13.3[2]
Coquille River				
City of Bandon	12.6	14.5	15.2	17.0
Ferry Creek				
City of Bandon	12.6	14.5	15.2	17.0

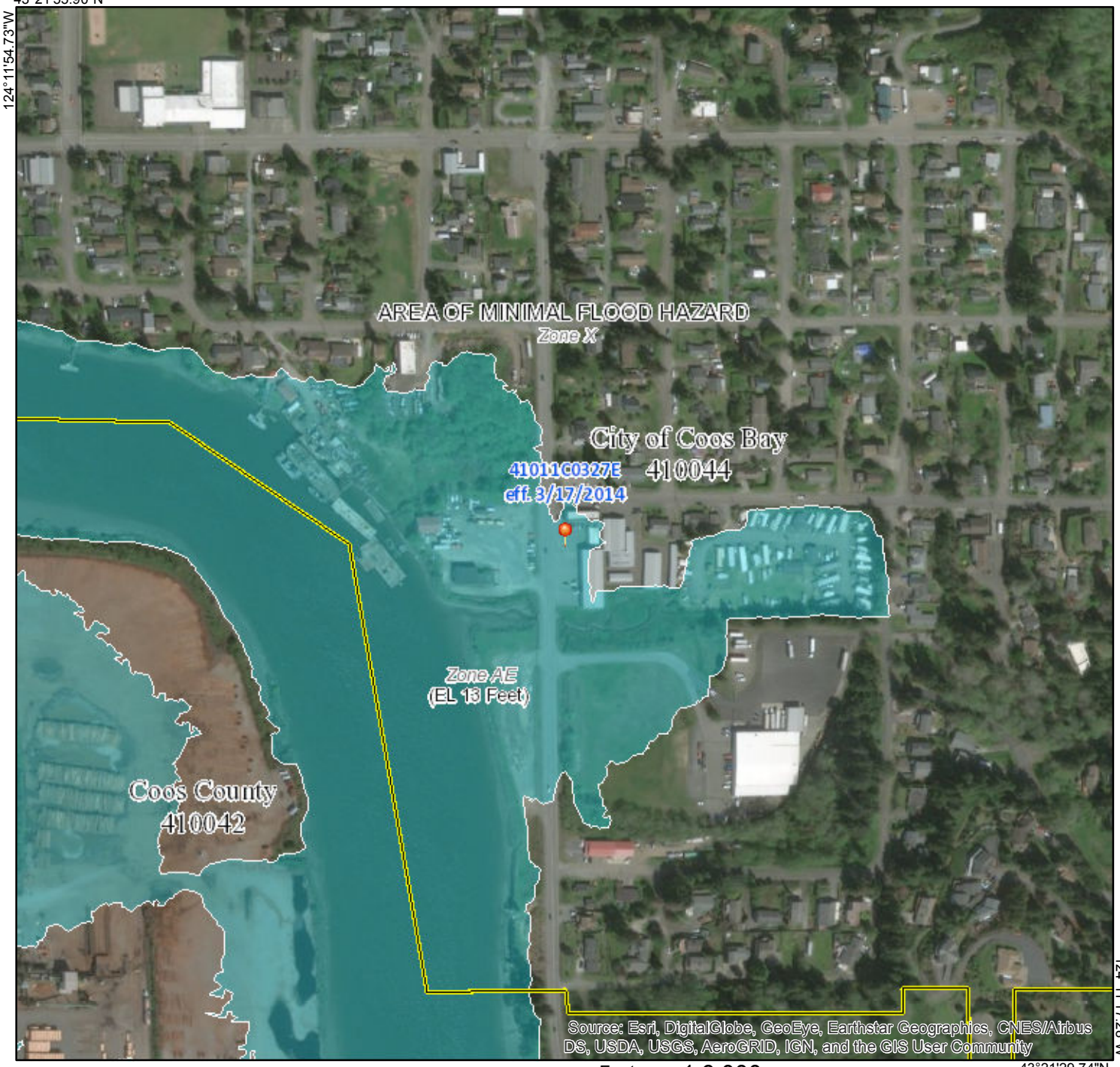
[1] Limited flow over city dike will fill low areas of downtown Coos Bay.
[2] Peak elevation is controlled by elevation in slough.
[3] Peak elevation is controlled by volume of Blossom Creek hydrograph that must be stored.
[4] Peak elevation is controlled by the total volume of flow over the dike stored in downtown Coos Bay and Blossom Creek areas.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

National Flood Hazard Layer FIRMette

FEMA



Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

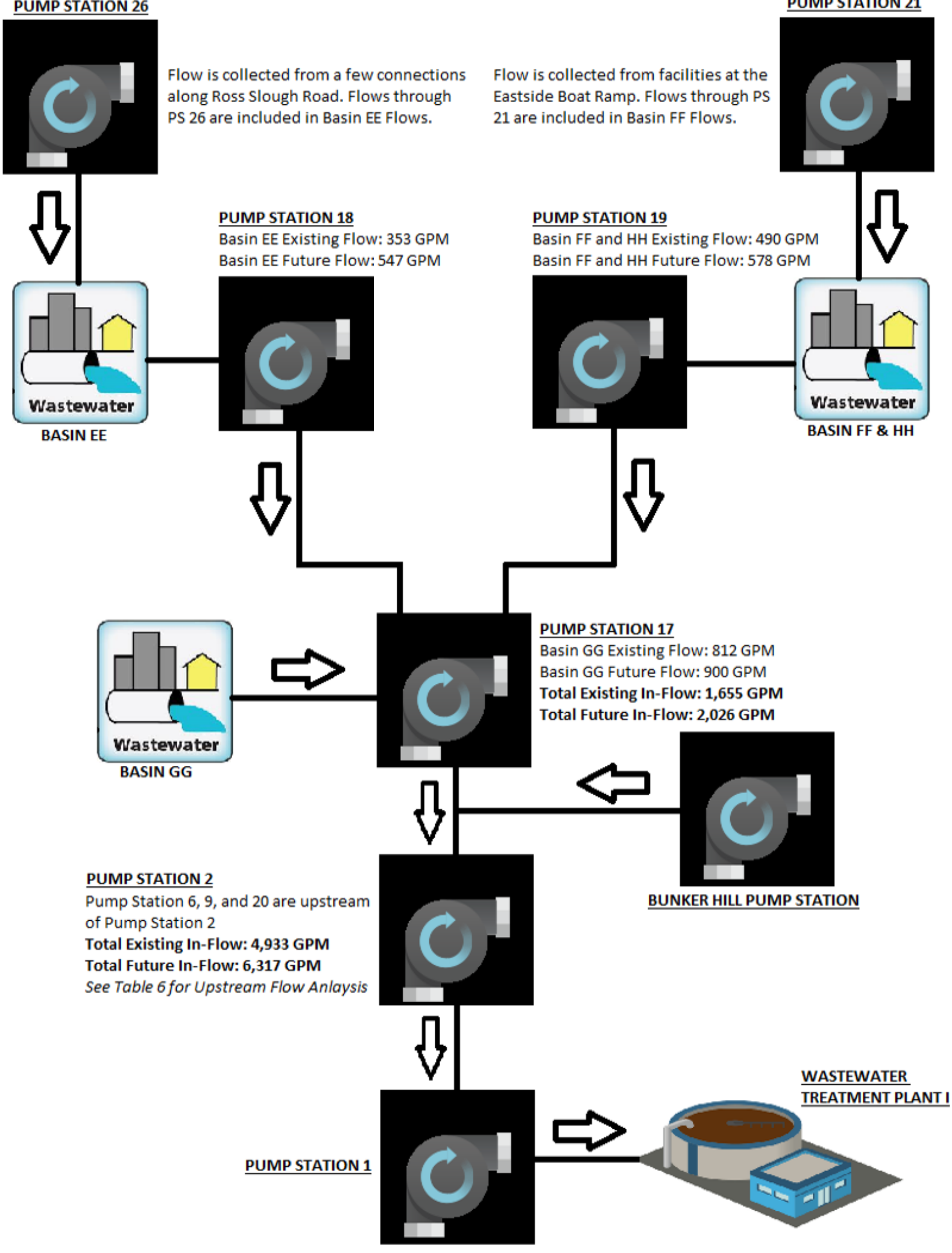
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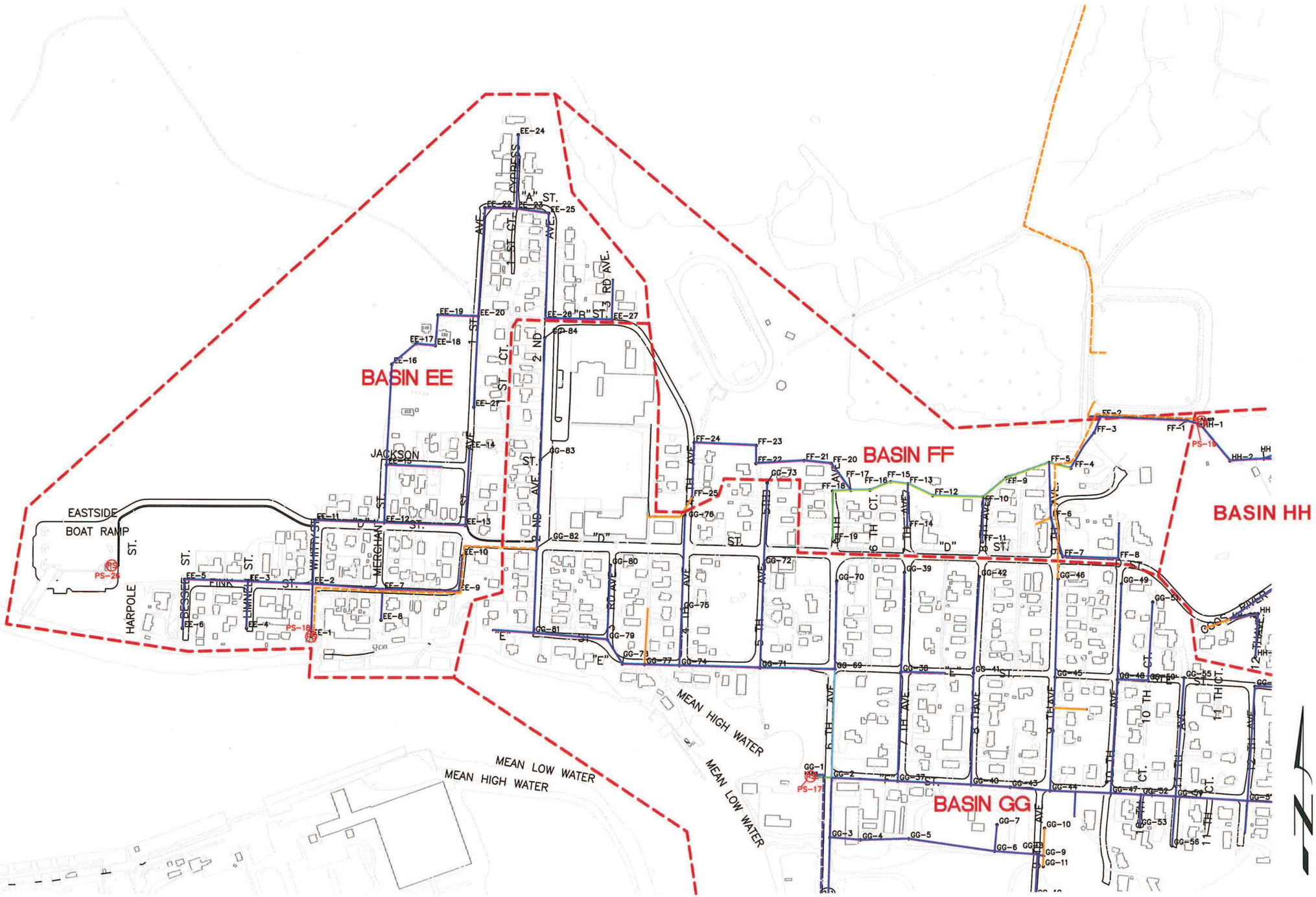
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/8/2018 at 6:00:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX F: Existing Collection System Map


PUMP STATION 26
Flow is collected from a few connections along Ross Slough Road. Flows through PS 26 are included in Basin EE Flows.
PUMP STATION 21
Flow is collected from facilities at the Eastside Boat Ramp. Flows through PS 21 are included in Basin FF Flows.
PUMP STATION 18
Basin EE Existing Flow: 353 GPM
Basin EE Future Flow: 547 GPM
PUMP STATION 19
Basin FF and HH Existing Flow: 490 GPM
Basin FF and HH Future Flow: 578 GPM
Wastewater
BASIN EE
Wastewater
BASIN FF & HH
Wastewater
BASIN GG
PUMP STATION 17
Basin GG Existing Flow: 812 GPM
Basin GG Future Flow: 900 GPM
Total Existing In-Flow: 1,655 GPM
Total Future In-Flow: 2,026 GPM
BUNKER HILL PUMP STATION
PUMP STATION 2
Pump Station 6, 9, and 20 are upstream of Pump Station 2
Total Existing In-Flow: 4,933 GPM
Total Future In-Flow: 6,317 GPM
See Table 6 for Upstream Flow Anlaysis
PUMP STATION 1
WASTEWATER TREATMENT PLANT I



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

H B H Consulting Engineers

CITY OF COOS BAY

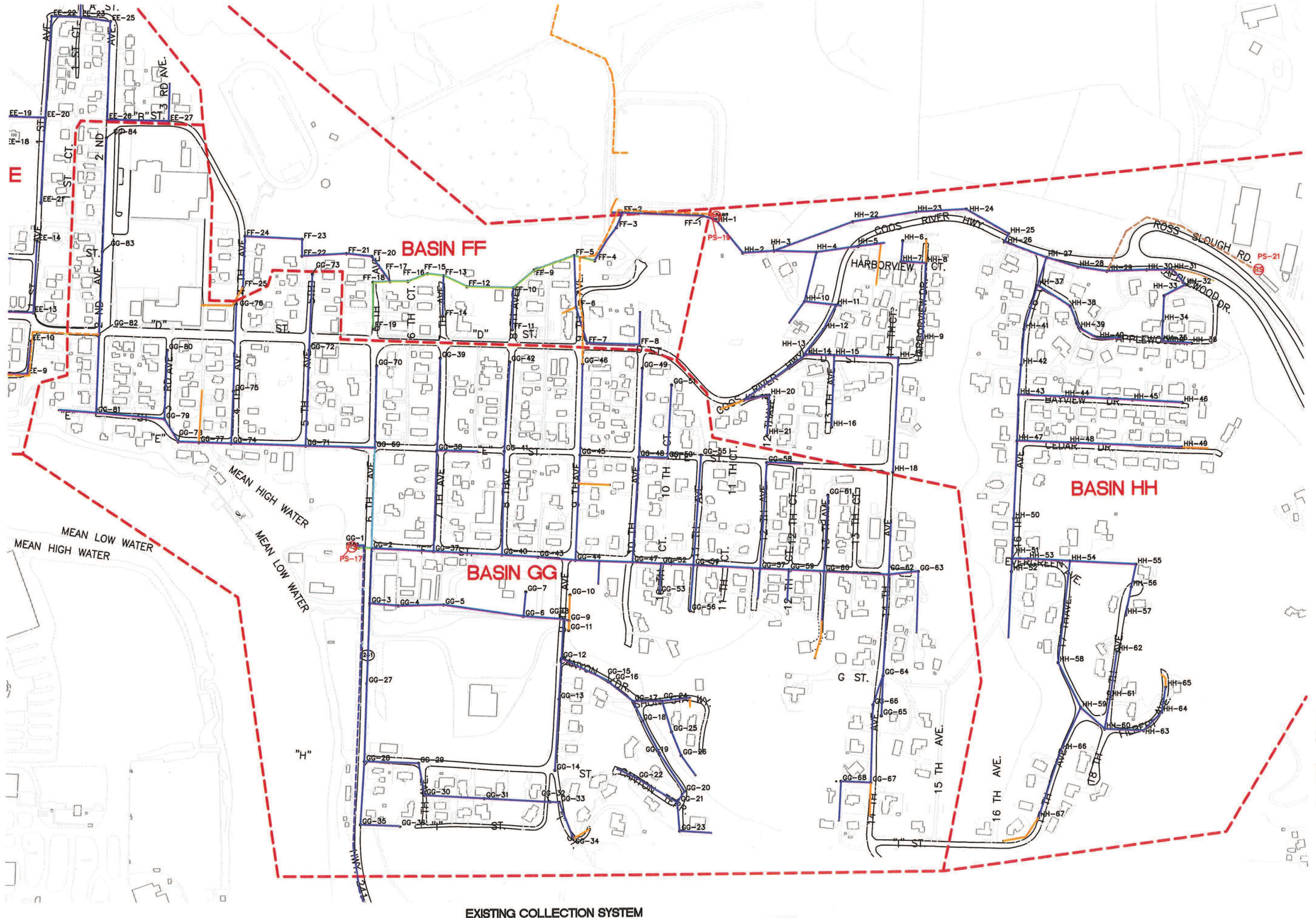
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS EE&FF

DRAWN BY: JGP

DATE: JAN 2006

MAP 17



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

H B H Consulting Engineers

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS GG&HH

DRAWN BY: JGP

DATE: JAN 2006

MAP 18

APPENDIX G: Chemical Feed System

Quality Products - Excellent

3216 E. Portland Avenue
Tacoma, WA 98404
253-779-4160
tmginc@tmgservices.net

April 20th, 2016
QUOTATION

To: A Pedroni

Reference:

TMG Services, Inc. is pleased to offer the following **QUOTATION** for the AH Water T80VP advanced dosing system per specification. AH Water is the named supplier and TMG Services is the representative for AH Water in the PNW. Note we are also including the tote and TriOxyn® chemical in our scope.

SECTION 11192: CHEMICAL FEED SYSTEMS
Scope of Equipment:

- 316 SS Nema 4X Panel (20" by 16" by 10")
  - HMI/PLC Control with 6" TFT Color Touchscreen
  - 120v 2-pole Disconnect with Power Outlet
  - Pre-Installed Inlet and Outlet
  - External Terminal Block for Field Connections
- (1) Blue-White Peristaltic Pump A100V (rated 0.2 to 2.5 gph)
  - (1) Spare Peristaltic Tube
- Stainless Steel Stand for the Panel and Piping
- Calibration Port with Valves
- AH Water Quick Connect Technology for Pump
- (1) Level Transducer (0-10 psi)
- (1) AH Water Modem for Web Access (Includes 1 year of Service – renewal annual fee $252.00)
- All parts, valves, piping, and miscellaneous to complete the installation
- Level Detection System
- Shop Testing
- Installation Assistance, Field Testing, Training, Start-up, and Optimization Services
- Freight to Site
- Warranty as Specified
- Complete Installation on a prepared site Includes (1 trip – 2 days):
  - Labor
  - Miscellaneous Pipe and Fittings
  - Start-up and Testing
  - Training

PRICE: $28,161 (Price Includes Freight, Start-up & Training)

Terms & Conditions of Sale:

-F.O.B.: JOBSITE
-Payment Terms: Net 30 Days – Our terms of payment are 100% payable 30 days after shipment. Since this is an agreement between Buyer and Seller, and Seller has no relationship with the third party owner, this agreement must be independent of any third party action or inaction. Payment will be due as indicated above without a dependency on the buyer being paid by the owner, with no further restriction or impediments, and regardless of any payment arrangement that may exist between contractor and owner.
-This price is in effect for 60 days.
-Submittals, if required, will be provided 4-6 weeks after receipt of all technical data at T M G Services.
-Delivery will be made in approximately 4-6 weeks after receipt of order and/or approvals and resolution of all necessary technical data at T M G Services.
-Manufacturers' standard warranties apply to all equipment and components listed on this quotation.

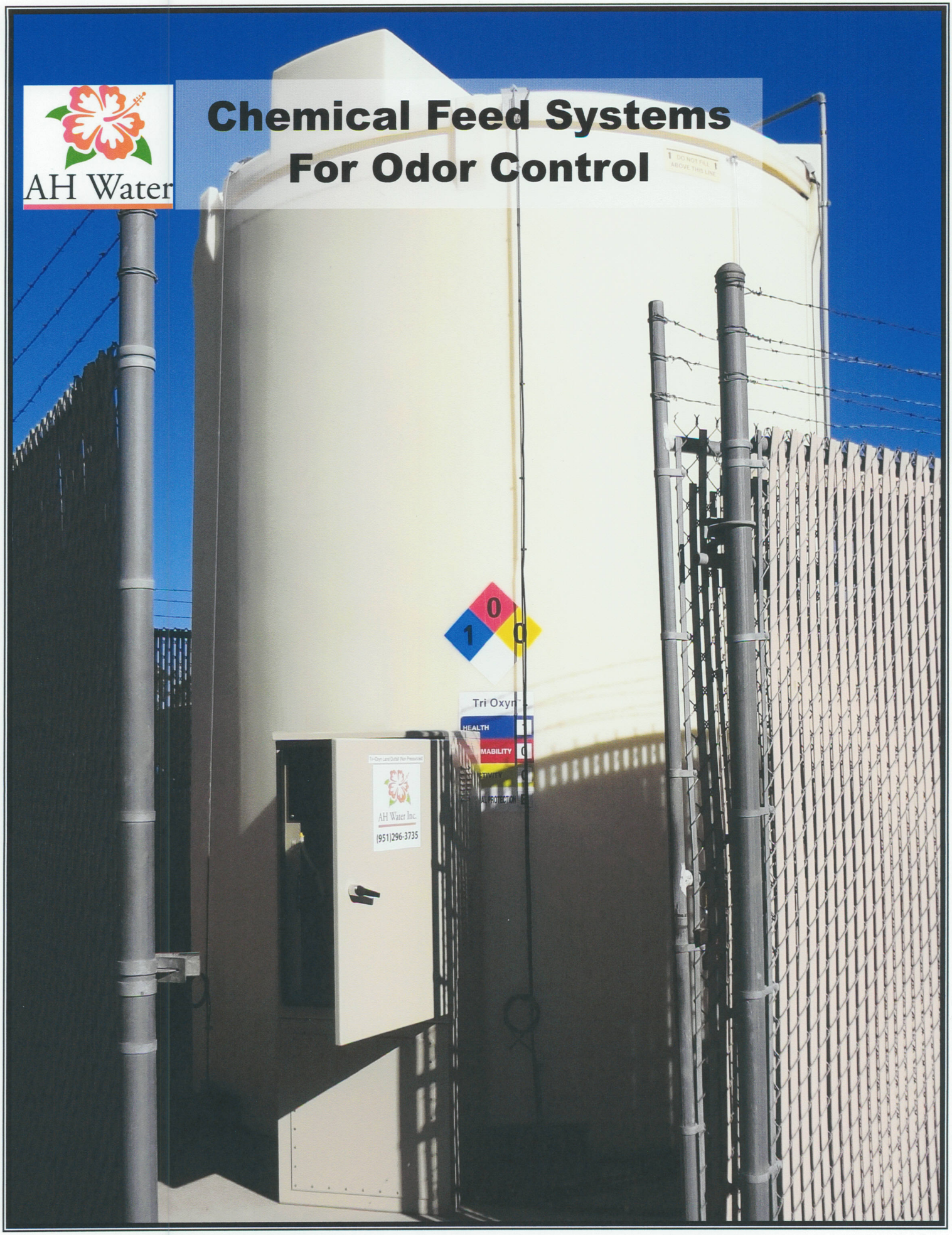
-Customer is responsible for off-loading all merchandise at its point of destination.
-Quotation prices do not include any sales taxes or any other taxes that may apply.
-This quotation is limited to the products and/or services as listed and excludes any item or service not specifically listed.

If you have any questions or need further information please do not hesitate to call me at (253) 779-4160.
TMG Services, Inc. and I look forward to working with you.

Sincerely,
Robert Jimenez
TMG Services, Inc.

AH Water

Chemical Feed Systems For Odor Control



Simplifying Your Odor Control Decision

CONTROL MODELS

Model	Overall Dimensions	Controls	Pump Model	Treatment Range
T80-T	Stand or Wall Mounted: 16"W X 20"H X 10"D	7 Day Timer Controlled	Blue-White A100NC	1 to 20 GPD
T80-VP*	Stand or Wall Mounted: 16"W X 20"H X 10"D	PLC System Control	Blue-White A100NV	5 to 80 GPD
T200-VP*	Stand or Wall Mounted: 24"W X 30"H X 12"D	PLC System Control	Blue-White A100NV	50 to 200 GPD
T500-V*	Free Standing: 24"W X 61"H X 20"D	PLC System Control	Blue-White A3V	50 to 500 GPD
T2000-V*	Free Standing: 25"W X 62"H X 25"D	PLC System Control	Blue-White A4V	100 to 2000 GPD
Retrofit	Tie in Box to Existing System: 16"W X 20"H X 10"D	PLC System Control	Existing Pumps	Existing Range

* These systems are available with high pressure diaphragm pumps - up to 175 psi

Blue-White® Industries, Ltd.



T500-V Model





T80-VP Model

CONTROLS

AH Water provides a variety of options for precise dosing control. AH Water has focused on providing PLC Based advanced controls that are economical for all dose rates. All AH Water systems are designed for ease of use and maintenance. The systems are designed for any type of odor control chemical on the market.

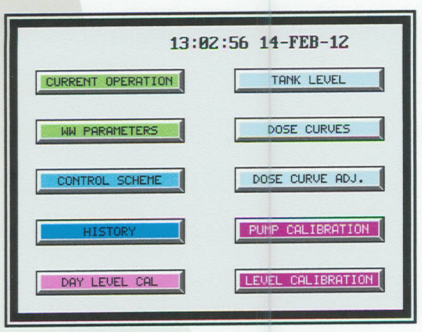
Features:

Timer Controls

- Compact Design
- Economical for low rate systems
- Wall or stand mounted
- Quick connect power and liquid connections
- 7 day programmable timer
- 1 or 2 pump options with separate controls
- 120V extra always on outlet



PLC Advanced Control



Standard PLC

- Compact design up to 2000gpd treatment
- All touch screen controls
- Quick connect power, liquid and control connections
- 48 - 1/2 hour set points for each day
- Adjusted flow pace/tie-in to pumps for force main injection
- Pressures to 150 psi - standard
- Weekly and daily adjustment factors
- Ultrasonic or pressure transducer for level monitoring
- Additional 16 I/O for easy tie to SCADA and other systems
- Secure Remote access to the PLC over the internet
- Easy custom programming
- Easy retrofit into existing systems

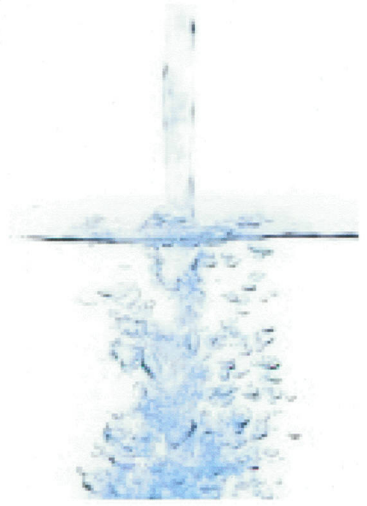
TriOxyn™ outperforms the competition at a lower cost

AH Water provides signature treatment solutions and is a manufacturer of nitrate products specifically formulated for superior odor control.

TriOxyn™ is a neutral pH solution with less nitrate for any given goal; is double filtered and with every load comes a certificate of analysis.

TriOxyn™ is ammonia free thereby diminishing the need for oxygen. There is no oxygen / nitrate demand created by the product in the collection system or at the treatment plant.

All American components and chemicals are used in developing a TriOxyn™ program; from the Blue White peristaltic pump to the tanks and fittings which positively affect availability and pricing.





- AH Water offers complete odor control programs
- Our technicians and engineers will exceed your expectations
- You will receive personal attention
- Our products exceed industry standards.
- 100% American Made
- Your satisfaction is our goal
- We pride ourselves on providing the most comprehensive program at a competitive price



AH Water

26111 Ynez Rd. Ste. C-3
Temecula, CA 92591
Office 951.296.3735
Fax 951.296.1837
ahwater@verizon.net

www.ah-water.com

AH Water
26111 Ynez, C-3
Temecula, CA 92591

The TriOxyn® Process

Overview

The TriOxyn® Process is a combination of reactions in wastewater that occurs when the active ingredient in TriOxyn, nitrate, is added to the system. This addition results in 2 specific reactions that effectively control hydrogen sulfide in solution. The first reaction is the biological reduction of BOD with nitrate as opposed to sulfate as the electron receptor (or oxygen source) for the bacteria. The second reaction is the biological oxidation of sulfide to sulfate that happens with naturally occurring bacteria removing any upstream or local production of sulfide in solution. The net effect is total control over sulfide in solution to any desired level at a given control point.

TriOxyn® is a non- hazardous solution of calcium nitrate manufactured to a specification that best meets the specific application. The optimal TriOxyn® formulation contains 3.5 pounds of nitrate-oxygen and has no ammonia.

Process Reactions and Stoichiometry

The production of sulfide in a municipal wastewater system predominantly occurs in the collection system. The TriOxyn® process can occur in any place in a wastewater system. When the TriOxyn® process is utilized in the collection system, the hydrogen sulfide is removed which benefits the downstream Treatment Facility. In the collection system, gravity or force main, where the TriOxyn® Process is being implemented there are 3 major zones and 3 major reactions occurring simultaneously.

In a given collection system pipe, at any section of the pipe where the TriOxyn® process is initiated, the following reactions are occurring in the various zones:

Zone 1 - The bulk fluid

Reactions:

$$\mathbf{6NO_3^- + 5CH_3OH \rightarrow 5CO_2 + 3N_2 + 7H_2O + 6OH^-} \qquad \mathbf{(1)}$$

$$\mathbf{8NO_3^- + 5H_2S \rightarrow 5SO_4^{=} + 4N_2 + 4H_2O + 2H^+} \qquad \mathbf{(2)}$$

The hydrogen sulfide shown in equation 2 is from upstream or locally produced sources.

Methanol, CH_30H, is used to model the carbon source or BOD in all reactions. In the actual wastewater there are many other molecular carbon sources with similar reactions.

Zone 2 - The slime layer in contact with the bulk fluid

Reactions:

$$6NO_3^- + 5CH_3OH \rightarrow 5CO_2 + 3N_2 + 7H_2O + 6OH^- \quad (1)$$

$$8NO_3^- + 5H_2S \rightarrow 5SO_4^{=} + 4N_2 + 4H_2O + 2H^+ \quad (2)$$

The hydrogen sulfide shown in equation 2 is from upstream or locally produced sources such as the slime layer that does not have access to the nitrate and therefore uses sulfate as the electron receptor or oxygen source.

Zone 3 - The slime layer not in direct contact with the bulk fluid

Reaction:

$$SO_4^{=} + 4CH_3OH \rightarrow S^{=} + 4H_2O + 2CH_4 + 2CO_2 \quad (3)$$

The bacteria in the slime layer in contact with the bulk fluid consume the nitrate provided in the bulk fluid. As the nitrate penetrates the slime layer there is a concentration gradient from the bulk fluid in toward the pipe wall as the nitrate consumed. Hydrogen sulfide is produced in this zone and diffuses into Zones 1 and 2 where the nitrate in reaction 2 is able to remove it. This allows the hydrogen sulfide levels to be zero at a given control point while keeping the process cost effective.

APPENDIX H: Pacific Power

CUSTOMER COST ESTIMATE

Customer Name: City of Coos Bay **Date:** 4/23/2018

Title: 699 6th Ave, CB -PMP#17 upgrade prjct **Request #** 6513951

The cost estimate provided below is valid as per conditions set forth.

Total Job Cost	**$**	17286
Less Customer Allowance	**$**	0
Less Contract Administration Credit	**$**	0
Total Customer Advance	**$**	**17,286.00**

Ball Park Estimate ☑ **A Ball Park Estimate is non-binding.**

☐

Conditions/Comments

City of Coos Bay upgrading pump sizes at site #17 from existing 2-25 hp pumps to 2-60 hp pumps. This ballpark cost covers a new three phase primary pole being set at the SW corner of 6th Ave/ F St. intersection. This new pole will have a transformer bank installed on it to provide the pump station #17 with a 277/480 volt, 4 wire wye service. This ballpark is for a 200 amp service entrance (direct connect metering). This ballpark includes a underground service from the new pole. Customer provides 1-3" pvc conduit from new meter base to new pole location. 50% start reduction required on large motors.

Customer Signature n/a

PacifiCorp Signature Michael Smith, Estimator, Coos Bay District

White - Customers Copy
Yellow - PacifiCorp File

RCMS-Estimating Support


6th ave
699, pmp#17
Installing new pole for three phase transformer bank, underground service to 200 amp 277/480v, 4 wire meter base (200 amp).
1994
Imagery Date: 5/1/2015 43°21'43.97" N 124°11'35.51" W elev 13 ft eye alt

APPENDIX I: Proposed Building Information







DuraFiber™ Buildings

Super-Strong, Lightweight, Insulated

Shelter your equipment, electronics, and chemicals from extreme weather and temperatures with Orenco Composites' prefab DuraFiber™ Buildings — a uniquely rugged and affordable solution.

DuraFiber Buildings are made of fiberglass using a closed-molded (not sprayed up), single-piece construction process to ensure a leakproof, seamless structure. The insulated, foam-core fiberglass walls come standard with a thickness of 3"or 4".

Interior surfaces are protected with a polyester gelcoat, while exterior surfaces are protected with a high performance polyaspartic urethane.

The result? A super-strong, lightweight, insulated structure that is durable, corrosion-resistant, and easily transportable by truck, rail, cargo container, or aircraft. Numerous sizes and custom options are available.

See details on back.

Orenco® COMPOSITES

Orenco® Composites • 133 Weyerhaeuser Dr. N., Roseburg, OR 97470 • (844) 795-9568 • (541) 459-6970 • www.orencocomposites.com

DuraFiber™ Buildings

BUILDINGS SERVE MANY MARKETS

- Water and Wastewater
- Communications
- Transportation
- Power

AND MANY APPLICATIONS

- Lift Station Controls
- Chlorination and De-Chlorination
- Motor control centers
- Power distribution centers
- Process and monitoring equipment
- Communication equipment
- Generator housing and sound attenuation
- Chemical feed and storage



A Range of Standard and Custom Features

Standard Features/Specifications

- Single-piece, closed-molded fiberglass construction
- Integral foam-core insulation in walls and roof
- No wood embedded in the structure
- Built-in internal pocket attachment system
- Insulated fiberglass entry door with stainless steel hardware
- Corrosion-resistant, UV-stable finish
- Light and transportable; eyes/brackets
- Standard dimensions and specifications ...
  - Length: 4-50 ft (1.2-15.2 m) in 1-ft increments
  - Width: 6-40 feet (1.2-12.2 m) in 2-ft increments
  - Height: 8-12 feet (2.4-3.7 m) in 1-ft increments
  - R-18 to R-24 insulation value (RSI-2.1 to RSI-4.2)
  - 100 lb/ft^2 roof rating, live load (488 kg/m^2)
  - 160 mph wind-rating (258 kph)
- Maintenance-free
- 10-year warranty

Optional Features

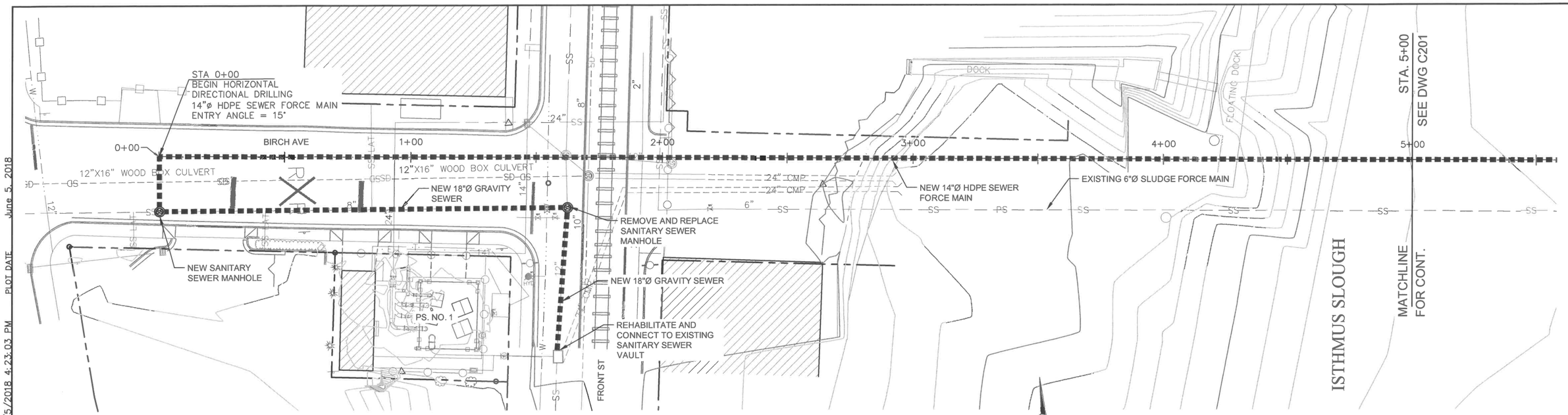
- Interior and exterior lighting
- LED lighting
- Anti-skid fiberglass floor, integrally bonded and sealed
- Double doors
- Split ductless HVAC Systems
- Electrical outlets
- Interior and exterior colors
- Insulation values of R-36 or greater
- Windows
- Interior walls
- Load centers, transformers
- Control systems
- Hazardous location components (Class I Divison I, II)
- Custom equipment
- Roof Hatches

Orenco® COMPOSITES

Call **Orenco Composites** at **(844) 795-9568** for more information or to request a Specification Sheet.

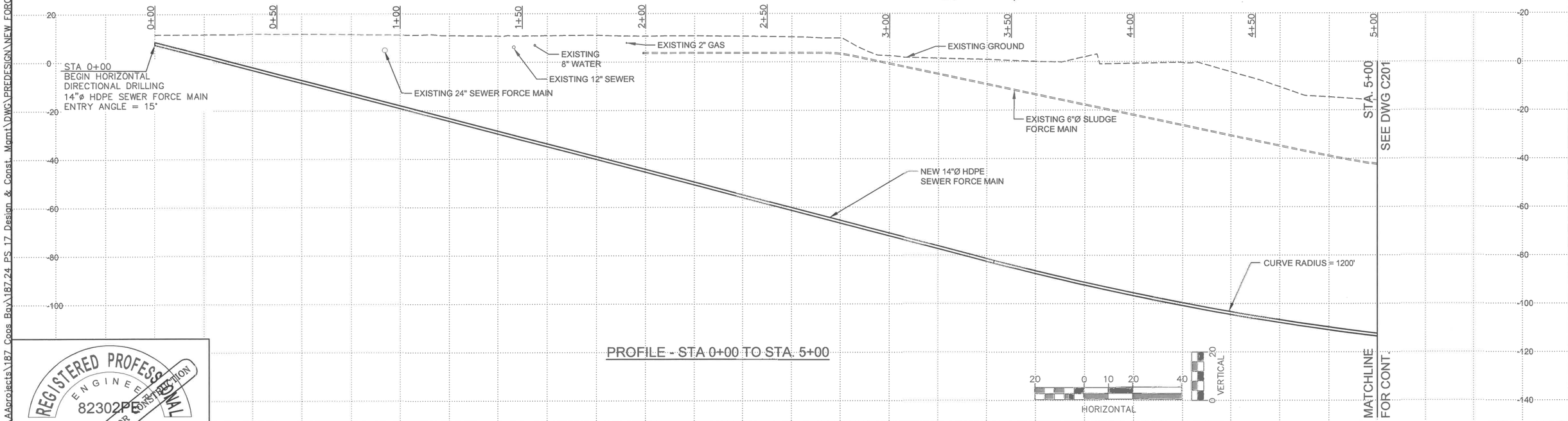
APPENDIX J: Proposed Force Main Drawings

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PLAN VIEW - STA. 0+00 TO STA. 5+00 (1 / C200)



PROFILE - STA 0+00 TO STA. 5+00

HORIZONTAL: 20 0 10 20 40
VERTICAL: 20 0

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
CREW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

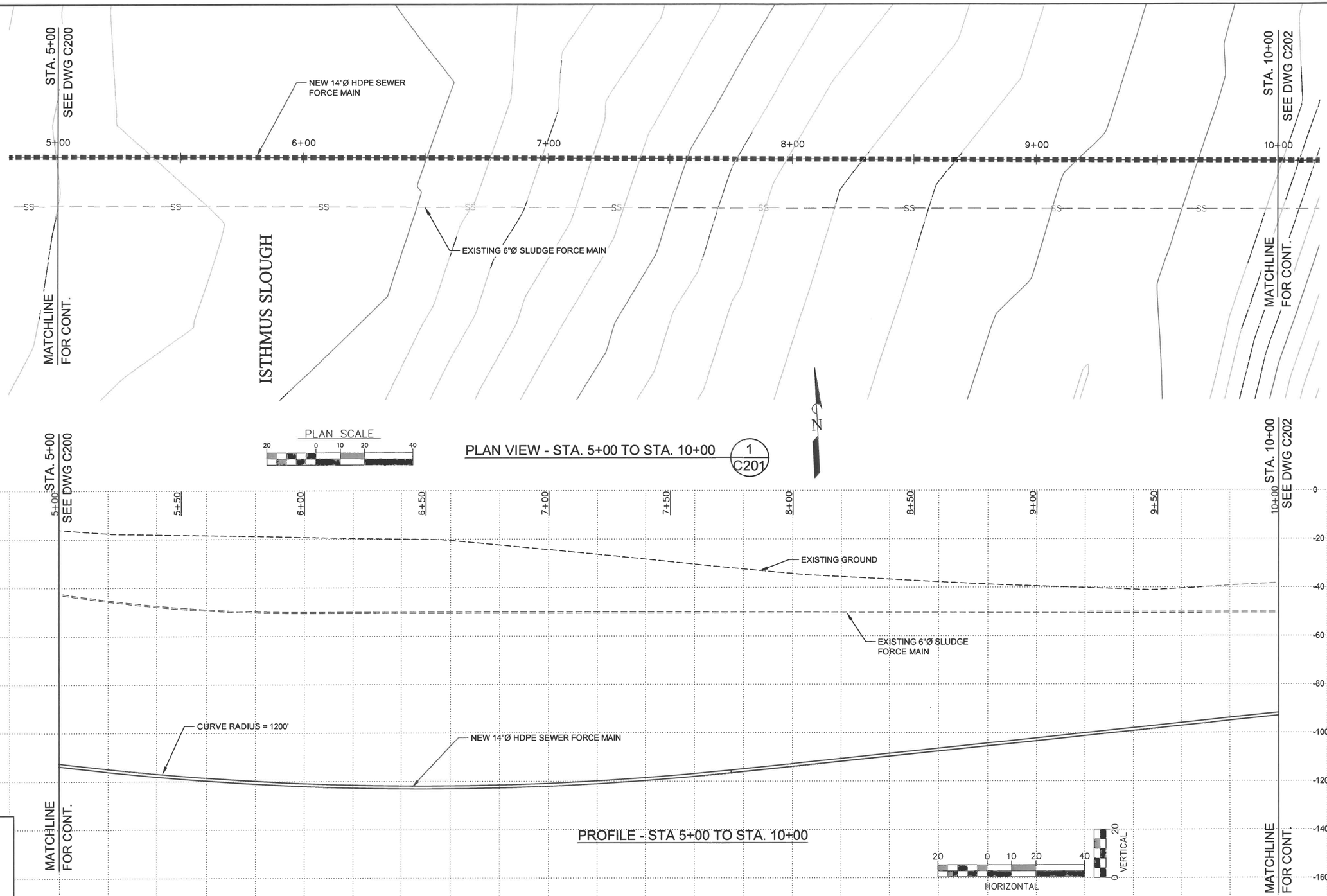
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IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 0+00 TO STA. 5+00

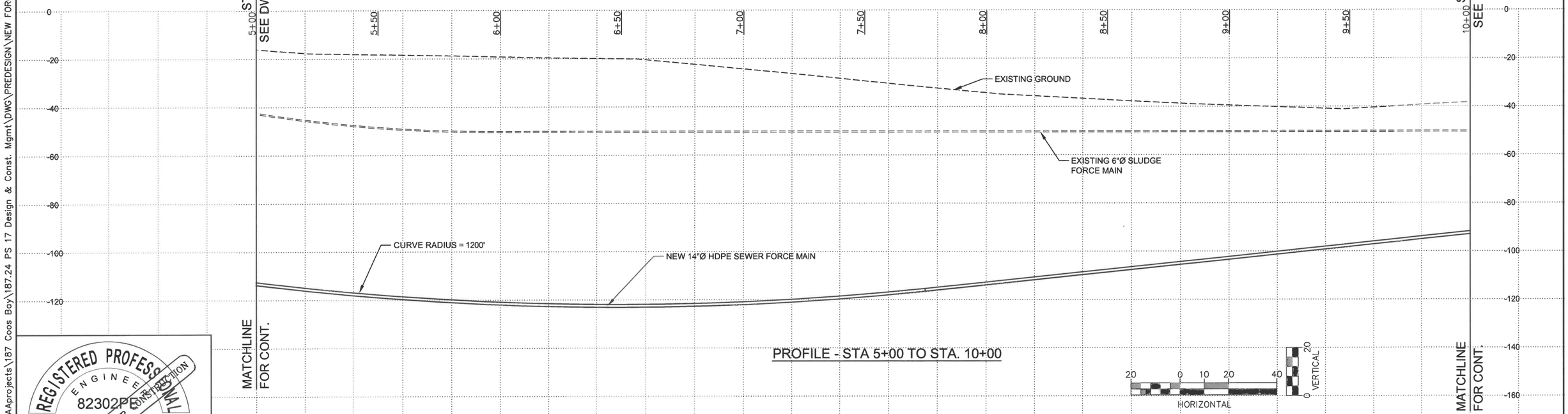
PROJECT NO.	DRAWING NO.
187.24	C200
DATE	SHEET NO.
JUNE 2018	1 OF 16

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PLAN VIEW - STA. 5+00 TO STA. 10+00 (1 / C201)



PROFILE - STA 5+00 TO STA. 10+00

20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
PRELIMINARY NOT FOR CONSTRUCTION
MAY 23, 2013
DREW C. HALL
EXPIRES 06/30/19

DESIGNED: CGP
DRAWN: CGP
APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

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ENGINEERS & PLANNERS, INC.
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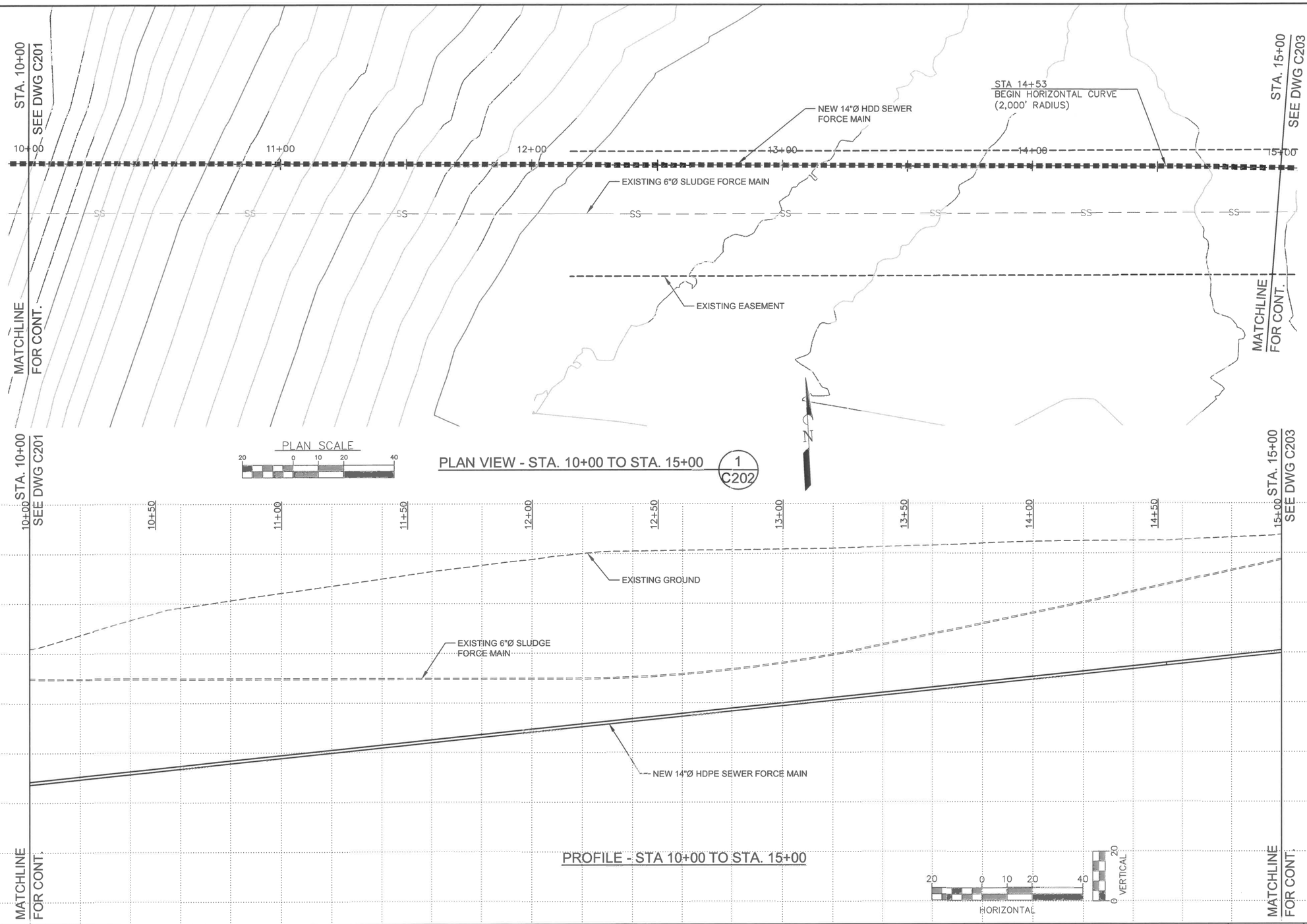
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PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 5+00 TO STA. 10+00

PROJECT NO. 187.24
DRAWING NO. C201
DATE JUNE 2018
SHEET NO. 2 OF 16

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REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
NOT FOR CONSTRUCTION
PRELIMINARY
MAY 23, 2013
ANDREW C. HALL
EXPIRES 06/30/19

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

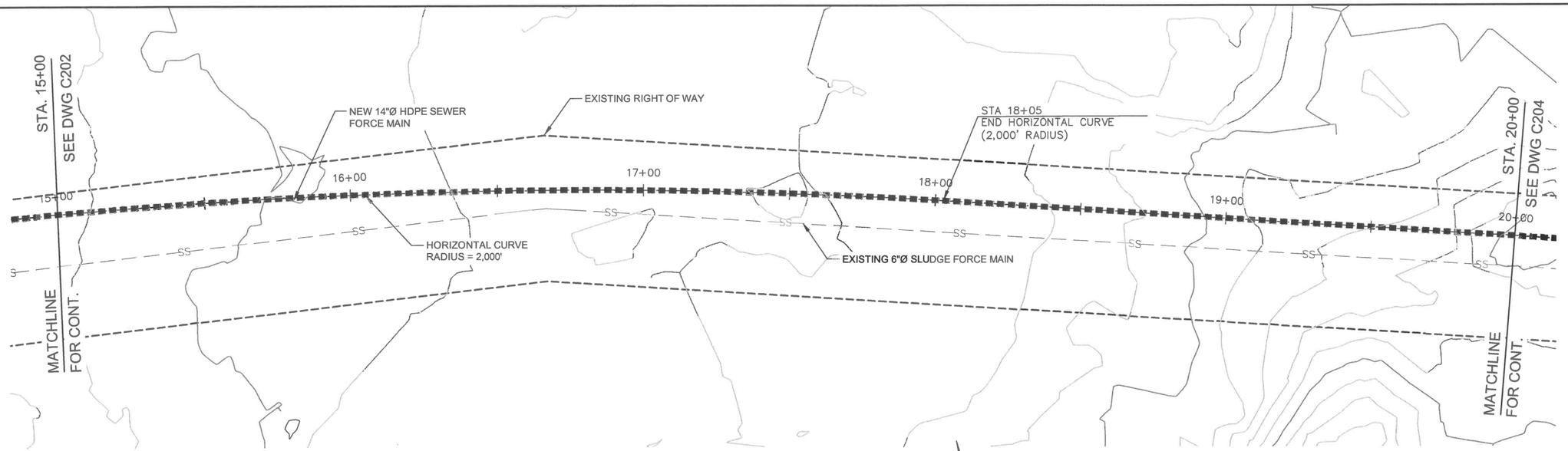
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CITY OF COOS BAY

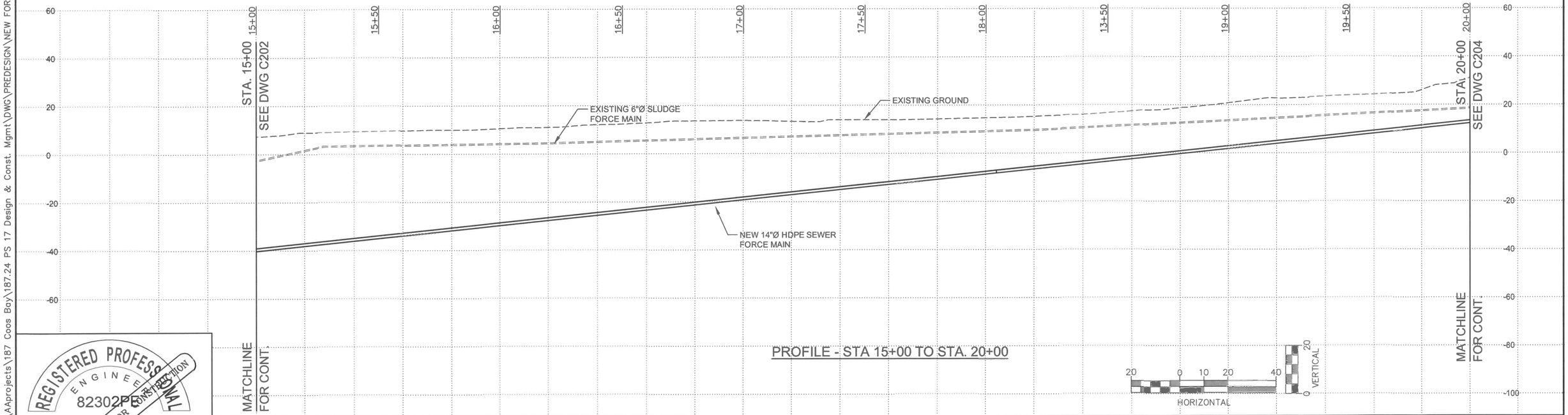
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PLAN & PROFILE - STA 10+00 TO STA. 15+00

PROJECT NO.	DRAWING NO.
187.24	C202
DATE	SHEET NO.
JUNE 2018	3 OF 16



PLAN SCALE
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PLAN VIEW - STA. 15+00 TO STA. 20+00 (1 / C203)



PROFILE - STA 15+00 TO STA. 20+00

20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JANUARY 23, 2013
ANDREW C. HALL
PRELIMINARY - NOT FOR CONSTRUCTION
EXPIRES 06/30/19

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

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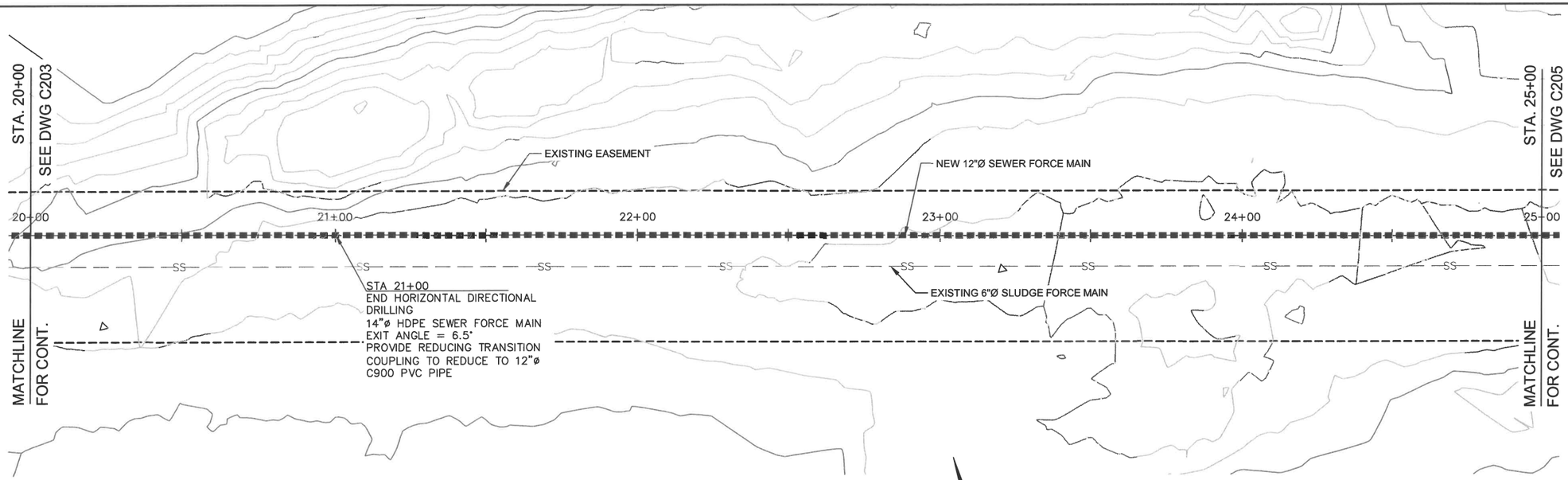
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CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 15+00 TO STA. 20+00

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DATE	SHEET NO.
JUNE 2018	4 OF 16

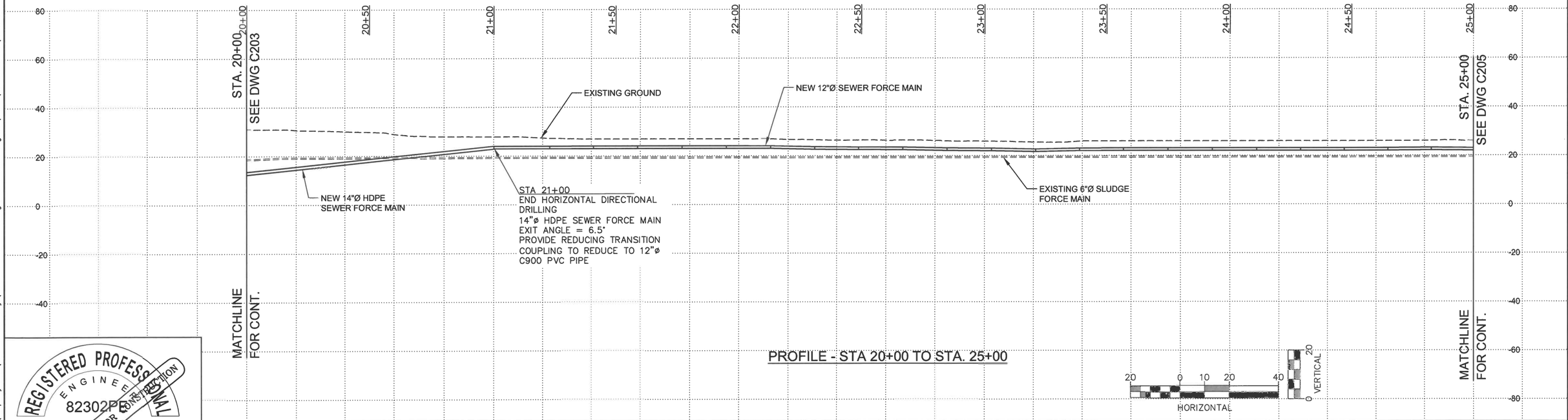
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PLAN SCALE
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PLAN VIEW - STA. 20+00 TO STA. 25+00 (1 / C204)



PROFILE - STA 20+00 TO STA. 25+00

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
CONSTRUCTION
NOT FOR
PRELIMINARY
AREW C. HALL
EXPIRES 06/30/19

DESIGNED:	DRAWN:
CGP	CGP

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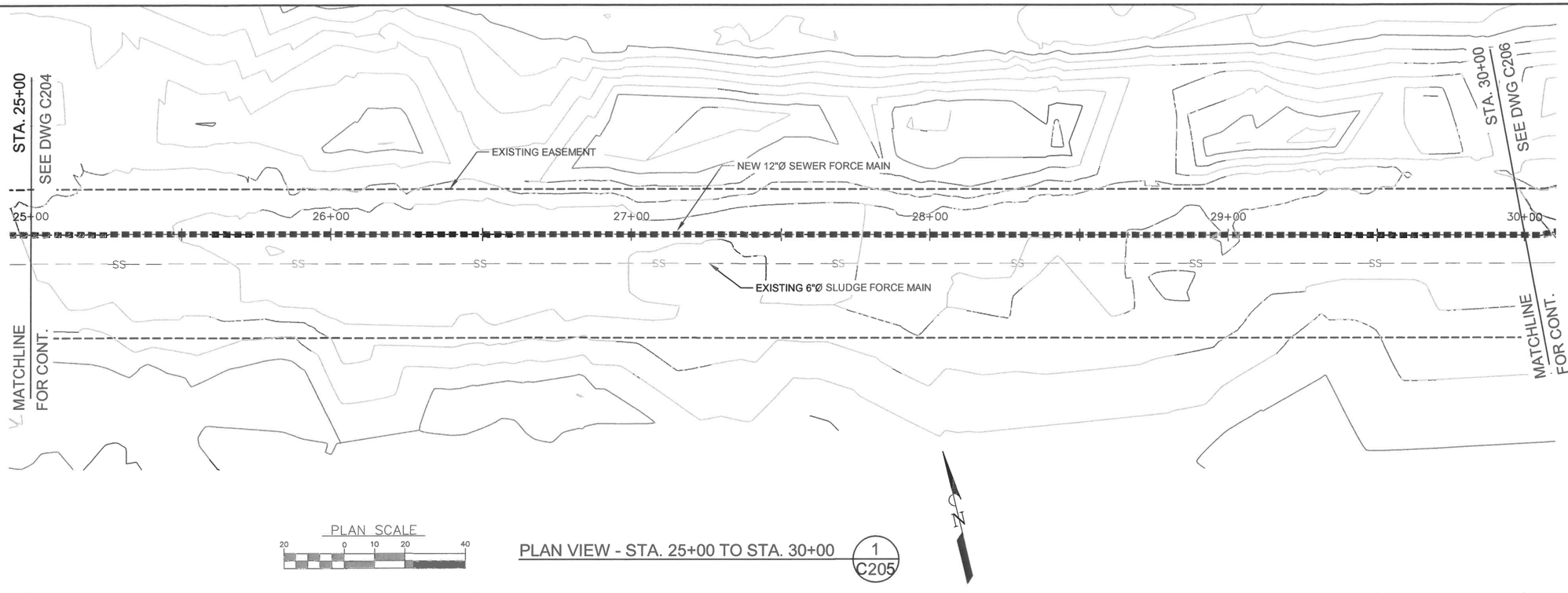
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CITY OF COOS BAY

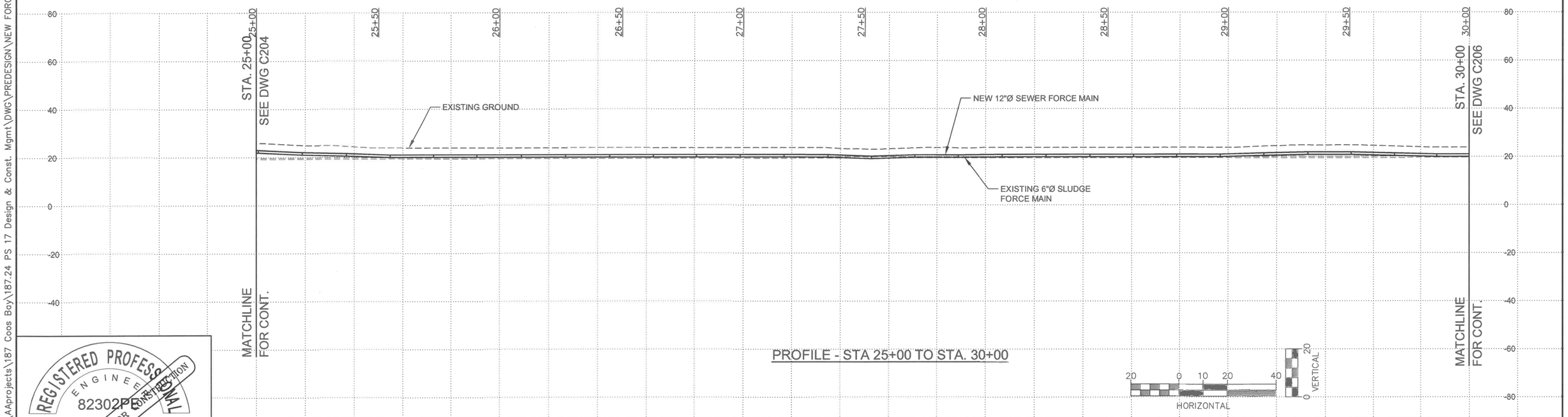
NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 20+00 TO STA. 25+00

PROJECT NO.	DRAWING NO.
187.24	C204
DATE	SHEET NO.
JUNE 2018	5 OF 16



PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 25+00 TO STA. 30+00 (1 / C205)



PROFILE - STA 25+00 TO STA. 30+00

HORIZONTAL: 20 0 10 20 40
VERTICAL: 20 0

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
DREW C. HALL
EXPIRES 06/30/19
PRELIMINARY - NOT FOR CONSTRUCTION

DESIGNED: CGP
DRAWN: CGP
APPROVED BY:
DATE:

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

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ENGINEERS & PLANNERS, INC.
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COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

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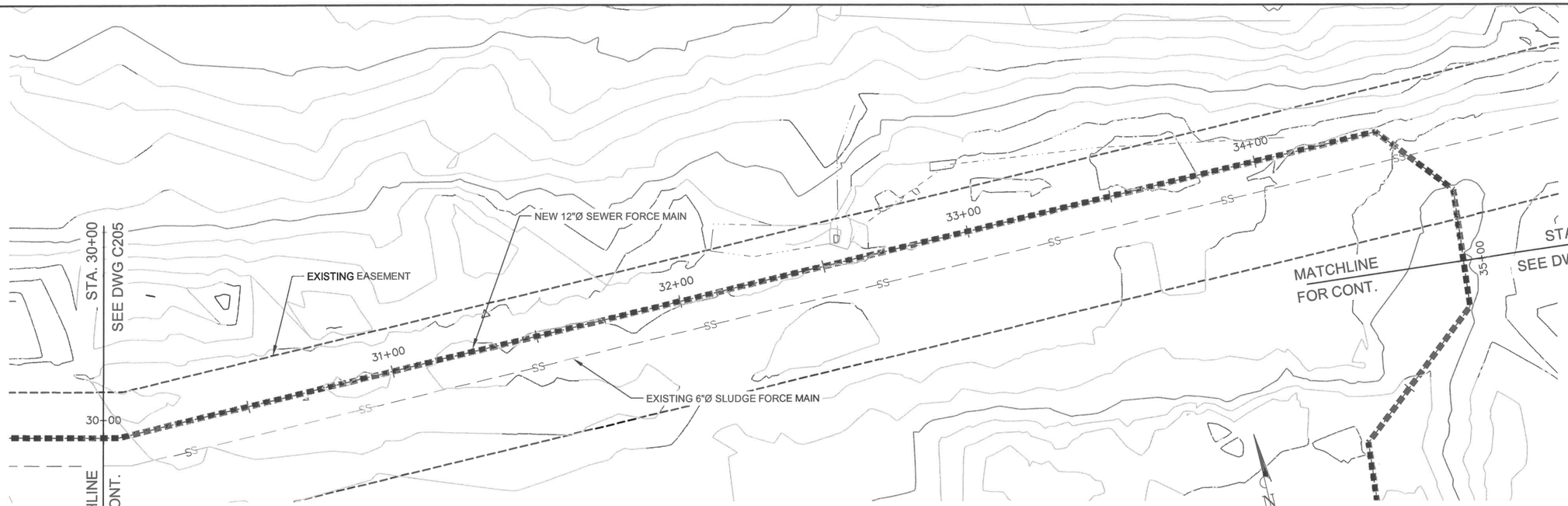
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CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 25+00 TO STA. 30+00

PROJECT NO. 187.24
DRAWING NO. C205
DATE JUNE 2018
SHEET NO. 6 OF 16

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PLAN SCALE
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PLAN VIEW - STA. 30+00 TO STA. 35+00 (1 / C206)

PROFILE - STA 30+00 TO STA. 35+00

20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
PREMIUM EXPIRES 06/30/19
EXPIRES 06/30/19
AND CONSTRUCTION
NOT FOR
DREW C. HALL

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

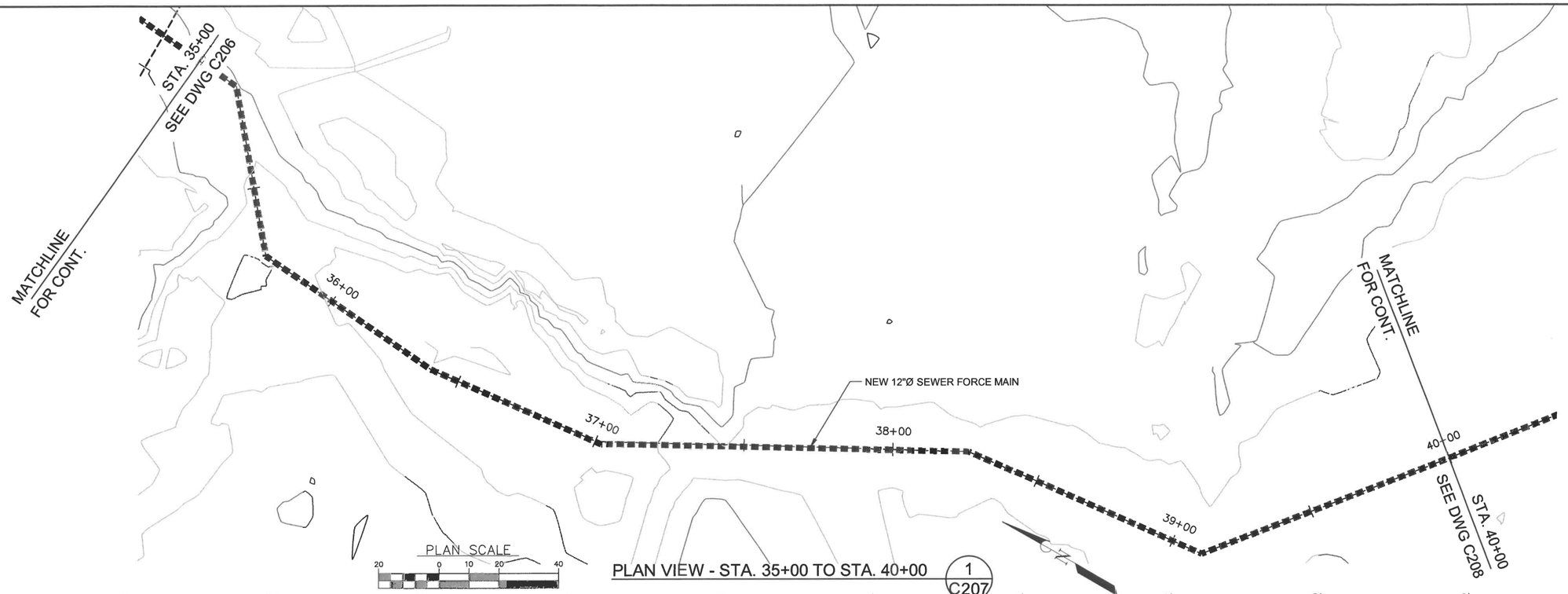
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

LINE IS 1 INCH AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

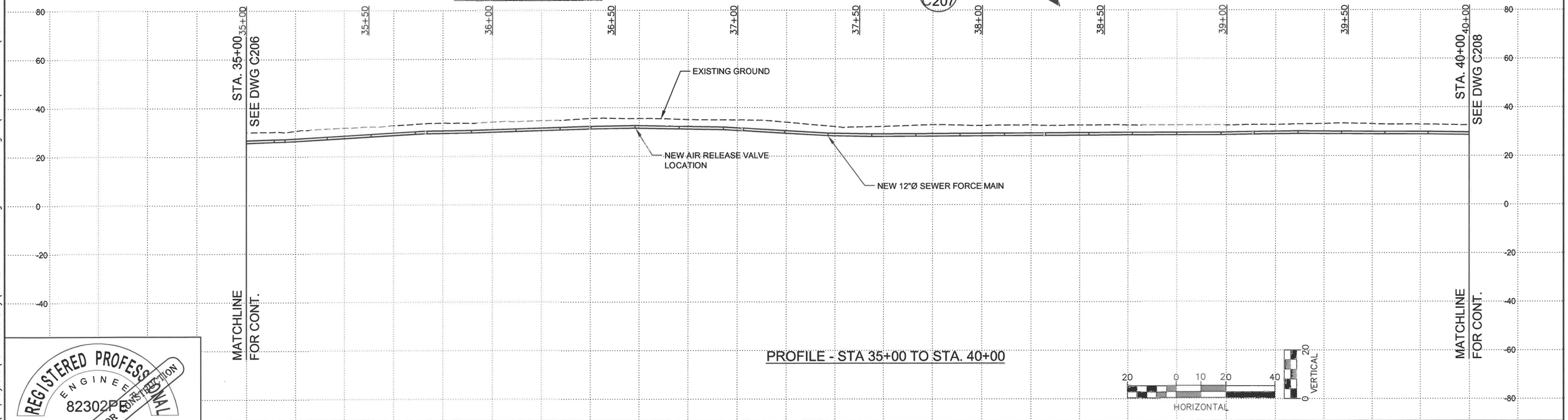
PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 30+00 TO STA. 35+00

PROJECT NO.	DRAWING NO.
187.24	C206
DATE	SHEET NO.
JUNE 2018	7 OF 16



PLAN VIEW - STA. 35+00 TO STA. 40+00 (1 / C207)



PROFILE - STA 35+00 TO STA. 40+00

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JANUARY 23, 2013
CREW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

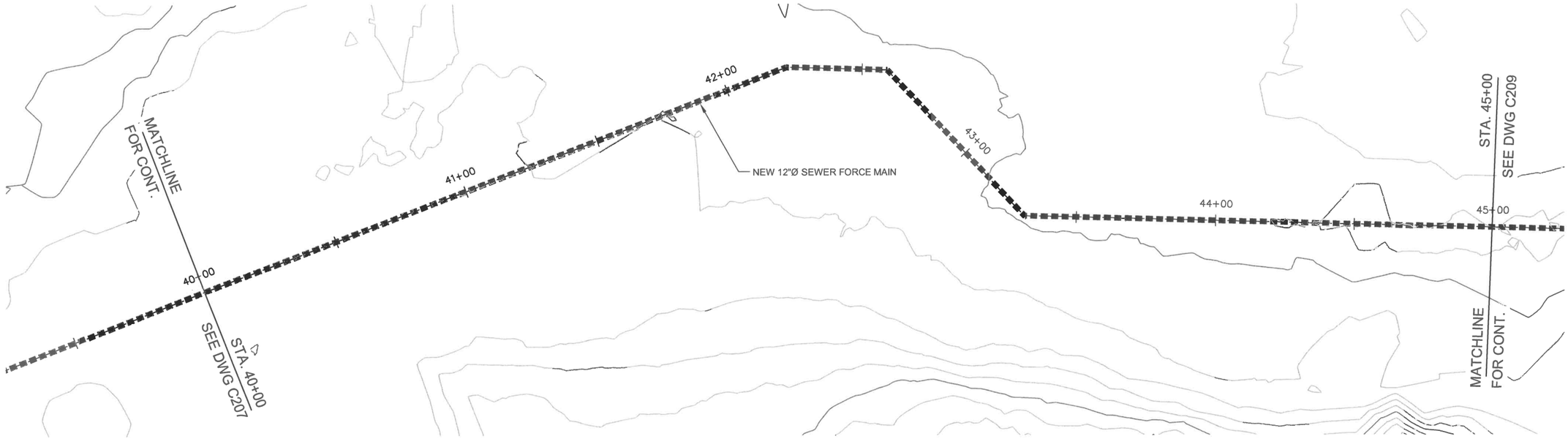
LINE IS 1 INCH AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 35+00 TO STA. 40+00

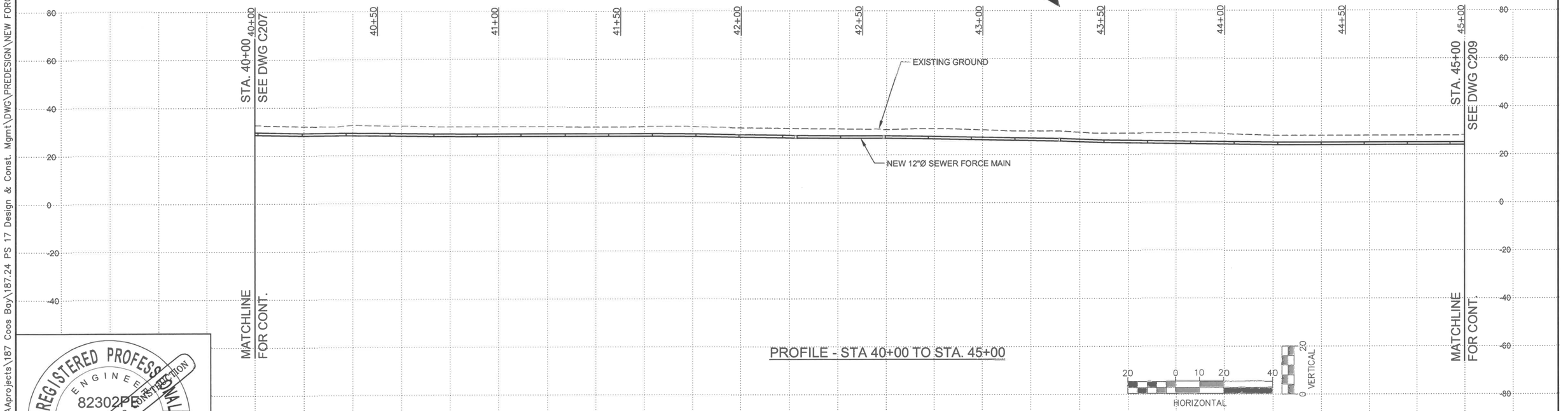
PROJECT NO.	DRAWING NO.
187.24	C207
DATE	SHEET NO.
JUNE 2018	8 OF 16

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PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 40+00 TO STA. 45+00 (1 / C208)



PROFILE - STA 40+00 TO STA. 45+00

20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JANUARY 23, 2013
ANDREW C. HALL
EXPIRES 06/30/19
PRELIMINARY - NOT FOR CONSTRUCTION

DESIGNED: CGP
DRAWN: CGP
APPROVED BY: DATE:

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

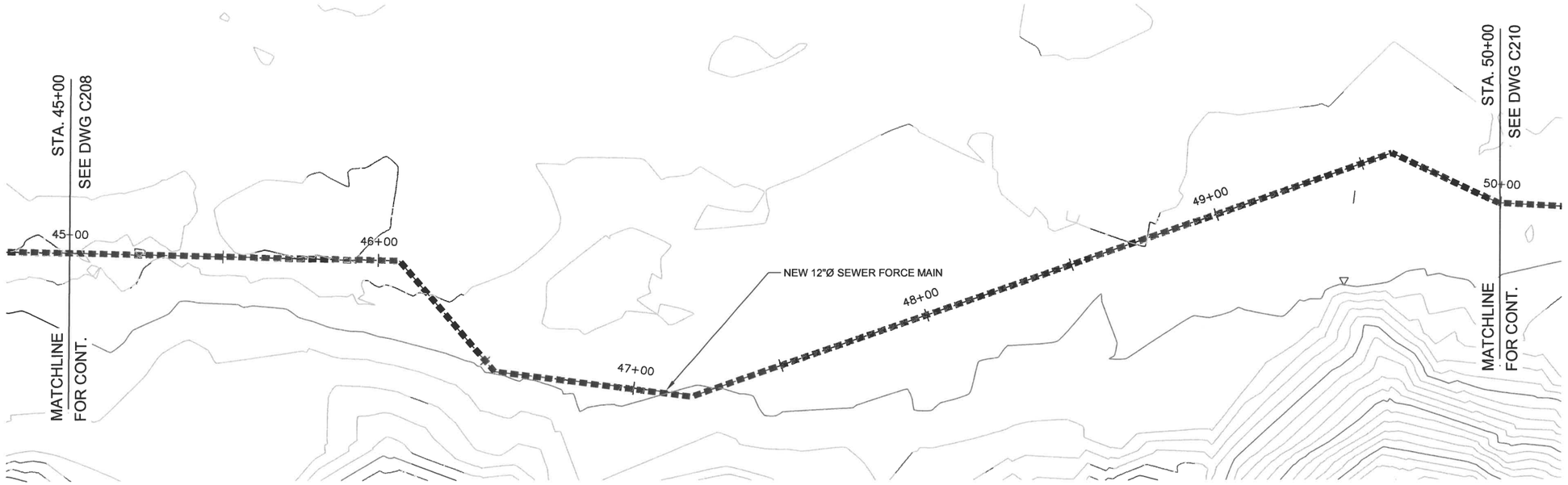
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IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 40+00 TO STA. 45+00

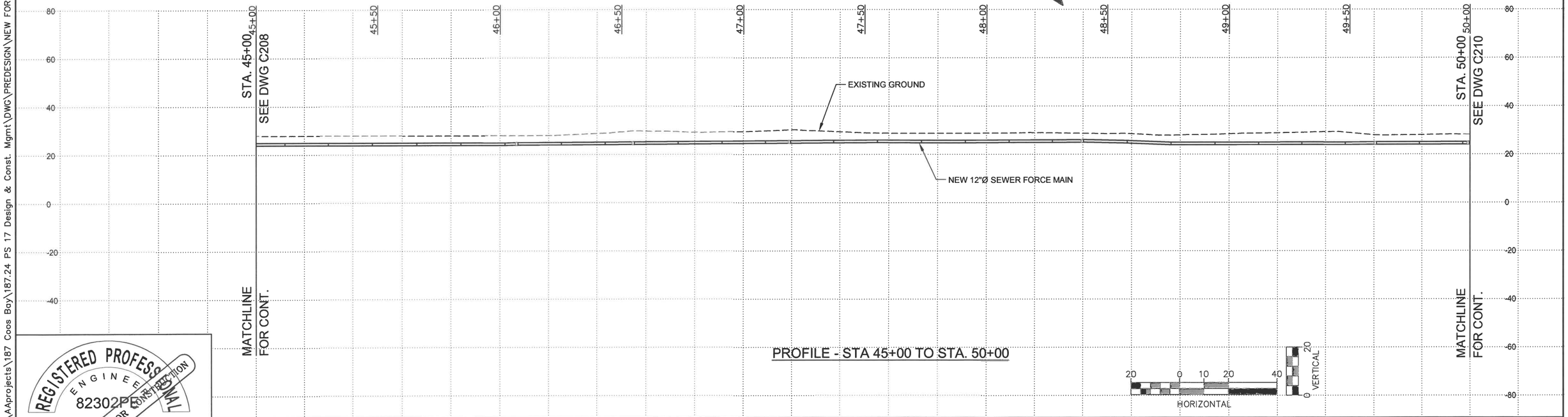
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DRAWING NO. C208
DATE JUNE 2018
SHEET NO. 9 OF 16

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PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 45+00 TO STA. 50+00 (1 / C209)



PROFILE - STA 45+00 TO STA. 50+00

20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JANUARY 23, 2013
ANDREW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

LINE IS 1 INCH AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

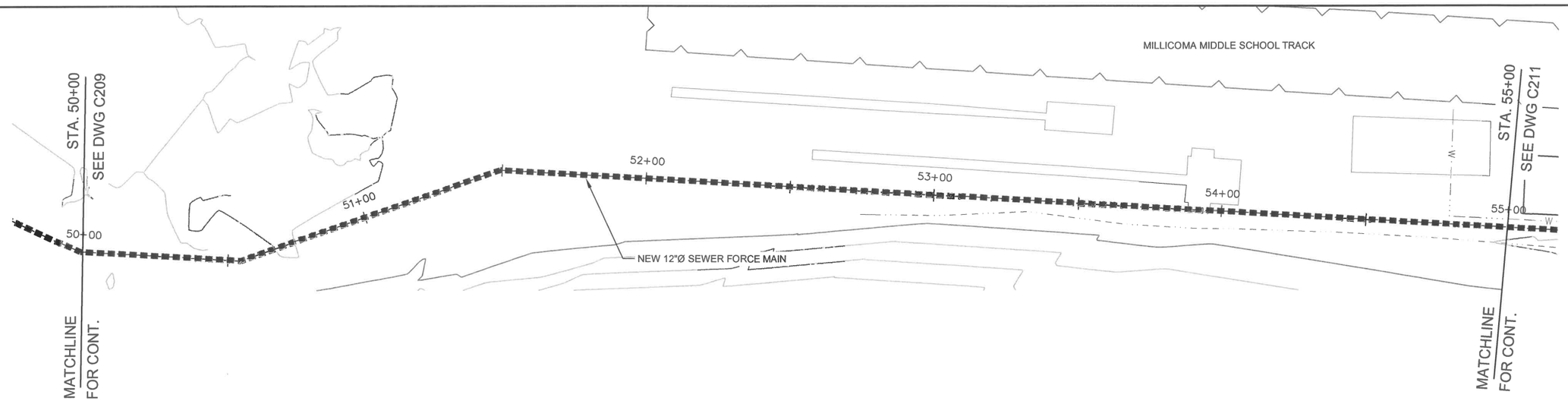
PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 45+00 TO STA. 50+00

PROJECT NO.	DRAWING NO.
187.24	C209
DATE	SHEET NO.
JUNE 2018	10 OF 16

\\Dyer2\h\dyer-port\AAprojects\187 Coos Bay\187.24 PS 17 Design & Const. Mgmt\DWG\PREDESIGN\NEW FORCE MAIN.dwg, 6/5/2018 4:23:03 PM PLOT DATE June 5, 2018

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PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 50+00 TO STA. 55+00 (1 / C210)

PROFILE - STA 50+00 TO STA. 55+00

20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
REW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

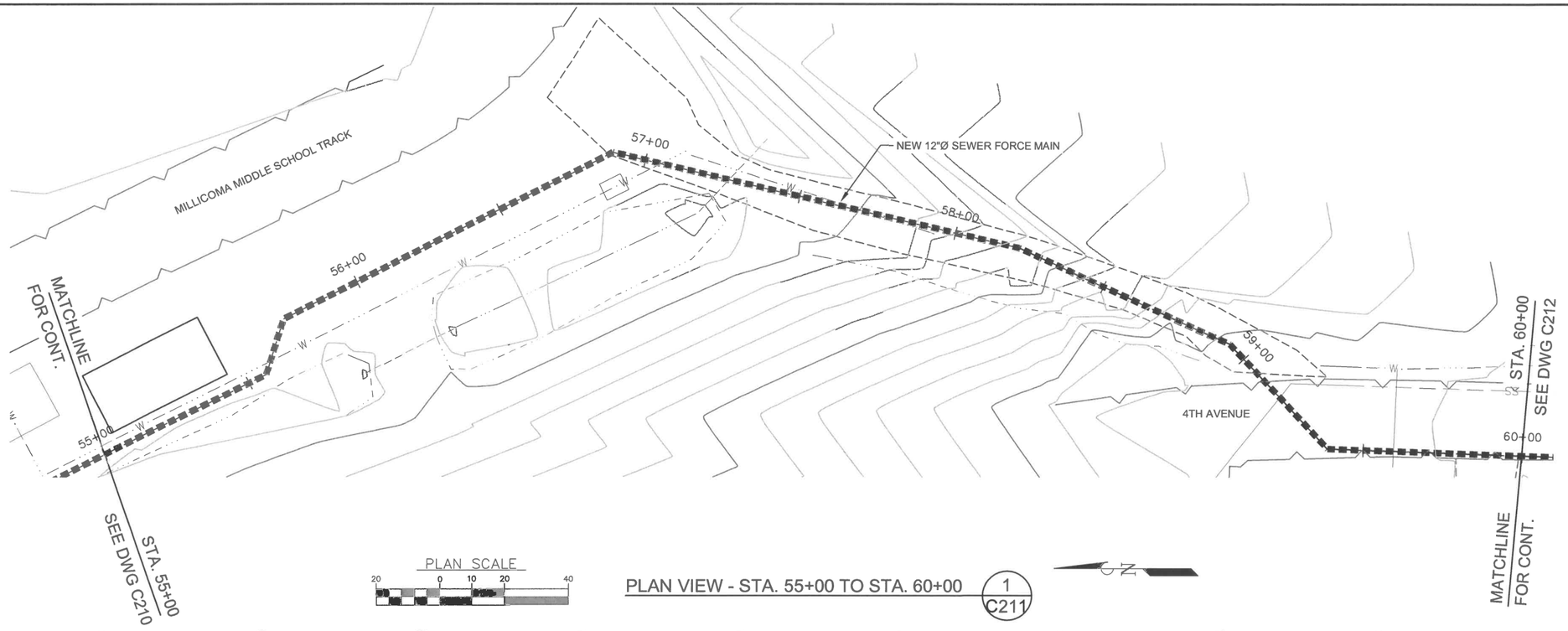
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

LINE IS 1 INCH AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 50+00 TO STA. 55+00

PROJECT NO.	DRAWING NO.
187.24	C210
DATE	SHEET NO.
JUNE 2018	11 OF 16

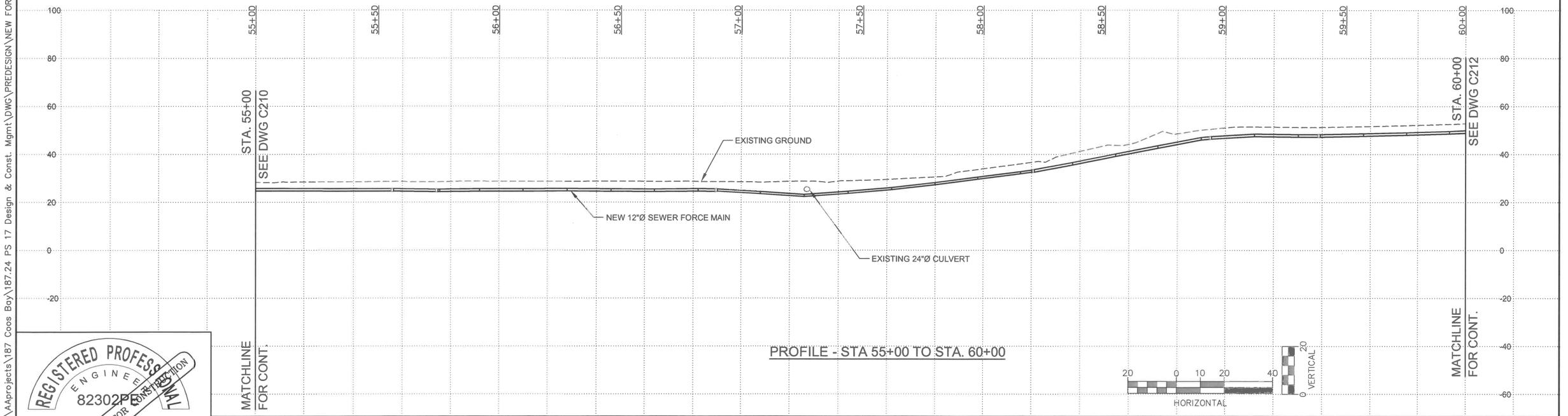


PLAN SCALE

20 0 10 20 40

PLAN VIEW - STA. 55+00 TO STA. 60+00 (1 / C211)

N



PROFILE - STA 55+00 TO STA. 60+00

20 0 10 20 40 HORIZONTAL

20 0 VERTICAL

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
PRELIMINARY - NOT FOR CONSTRUCTION
MAY 23, 2013
ANDREW C. HALL
EXPIRES 06/30/19

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

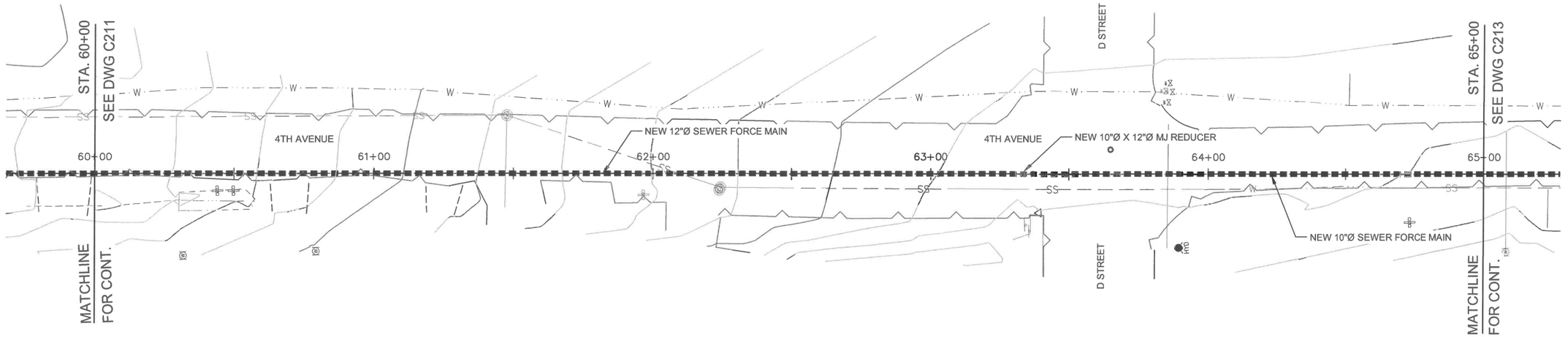
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IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 55+00 TO STA. 60+00

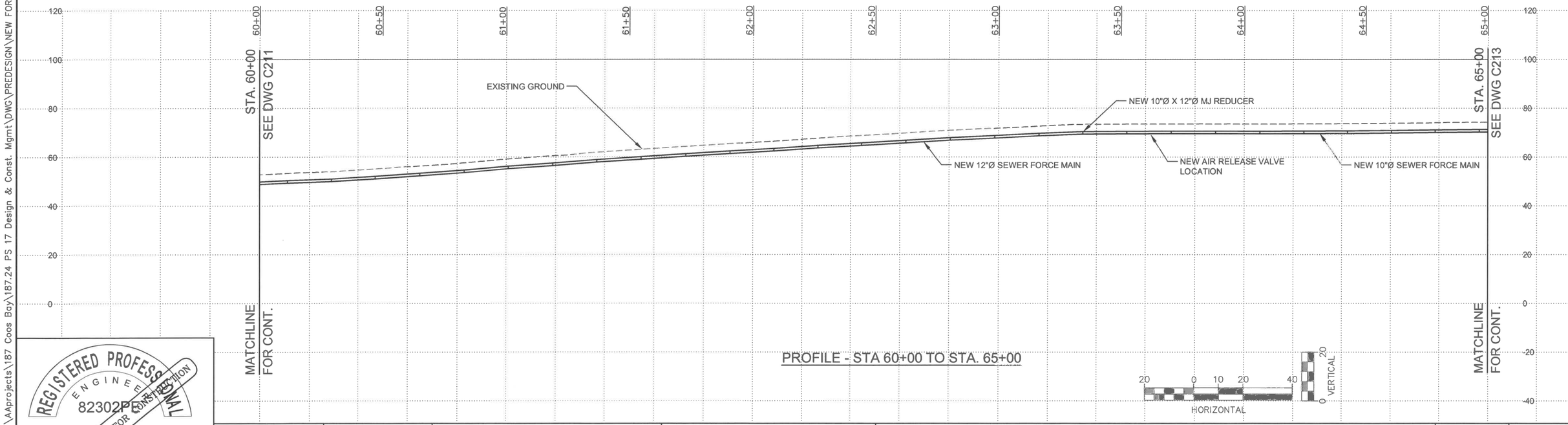
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DATE	SHEET NO.
JUNE 2018	12 OF 16

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PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 60+00 TO STA. 65+00 (1 / C212)



PROFILE - STA 60+00 TO STA. 65+00

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
DREW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

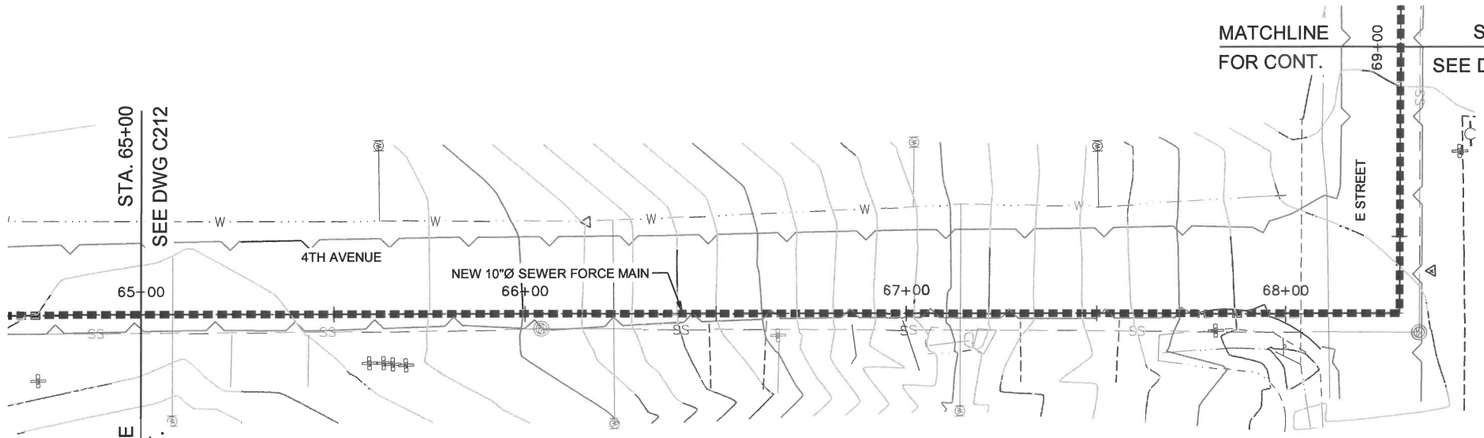
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IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 60+00 TO STA. 65+00

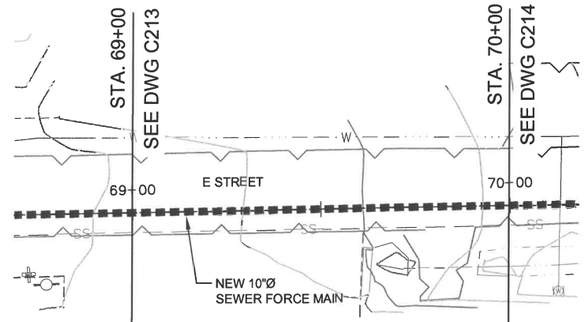
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187.24	C212
DATE	SHEET NO.
JUNE 2018	13 OF 16

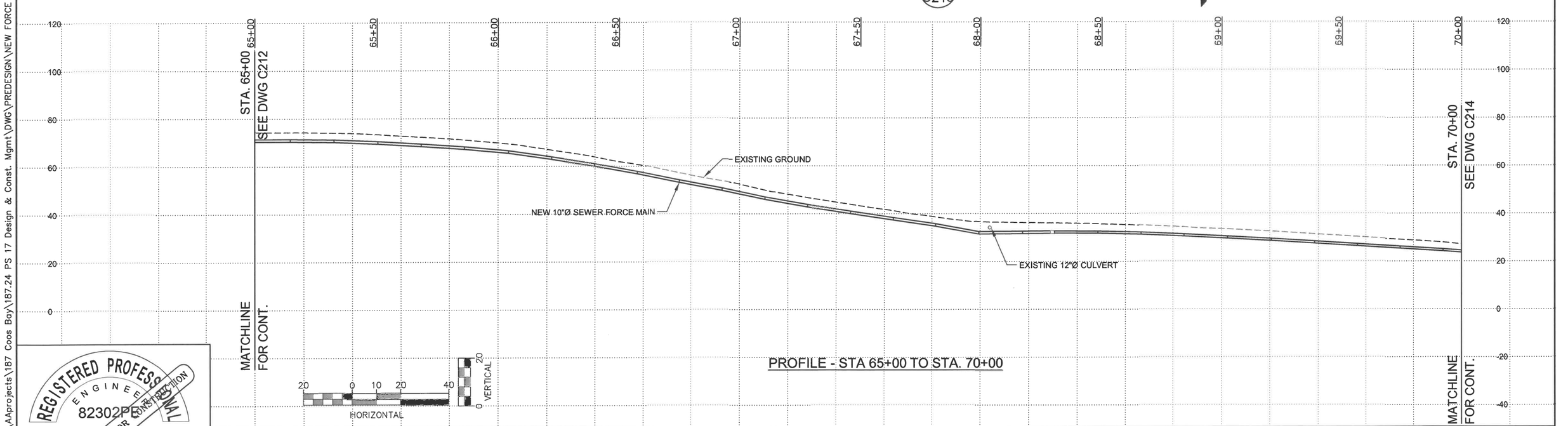
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PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 65+00 TO STA. 70+00 (1 / C213)





PROFILE - STA 65+00 TO STA. 70+00

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
CREW C. HALL
EXPIRES 06/30/19
PRELIMINARY - NOT FOR CONSTRUCTION

DESIGNED: CGP
DRAWN: CGP
APPROVED BY: _____ DATE: _____

REVISIONS				
REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

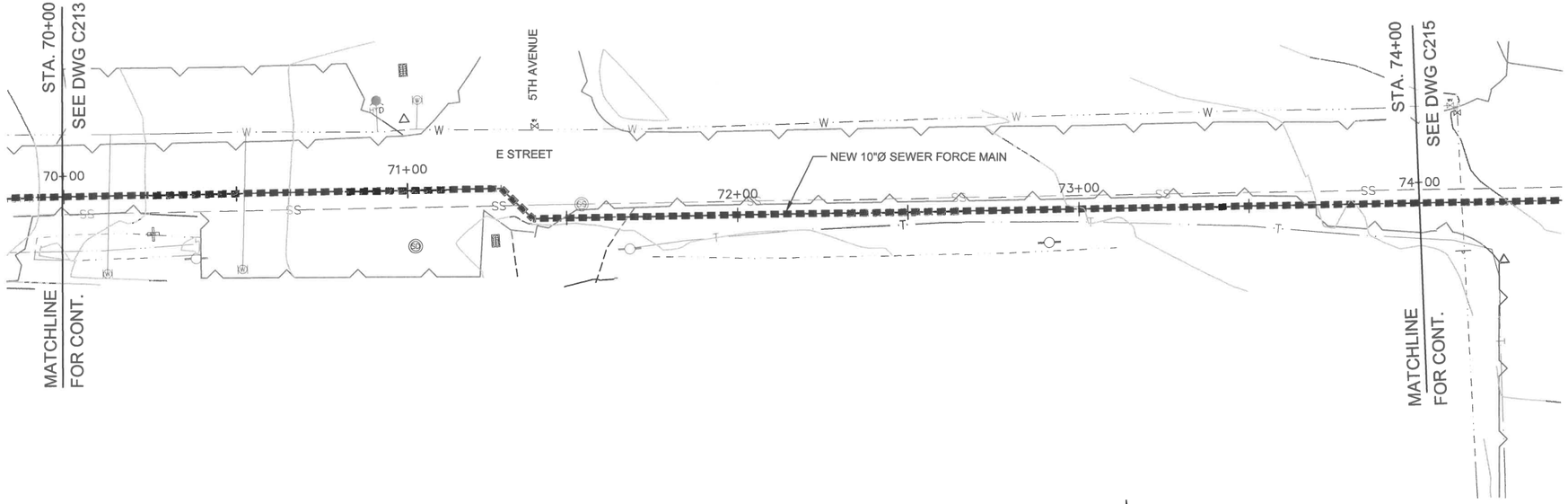
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IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 65+00 TO STA. 70+00

PROJECT NO.	DRAWING NO.
187.24	C213
DATE	SHEET NO.
JUNE 2018	14 OF 16

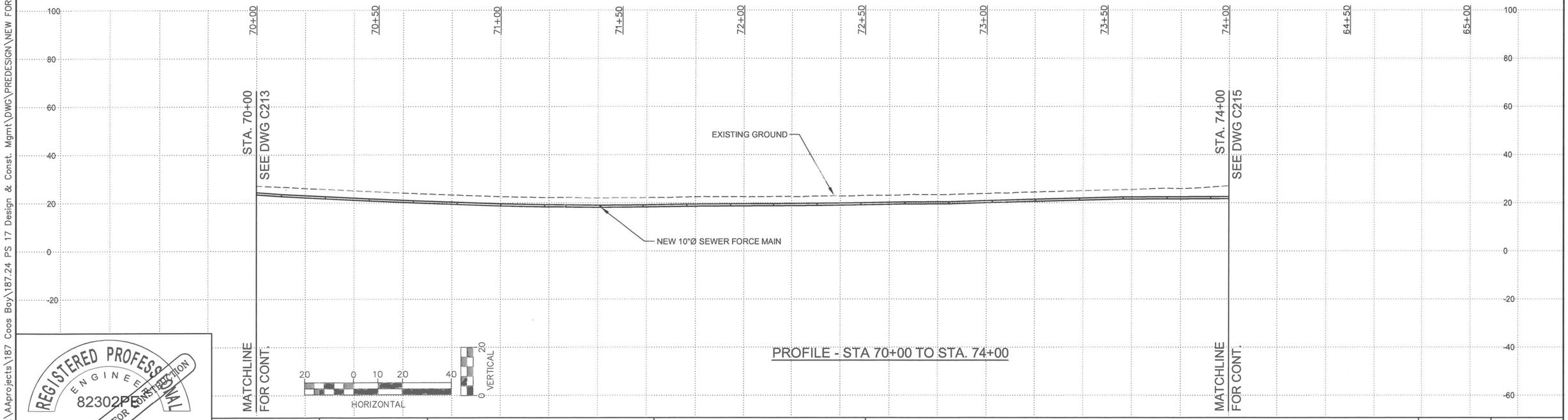
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PLAN SCALE
20 0 10 20 40

PLAN VIEW - STA. 70+00 TO STA. 74+00 (1 / C214)

N



20 0 10 20 40 HORIZONTAL
20 0 VERTICAL

PROFILE - STA 70+00 TO STA. 74+00

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
CREW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED: CGP
DRAWN: CGP
APPROVED BY:
DATE:

REVISIONS				
REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

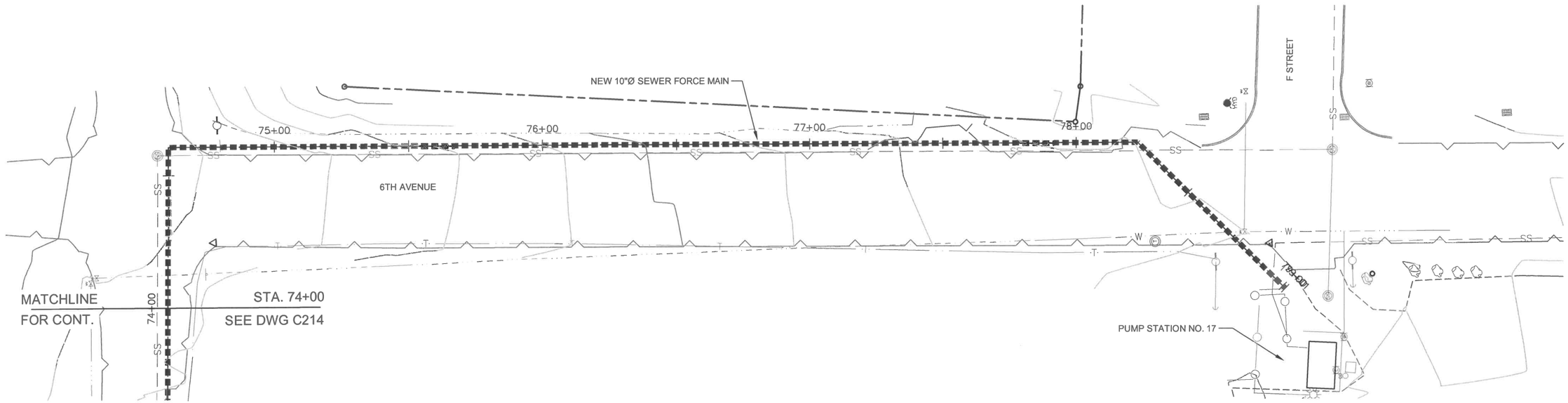
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IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

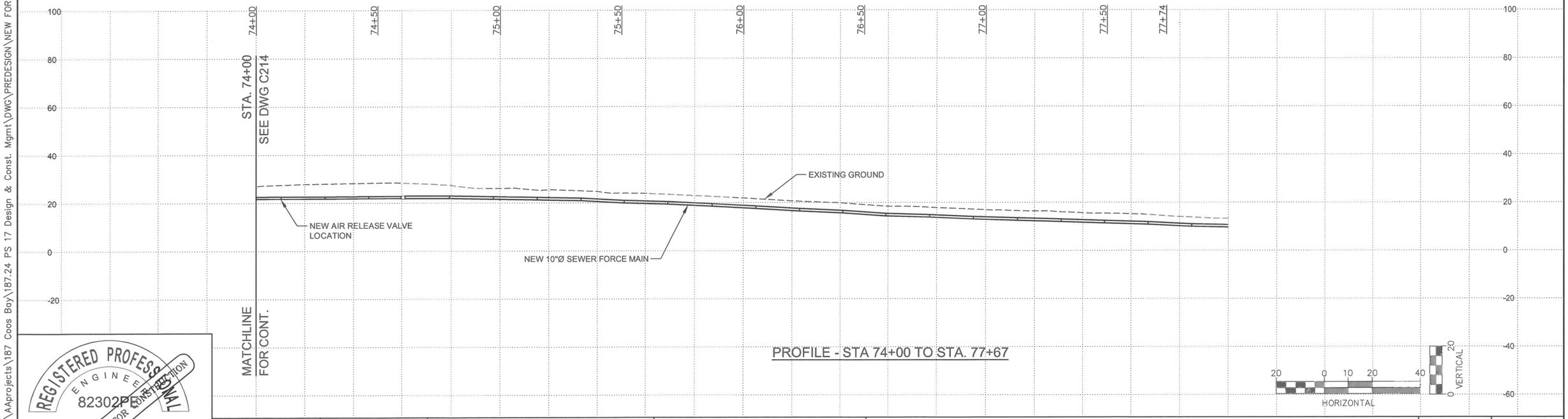
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PROJECT NO. 187.24
DRAWING NO. C214
DATE JUNE 2018
SHEET NO. 15 OF 16

\\Dyer2\h\dyer-part\AAprojects\187 Coos Bay\187.24 PS 17 Design & Const. Mgmt\DWG\PREDESIGN\NEW FORCE MAIN.dwg, 6/5/2018 4:23:03 PM PLOT DATE June 5, 2018



PLAN VIEW - STA. 74+00 TO STA. 77+67 (1 / C215)



PROFILE - STA 74+00 TO STA. 77+67

REGISTERED PROFESSIONAL ENGINEER
82302PE
OREGON
JULY 23, 2013
DREW C. HALL
EXPIRES 06/30/19
PRELIMINARY NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:
CGP	CGP

APPROVED BY: _____ DATE: _____

REVISIONS

REVISED	DESCRIPTION	SUBMIT.	APPR'D.	DATE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

LINE IS 1 INCH AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

PUMP STATION NO. 17 IMPROVEMENTS
CITY OF COOS BAY

NEW SEWER FORCE MAIN
PLAN & PROFILE - STA 74+00 TO STA. 77+74

PROJECT NO.	DRAWING NO.
187.24	C215
DATE	SHEET NO.
JUNE 2018	16 OF 16

\\Dyer2\h\dyer-part\AAprojects\187 Coos Bay\187.24 PS 17 Design & Const. Mgmt\DWG\PREDESIGN\NEW FORCE MAIN.dwg, 6/5/2018 4:23:03 PM PLOT DATE June 5, 2018

APPENDIX K: HDD Cost Estimates

THE HDD COMPANY

EL DORADO HILLS | OFFICE Suite 210,
4525 Serrano Parkway, El Dorado Hills, CA USA 95762

MAIN 530 676 5705 | CROSSINGGROUP.COM

23 April 2018

The Dyer Partnership
1330 Teakwood Ave
Coos Bay, OR 97420

ATTN: Andrew Pedroni

RE: Isthmus Slough HDD – Budgetary Letter
Directionally drill and install approximately 1800 feet of 14-inch HDPE under the Isthmus Slough in Coos Bay, OR.

The HDD Company is pleased to submit the following **budgetary** quote:

1. Responsibilities of The HDD Company

1.1. Provide all required insurance certificates.
1.2. Provide any written submittals and qualifications required.
1.3. Provide a drill rig with sufficient capabilities to install the crossing, a closed-loop mud system, mud pumps, vacuum trucks, dump trucks, Tru-Track Wire-line steering system, and support equipment necessary.
1.4. Provide all required union labor for the drilling operations.
1.5. Provide preliminary drawings and final as-built drawings.
1.6. Provide all water and water storage for the duration of drilling operations.
1.7. Haul and dispose of all **non-contaminated** drilled solids and excess drilling fluids.
1.8. Provide, string, fuse, and test the 14-inch HDPE pipe for the bore.
1.9. Provide manpower and equipment to handle pipe during pullback.
1.10. Provide pipeline rollers for pullback and roller cradles for pullback.
1.11. Provide 14-inch pulling head.
1.12. Leave the entry and exit areas clean, free of debris, and to a rough grade. This includes filling in and asphalting the excavation to be made on the west side of the bore (Birch Ave) for the drilling rig.
1.13. Provide bonding at 1%, which is not included in the pricing below.

2. Responsibilities of Others

2.1. Stake entry and exit points with stations and elevations.
2.2. Provide suitable truck access and turnaround area to each side of the bore.
2.3. Provide stable, level, and graveled/matted work areas on each side of the bore.
2.4. Provide all permitting to undertake the project.

2.5. Provide BMPs for the duration of drilling activities (The HDD Company will maintain).
2.6. Provide all settlement monitoring if required.
2.7. Provide and maintain all traffic control if required.
2.8. Pothole all existing utilities in the immediate vicinity of the bore.
2.9. Provide temporary laydown area for pipe string.
2.10. Perform all final tie-ins and site restoration.

3. Budgetary Pricing

3.1. 1800 feet of 14-inch HDPE: **$755,500.00**

4. Clarifications

4.1. This **budgetary** proposal is based upon the drawings, specifications, and geotechnical information provided to us on or before **23 April 2018.**
4.2. HDPE pipe was assumed to be DR 9, and figured at a price of $1.00/lb.
4.3. The price may change based on the access and work sites at the time of bid. It was assumed all drilling activities would take place from the west side of the bore (Birch Ave).

5. Exclusions

5.1. The HDD Company and its personnel are not engineers. Therefore, we exclude all design and engineering services unless any are specifically noted as included in this proposal. Any drilling plans or profiles that we submit to you will be based upon the design information in the contract documents and our experience as HDD contractors. Any plans or profiles we provide are recommendations only and are subject to review and approval by the project owner and/or its engineers.
5.2. All permits, including federal, State and local environmental permits, the SWPPP permit and any associated SWPPP plans, any right-of-way (ROW) agreement or easements, and all access necessary for us to perform our work shall be provided by others. If our operations are delayed or otherwise impacted by any delays or problems with permits, SWPPP plans, ROW agreements, easements or access arrangements our compensation and time for completion will be equitably adjusted.

6. Terms and Conditions

6.1. Schedule
6.1.1. This proposal is based upon performance under a reasonable and mutually agreed-to project schedule in so far as that schedule applies to our work. The approved project baseline schedule and all monthly updates must be provided to us on a regular and timely basis to keep us apprised of schedule changes which may impact the timing and efficiency of our work. We will not be liable for any delays caused by others or by factors beyond our reasonable control.
6.2. Indemnification
6.2.1. We will indemnify you and/or the project owner for personal injury or property damage claims to the extent of our own negligence. Our

proposal excludes any obligation to indemnify you for your own negligence or to indemnify any other party for that party's own negligence or to indemnify any design professional.

6.3. Payment

6.3.1. Monthly progress payments will be made to the HDD Company within (7) seven days after you receive each monthly payment from the project owner, but in no event later than 120 days from the date you received your invoice.

6.3.2. We will receive our final payment within 30 days after you receive our final billing and our work has been completed and accepted. Acceptance will not be unreasonably withheld or delayed. If you dispute any portion of any billing, you will promptly notify us in writing of the nature of the dispute and you will pay the undisputed portion of the billing without delay. If any undisputed amounts are past due for more than 10 days, we reserve the right to stop work until all payments are brought current. We will provide lien releases in accordance with applicable state statutes or regulations. We will keep the project free of liens from out subcontractors, suppliers and other vendors provided we have been paid by you for the work covered by any such liens.

6.4. Extra/Force Account Work:

6.4.1. If we are directed to perform any work on a force account or time and material basis, the rates for our labor and equipment will be as stated in our proposal, or if no rates are included with this proposal, as stated in our then current standard labor and equipment rate schedule. If we are directed to standby or suspend work while other operations occur, or delays or other problems are resolved, or if we are required to standby due to events or circumstances beyond our control, the standby time for our labor and equipment will be paid as stated in this proposal.

6.5. Differing Site Conditions

6.5.1. If the conditions we encounter in the performance of our work differ materially from those indicated in the contract documents, boring logs, geotechnical reports or other information furnished to us prior to bid, or from those ordinarily encountered and generally recognized as inherent in the type of work provided for in our proposal, then our compensation and time for completion will be equitably adjusted to account for any resulting delay and added costs. *(See Item 4.4 in the clarifications above.)*

7. Delays and Work Stoppages:

7.1. All work stoppages that arise through no fault of The HDD Company will be billed at $10,500 per day (no crew on site).

The HDD Company appreciates the opportunity to furnish you this **budgetary** quote for this project and looks forward to working with you. Should any of the information presented above need further clarification, please do not hesitate to contact us.

Sincerely,
The HDD Company

Michael Corey
Project Engineer

'We Get Under It'

447 N. 1st Street Ste. 250 ~ PO Box 33
Kalama, WA 98625
PH: 360.673.4433 FAX: 360.673.4466
DowningHDD@Kalama.com www.DowningDiversified.com
Small Disadvantaged Business ~ 031164003

Date: April 19, 2018
Quote is valid for 30 days from above date

Company: The Dyer Partnership
Attention: Andrew Pedroni
Ph: 541.269.0732
Email: apedroni@dyerpart.com

Job Name: Isthmus Slough Coos Bay HDD Budgetary Proposal

Downing Diversified, LLC is pleased to provide the following HDD Budgetary Proposal for installation with standard jetter tooling:

- **Install (1) 14" OD SDR 11 Slough Crossing in sandy ground conditions, approximately 1,800' @ $240/lf**
- **Plus $20,000.00 mobilization fee invoiced upon arrival**

Budgetary Inclusion: Shoot/pull, pull head, wireline guidance system, mud disposal/recycling, (1) round trip mobilization, bore profile on completion.

Budgetary Exclusions: Materials, fusion/handling, water source, private locates, excavation, access, plating, saw cutting, entry/exit pits, restoration, traffic control, arrow boards, shoring, de-watering, permits, tie-ins, sweeps, testing, grouting, calculations if necessary, engineering, surveying, full assist as needed and all other items not listed as part of the above DD inclusions.

Rock Clause: Rock/Heavy Cobble/Boulders/Wood or any man-made obstructions that may cause failure of installation with standard jet cutter tooling will result in a renegotiation of the pricing or possible cause for failure to complete bore. Bid price will be increased accordingly to the total length of the bore. Downing Diversified also excludes extra costs/delays due to the encountering of unknown springs or aquifers.

NOTE: Based on prevailing wage.

Contract Price: Based on lump sum & lf prices listed above.

We appreciate the opportunity to provide a budgetary number for you on this project. I can be reached at **(360) 200-2659.**

Best Regards,

Jimmy Downing

_____ _____
Customer Signature Date

_____ _____
Downing Diversified, LLC Date

© 2015 Downing Diversified, LLC

APPENDIX L: Foundation Engineering Memorandum

Foundation Engineering, Inc.
Professional Geotechnical Services

Memorandum

Date: June 5, 2018

To: Aaron Speakman, P.E.
Andrew Hall, P.E.
Dyer Partnership

From: James K. Maitland, P.E., G.E.
Erin J. Gillaspie, P.E.

Subject: Geotechnical Data Report – DRAFT

Project: Pump Station No. 17 Force Main Replacement
Project 2181034

We have completed the geotechnical investigation for the above-referenced project. Details of our work and findings are provided below.

BACKGROUND

The City of Coos Bay (City) plans to extend a new 12-inch diameter force main sewerline from the existing Pump Station No.1 on the west side of Isthmus Slough to Pump Station No. 17 to the east via Horizontal Directional Drill (HDD) bore. The site location is shown on Figure 1A (Appendix A).

The City is the owner and The Dyer Partnership Engineers and Planners, Inc. (Dyer) is the project lead. Staheli Trenchless Consultants (Staheli) is the HDD designer. Dyer retained Foundation Engineering, Inc., to provide an investigation of subsurface conditions for the HDD design (by Staheli). Our scope of work was outlined in a proposal dated March 22, 2018, and authorized by a signed agreement dated April 13, 2018.

PREVIOUS EXPLORATION

Several projects have been completed by Foundation Engineering and others in the vicinity of the planned HDD bore. Projects that involved subsurface exploration relevant to the current project are referenced herein. The nearest boring logs and figures showing the approximate boring locations are included in Appendix B. A summary of the referenced projects is discussed below and included in the references section of this report.

- In 1987, L.R. Squire Associates, Inc. (Squire) advanced boring B-21 on the east side of the slough, and BH-22 on the west side of the slough. Both borings were drilled to a maximum depth of ±76.5 feet.

- In 1999, Foundation Engineering completed a series of borings for a proposed residential development on the Eastside of the slough. The nearest boring (BH-3) extended to a maximum depth of 81.5 feet.

- In 2015, Foundation Engineering drilled a boring (BH-1) at Pump Station No. 1, near the more recent BH-2, to a maximum depth of ±76.5 feet. For clarity, this previous boring is hereafter referred to as "BH-1 (2015)" in this report and in the appendix.

RECENT FIELD EXPLORATION

The recent investigation consisted of two borings drilled near the planned HDD bore alignment between April 17 and 19, 2018, to provide deeper subsurface information. The borings were located as close as possible to the two ends of the planned HDD bore, but their locations were dictated in part on access and utility conflicts. BH-1 was advanced in an open field on the east side of the slough. Due to available access, BH-1 is located ±300 feet south of the east end of the planned HDD bore. BH-2 was advanced in a paved parking lot on the west side of the site. Figure 2A (Appendix A) shows the approximate location of the two borings and proposed alignment of the HDD bore crossing.

The borings were advanced with a truck-mounted, CME-75 drill rig using mud-rotary techniques. Soil and rock samples were obtained at 5-foot intervals. Disturbed samples were obtained using a split-spoon sampler in conjunction with the Standard Penetration Test (SPT). The SPT provides an indication of the relative stiffness or density of the soils. We attempted to obtain relatively undisturbed samples of predominantly fine-grained units using thin-walled Shelby tubes. At BH-2, we obtained recovery in only one Shelby tube, despite repeated attempts. We believe the lack of sample recovery was due largely to the sand content of the soil.

LABORATORY TESTING

The laboratory testing program, as requested by Staheli, consisted of index tests (e.g., natural water content, percent fines, and Atterberg limits) to classify the soils and estimate their engineering properties. The test results are summarized in Tables 1C and 2C (Appendix C). The water contents are also shown on the boring logs.

It should be noted that very high natural water contents were recorded for some samples. The elevated water content is consistent with the observed softness of the silt and with the depositional environment of these sediments. In addition, the presence of scattered organic matter contributed to the high water contents. Similar elevated water contents were observed in local estuarine deposits in Foundation Engineering's previous nearby borings and were reported in the above-referenced Squire boring logs.

The Atterberg limit test results are shown on Figure 1C (Appendix C). The tests indicated Liquid Limits (LL) for the silt in the range of 61 to 96 and Plasticity Indices (PI) of 22 to 43. These limits correspond to a Unified Soil Classification System (USCS) description of "high plasticity silt" and a USCS designation of MH. However, the silt appears to be friable, likely due to the presence of sand, shell fragments, and organic matter.

One ash content test was completed on a sample taken from BH-1 at a depth of ±65 to 66.5 feet to represent the typical organic content of the estuarine silt. That test indicated an ash content of ±8 percent. Therefore, we have typically used a description of "some organics" and the dual USGS designation of MH-OH on the boring logs to reflect the presence of organics. The organics typically consist of small wood and plant fibers.

Percent fines tests were also completed on samples selected for Atterberg limits tests. The percent fines tests indicated the samples consisted of sand with scattered to some shells and organic matter. The sand is predominantly fine (i.e., passes the No. 40 sieve). However, the particle size distribution can vary in this material given the presence of shells in many samples.

Field vanes shear strength tests were run on the Shelby tube samples. Results of those test are summarized in Table 3C (Appendix C). The undrained shear strength of 0.4 to 0.6 tons/ft^2 (tsf) are representative of the silt at BH-1 from ±50 to 96 feet. The values obtained at BH-2 are lower, likely due to the presence of fine sand. Therefore, the vane measurements may not accurately depict the undrained shear strength of this unit. The two Squire borings described above reported undrained shear strengths ranging from 0.05 to 0.28 tsf within the upper silt, and 0.4 tsf for one sample of the deeper silt.

In some instances, the field vane measurements indicated higher shear strengths than suggested by the SPT N-values. It is typical for vane shear test results on estuary deposits to suggest higher undrained shear strengths than material strengths correlated to SPT N-values. We believe this is due primarily to the soil's sensitivity, elevated water content, and the disturbance caused by driving the SPT sampler. However, the results of the SPT's were used to describe soil consistency on the logs to reflect the likely response of soil disturbance caused by the action of the HDD bore.

SITE TOPOGRAPHY AND PROPOSED HDD BORE

Dyer provided topographic data for the project along the proposed HDD bore alignment. Figure 3A (Appendix A) shows a plan topographic view of the planned alignment. Figure 4A shows a cross-section of the alignment and generalized subsurface conditions encountered in the borings. The preliminary planned vertical alignment of the HDD bore and notes provided by Staheli are also shown.

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DISCUSSION OF SOIL CONDITIONS AT EASTSIDE OF PROPOSED HDD BORE

East Side of HDD Bore (BH-1)

Boring BH-1 was drilled near the east end of the planned HDD bore and encountered the following generalized subsurface profile:

Table 1. BH-1 Generalized Subsurface Profile

Approximate Depth Interval (ft)	Generalized Description of Soil Units
0 – 41	Loose to medium dense SAND to silty SAND
41 – 55	Medium stiff SILT, some sand
55 – 110	Very soft SILT, some sand
110 – 125	Loose to medium dense silty SAND
125 – 150	Soft to medium stiff SILT to sandy SILT
150 – 155	Loose silty SAND
155 – 171.5	Medium stiff to stiff SILT to organic sandy SILT

The depths reported above were inferred from the drilling action and sampling at 5-foot intervals. Therefore, the contacts between individual soil units are approximate only. A discussion of the individual soil units is provided below. Please note some of the units summarized in Table 1 have been subdivided. More detailed descriptions of individual soil units, along with SPT N-values recorded during sampling, are provided in Appendix B.

0 to 15 feet. Fill was encountered at BH-1 to a depth of ±15 feet. The fill consists of loose to medium dense silty sand to sandy, some silt and contained scattered to trace shells. A percent fines test completed on a sample of the fill taken from ±10 to 11.5 feet indicated the sand contains ±10 percent silt. We assume the fill consists of material dredged from the bay.

15 to 21.5 feet. Dark grey, very soft silt with some organics (wood fibers) was encountered from ±15 to 21.5 feet. The silt was significantly more organic from ±20 to 21.5 feet. N-values of 1 and 5 were recorded in this unit. The higher N-value was recorded near the contact with the underlying sand and appears to have been influenced by the sand content. Moisture contents ranged from ±69 to 119 percent. The elevated moisture contents are likely due to the presence of organic matter.

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21.5 to 41 feet. The organic silt is underlain by grey, fine sand with some silt and organics and scattered shells extending to ±41 feet. N-values in this unit ranged from 5 to 13, suggesting a loose to medium dense consistency. Moisture contents ranged from ±31 to 40 percent. A percent fines test completed on a representative sample taken from ±30 to 31.5 feet indicated this unit contains ±10 percent silt.

41 to 55 feet. Grey, medium to high plasticity silt with some sand and organics and scattered to some shells was encountered at from ±41 to ±55 feet. N-values ranged from 0 to 8 in this material. Moisture contents in this unit ranged from 61 to 68 percent. Atterberg limits tests indicate the soil has an LL of 79 and a PI of 31, corresponding to a USCS designation of MH. Percent fines testing indicated ±77 percent silt. This corresponds to ±23 percent sand-sized particles consisting predominantly of shells and fine sand, for which a description of "some sand" is appropriate. Field Vane tests indicated an undrained shear strength of 0.4 tsf, suggesting the in-situ, undisturbed soil is medium stiff to stiff.

55 to 80 feet. Grey, medium to high plasticity silt with some sand and organics and scattered to some shells was encountered at from ±55 to ±80 feet. N-values were consistently 0, suggesting the silt is very soft. Moisture contents in this unit ranged from 60 to 68 percent. Atterberg limits tests indicate the soil has an LL of 85 and a PI of 29, corresponding to a USCS designation of MH. Percent fines testing indicated ±70 to 82 percent silt. This corresponds to ±18 to 30 percent sand-sized particles consisting predominantly of shells and fine sand, for which a description of "some sand" is appropriate. Field Vane tests indicated an undrained shear strength of 0.6 tsf, at a depth of ±61 feet, suggesting the in-situ, undisturbed soil is medium stiff to stiff. The N-values of 0 suggest the silt is extremely sensitive to disturbance and the residual strength is very low. This assumption is consistent with the elevated water contents.

80 to 85 feet. Grey, loose silty sand with some organics and scattered to some shells was encountered from ±80 to 85 feet. An N-value of 5 was recorded in this stratum. Laboratory tests indicated a natural moisture content of ±61 percent and ±38 percent fines.

85 to 110 feet. Organic silt to silt with some sand, organics and scattered shells was encountered from ±85 to 110 feet. N-values of 0 to 3 recorded in this unit suggest a soft to very soft consistency. Natural water contents ranged from ±51 to 66 and the soil had ±63 to 82 percent fines in this stratum. Atterberg Limits tests on a sample taken at ±105 feet indicated an LL of 75, a PI of 32, and a USCS designation of MH.

110 to 125 feet. Silty sand with some organics and scattered shells extends from ±110 feet to ±125 feet. N-values of 6 to 16 suggest the sand is loose to medium dense. Moisture contents ranged from ±36 to 39 percent, suggesting the sand is relatively consistent. A sample from ±115 feet had ±38 percent fines.

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125 to 150 feet. Soft to medium stiff, grey silt extends from ±125 to 150 feet. The silt typically contains trace sand, becoming sandy below ±145 feet. N-values within this unit ranged from 2 to 8. Natural water contents ranged from ±47 to 60 percent. The fines content ranged from ±47 to 93 percent. Samples taken at ±125 and 135 feet had LL values of 80 and 81 and PI values of 31 and 33, corresponding to an MH designation.

150 to 155 feet. A lens of loose silty sand with some organics was encountered from ±150 to 155 feet. The silty sand had an N-value of 4 and contains ±44 percent moisture.

155 to 171.5 feet. Grey silt extends from ±155 to 171.5 feet, the exploration limits of BH-1. The sand and organic content varied significantly between samples. N-values of 6 to 18 indicate a medium stiff to very stiff soil. The N-values increased with depth, suggesting the silt becomes stiffer with depth, although the organic and sand content may have affected the N-values. Natural water contents ranged from ±51 to 77 percent.

No bedrock was encountered in BH-1.

Ground Water. Dyer provided an estimated ground surface elevation at BH-1 of ±El. 30. Prior to drilling BH-1, a test pit was excavated near the planned boring location. We observed rapid water infiltration into the test pit at ±11 feet, and assume this represents the ground water level at the time of our exploration. This assumed ground water level (±El. 19) is shown on the BH-1 boring log.

Comparison with Previous Borings. Squire's B-21 encountered very soft to soft silt with fine sand to a depth of ±68 feet. The silt contained numerous organics to ±35 feet and had SPT N-value of 0 for all samples taken to 35 feet. From ±35 to 68 feet, the SPT N-values ranged from 0 to 5. A thin layer of dense sand was encountered between ±35.4 and 37 feet. Medium dense sand with trace silt and scattered wood debris was reported from ±68 to 76.5 feet (the limits of exploration).

The 1999 Foundation Engineering BH-3 for the Eastside development project encountered a subsurface profile consisting of ±4.5 feet of loose sand (fill), ±5 feet of soft clayey silt with abundant organics and loose sand with trace shells and scattered wood debris to ±37.5 feet. SPT-N values in the sand ranged from 6 to 10. The sand was underlain by medium stiff silt to ±48 feet, followed by medium stiff clayey silt with scattered wood fragments to 81.5 feet, the limits of the exploration. N-values of 5 and 6 were consistently recorded in the deeper silt layer.

A comparison of the two previous boring logs with the current exploration suggests there can be significant variations in the thicknesses of the silt and sand layers and in the stiffness of the silt to a depth of at least ±75 to 80 feet along the planned bore alignment.

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DISCUSSION OF SOIL CONDITIONS AT WEST SIDE OF PROPOSED HDD BORE

West side of HDD Bore (BH-2)

Boring BH-2 was drilled on the west end of the planned HDD bore and encountered the following generalized subsurface profile:

Table 2. BH-2 Generalized Subsurface Profile

Approximate Depth Interval (ft)	Generalized Description of Soil and Rock Units
0 – 10	Pavement and very loose SAND
10 – 30	Very soft SILT to sandy SILT
30 – 85	Dense to very dense SAND to silty SAND
85 – 136	Stiff to very stiff SILT to sandy SILT
136 – 140.5	Medium dense silty SAND
140.5 – 145.3	Silty SANDSTONE

More detailed descriptions of individual soil and rock units are provided in Appendix B. Subsurface conditions are also discussed in more detail in subsequent sections of this report.

0 to 10 feet. The parking lot at BH-2 was paved with ±2 inches of asphaltic concrete (AC), followed by dense crushed rock to 2.5 feet. Below the pavement section, we encountered very loose, silty sand with silt laminations and scattered shells to ±10 feet. It was unclear whether this unit represents native estuarine deposits or fill. An N-value of 1 and was recorded at ±5 feet. The moisture content was 49 percent in this stratum.

10 to 30 feet. Dark grey, very soft, high plasticity silt with trace to some sand and scattered organics extends from ±10 to 30 feet. Sand lenses were also encountered within this stratum. An N-value of 0 was recorded in the soft silt at three depths. An N-value of 5 recorded at ±20 likely reflecting the presence of a lens of medium dense sand. Moisture contents in this unit ranged from ±64 to 86 percent. Laboratory tests indicated an LL between 61 to 96 and a PI between 22 to 29, which corresponds to a USCS MH designation. The tested samples within this soil unit contained ±77 to 94 percent fines.

30 to 85 feet. The silt is underlain by a ±55-foot thick layer of brown to grey, fine sand with silt interbeds and lenses. The sand is silty with scattered to some organics from ±65 to 85 feet. N-values typically ranged from 23 to 63, indicating a medium dense to very dense consistency. A 3-foot thick lens of stiff silt was encountered from ±70 to 73 feet. An N-value of 9 was recorded in the silt.

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Moisture contents in the sand ranged from ±20 to 39 percent, and the fines content of tested samples ranged from ±8 to 41 percent. A silt interbed at ±70 feet had a moisture content of ±48 percent.

85 to 136 feet. Grey to brown, medium to high plasticity silt extends from ±85 to 136 feet. The silt is typically stiff grading to very stiff with depth, with N-values ranging from 10 to 19. Occasional lenses of soil containing scattered shells and wood fibers were observed within this unit. Moisture contents ranged from ±32 to 58 percent and the fines content ranged from ±45 to 94 percent.

136 to 140.5 feet. A ±4-foot thick layer of medium dense, silty sand was encountered from ±136 to 140.5 feet. No SPTs or laboratory testing was completed in this layer.

140.5 to 145.3 feet. Grey, extremely weak to very weak (R0 to R1), silty sandstone was encountered at BH-2 at a depth of ±140.5 feet. The sandstone is part of the Coaledo Formation which has been mapped locally and has been encountered in other nearby borings. The sandstone is slightly weathered to ±145 feet, and fresh below. Practical sampling refusal (greater than 50 blows for 6 inches of sampler penetration) was recorded twice within the bedrock. The drilling was discontinued at ±145.3 in consultation with Staheli.

Ground Water. The surveyed grounds surface at BH-2 was ±El. 10.33. The boring was drilled ±50 feet from the bay and during our field exploration, we observed the water level vary with the tide from ±3 to 10 feet below the ground surface at BH-2. Based on the near-surface soils encountered in the boring, we anticipate the ground water level in the vicinity of BH-2 will vary with the tide and closely match the water level in the bay.

Comparison with Previous Borings

Squire's B-22 encountered fill consisting of very soft silt with wood and miscellaneous debris extending to ±10 feet. The fill was followed by very soft silt with organic debris and lenses of loose sand to ±28 feet. SPT N-values of 0 to 4 were reported within the silt layers. Dense to very dense sand with trace silt was encountered from ±28 to 64 feet. N-values in this stratum ranged from 37 to 62. The dense sand was followed by medium dense sand with some silt and numerous organics to ±76.5 feet, the limits of exploration. N-values of 21 were recorded at two depths in the lower sand unit. The Squire boring was consistent with the subsurface profile found at BH-2 (to the limits of the previous exploration).

The Foundation Engineering boring near Pump Station No. 1 (BH-3) encountered fill to ±10 feet. The fill was underlain by ±10 feet of very soft silt with scattered organics, followed by medium dense sand with some silt to ±60 feet. N-values of 27 to 36 were recorded in the sand, indicating a medium dense, grading to dense consistency. A layer of stiff silt was encountered from ±60 to 65 feet, followed by medium dense silty sand to ±75 feet and stiff silt to ±76.5, the limits of exploration.

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Although the thicknesses of the silt and sand units vary somewhat with those recorded our recent BH-2, their overall profiles are relatively consistent.

DISCUSSION OF SOIL CONDITIONS ALONG PROPOSED HDD BORE

Figure 4A (Appendix A) shows generalized subsurface profiles at the two borings and a cross section across the slough along the planned HDD bore alignment. It should be noted the figure required an exaggerated 3:1 (H:V) scale and BH-1 is offset ±300 feet to the south of the cross-section.

When viewing the cross sections from west to east, there appears to be poor correlation between the two borings, even when adjusting for the ±20-foot difference in ground surface elevations. At the west side of the planned HDD bore, there is fill and predominantly very soft silt to a depth of ±30 feet, followed by a thick sequence of predominantly dense to medium dense sand to ±85 feet. Predominantly stiff silt extends to ±136 feet, followed by a thin layer of sand underlain by bedrock.

In contrast, the subsurface profile at the east side can be viewed as alternating or interbedded layers of predominantly loose sand and very soft to soft silt to ±155 feet. The thick layer of medium dense to dense sand that was encountered in the upper portion of the profile on the west side was not found on the east side. Medium stiff to stiff silt was encountered from ±155 to 171.5 feet, the limits of our exploration. On the cross-section (Figure 4A), we have shown a line connecting the top of these two units. This interpretation is inferred from the N-values and observed stiffness of the samples and is very approximate. The inferred contact could be shallower on the east side to include the silt beginning at ±125 feet, although that silt unit appears to be somewhat softer than the corresponding soil on the west side.

No bedrock was encountered to the limits of our exploration at the east side. The dip of the rock surface is inferred by matching the approximate slope of the overlying silt unit but is only assumed and may not be accurate at those depths.

Preliminary information provided by Dyer and Staheli (and shown on Figure 4A) indicate the HDD bore will be drilled from west to east. At the west end, the bore will have an entry angle of ±15 degrees and will extend to a depth of ±140 feet. Therefore, the bore at the west side will penetrate up to ±30 feet of fill and interbedded very soft silt and very loose to medium dense sand, followed by predominantly medium dense to very dense silty sand from ±30 to 80 feet. Below ±80 feet, the bore will likely encounter predominantly stiff silt.

Beyond the entry segment, the HDD will have a curve radius of ±1,200 feet. Based on conditions extrapolated from BH-2, we anticipate the curve segment will encounter predominantly stiff silt.

Beyond the curve radius, the bore will extend in a straight segment toward the east, exiting at an angle of ±6.5 degrees. Soil conditions along the relatively long, straight segment are not well defined. Based on conditions encountered in BH-1, the silt at ±100 feet will become very soft as the bore extends from west to east. Therefore, beyond ±Sta. 8+00 to 10+00, we anticipate the HDD bore will encounter increasingly softer soils. This estimate is based on the inferred contact shown in Figure 4A and is very approximate. As the bore emerges at the east side, we anticipate it will encounter lenses of loose sand and very soft to medium stiff silt.

No large obstructions such as logs were encountered at either BH-1 or BH-2. The possibility of encountering potential obstructions beneath the slough is unknown.

VARIATION OF SUBSURFACE CONDITIONS, WARRANTY AND USE OF REPORT

This memorandum was prepared for the exclusive use of The Dyer Partnership Engineers and Planners, Inc. and Staheli Trenchless for their analysis and design of the Pump Station No. 17 Force Main Replacement project in Coos Bay, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent.

This memorandum is intended as a data report for the planning and design (by others) of horizontal directional drilling. Contractors using this information to estimate construction quantities, select equipment, materials, means and methods, and costs, do so at their own risk.

Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or ground water by hazardous or toxic materials. We assume that those services, if needed, have been completed by others.

It is assumed that contractors bidding on this project or using this information to plan, design and construct directional bores are familiar with local soil, rock and ground water conditions. The subsurface profiles should be considered accurate only at individual boring locations. Contractors should clearly understand that the discussion of subsurface conditions along the planned HDD bore alignment requires extrapolation from two very widely-spaced borings and the subsurface profiles at the two borings vary significantly. Therefore, the HDD contractor should expect varying subsurface conditions along the HDD bore alignment beneath the slough.

Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

We hope this information meets your current needs and look forward to assisting you further. Please do not hesitate to call with any questions.

Attachments

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REFERENCES

Port of Coos Bay, Eastside Development, Coos Bay, prepared for Richard Turi Architecture and Planning, by Foundation Engineering, Inc., dated April 21, 2000.

Pump Station No. 1 Improvements, prepared for Dyer Partnership Engineers & Planners, Inc., by Foundation Engineering, Inc. dated May 27, 2015.

Subsurface Exploration, Pressure Sludge Line Alignment, City of Coos Bay, Oregon, prepared for Brown and Caldwell, by L.R. Squire Associates, Inc., dated September 15, 1987.

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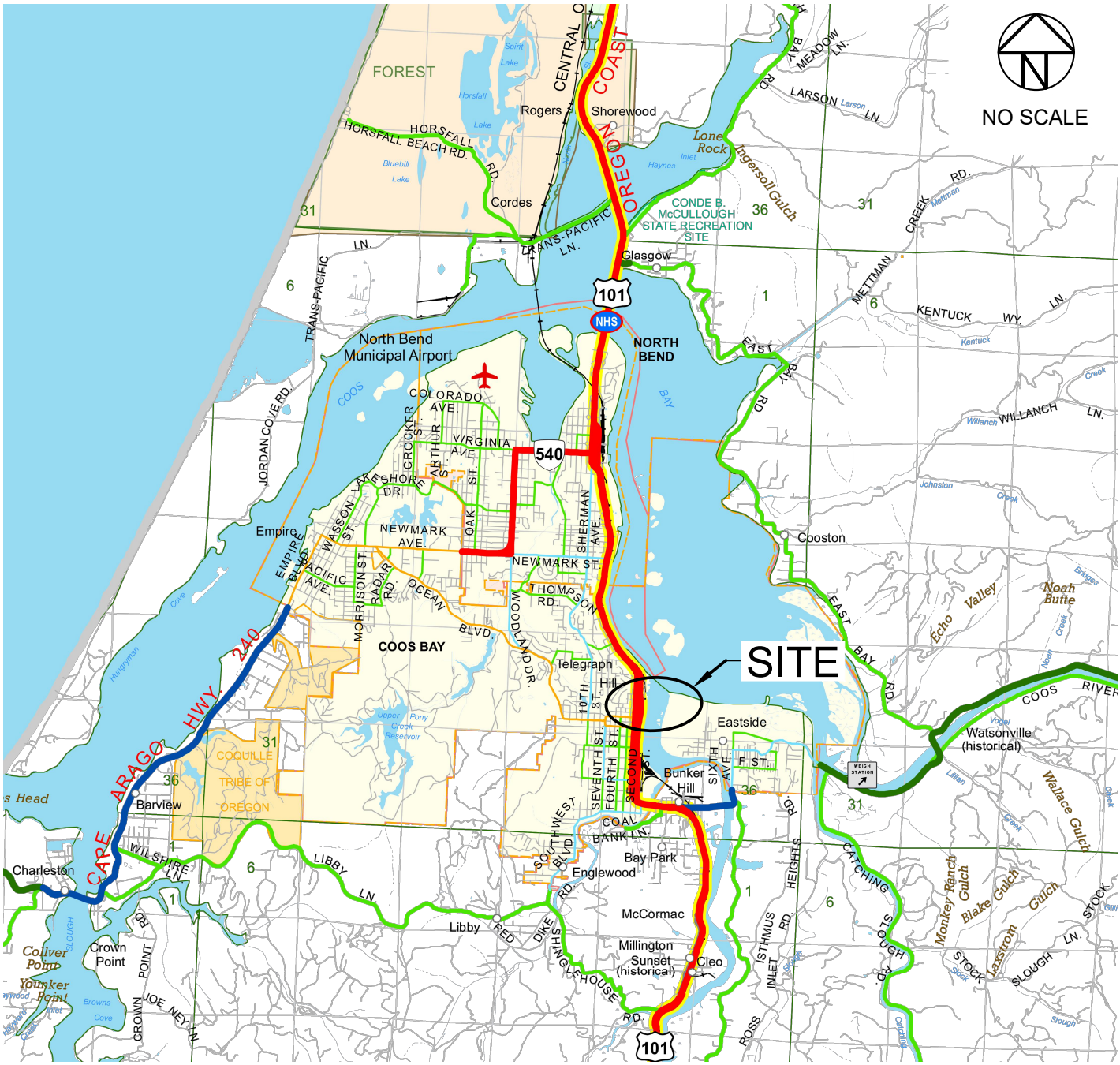
Appendix A

Figures

Professional
Geotechnical
Services

Foundation Engineering, Inc.

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Note: Base map obtained from the Oregon Department of Transportion website.

DATE APR 2018
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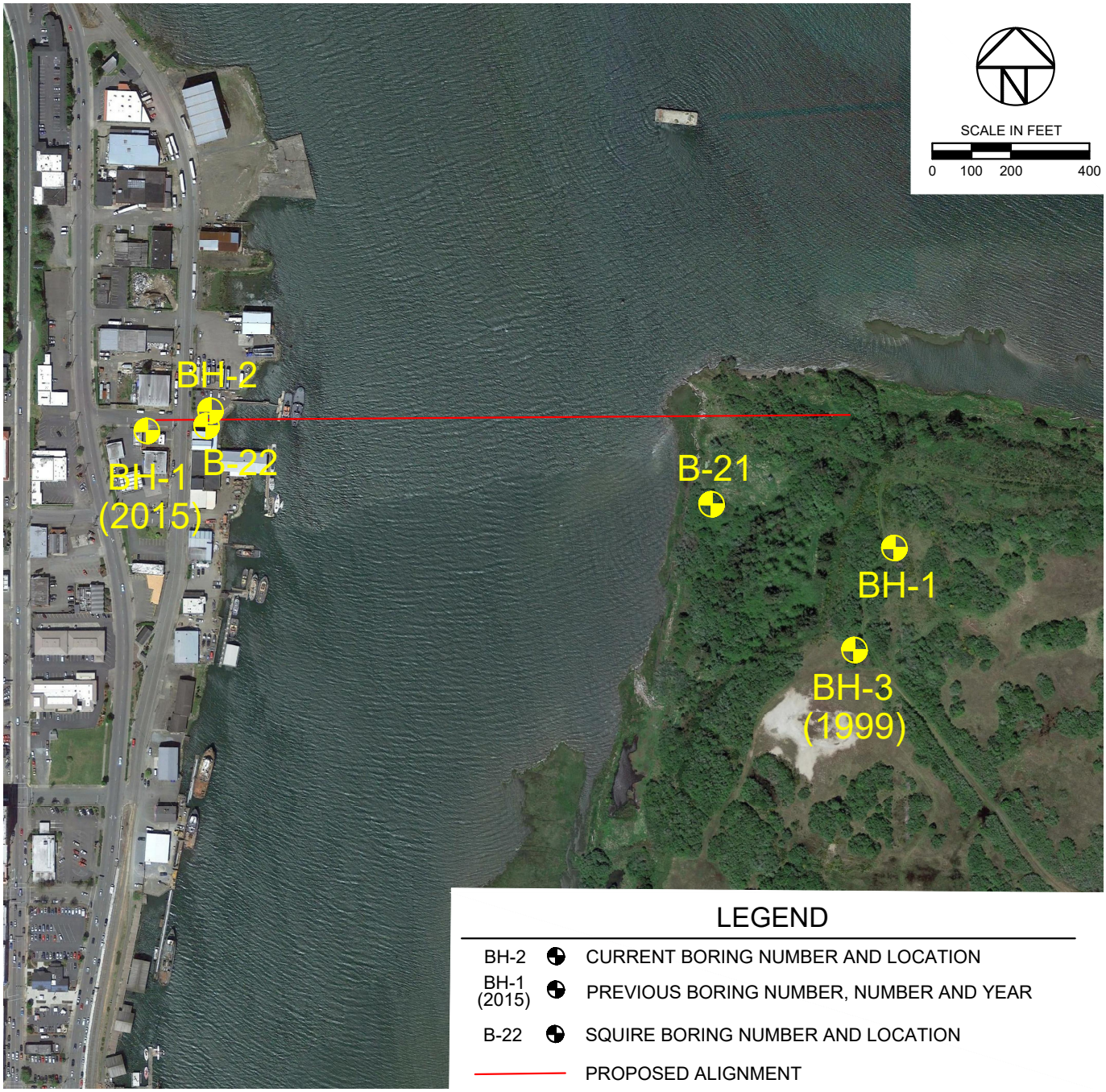
VICINITY MAP

PUMP STATION NO. 17 FORCE MAIN REPLACEMENT
COOS BAY, OREGON

FIGURE NO.
1A

FILE NAME: FIG 1A

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LEGEND

BH-2	CURRENT BORING NUMBER AND LOCATION
BH-1 (2015)	PREVIOUS BORING NUMBER, NUMBER AND YEAR
B-22	SQUIRE BORING NUMBER AND LOCATION
	PROPOSED ALIGNMENT

NOTES:

1. BH−1 LOCATION ESTABLISHED USING GPS. BH−2 LOCATION ESTABLISHED USING A METAL TAPE. OTHER BORING LOCATIONS ESTIMATED FROM VISUAL REFERENCE WITH LANDMARKS. BORING LOCATIONS ARE APPROXIMATE.
2. AERIAL IMAGE OBTAINED FROM GOOGLE EARTH.
3. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.

DATE MAY 2017
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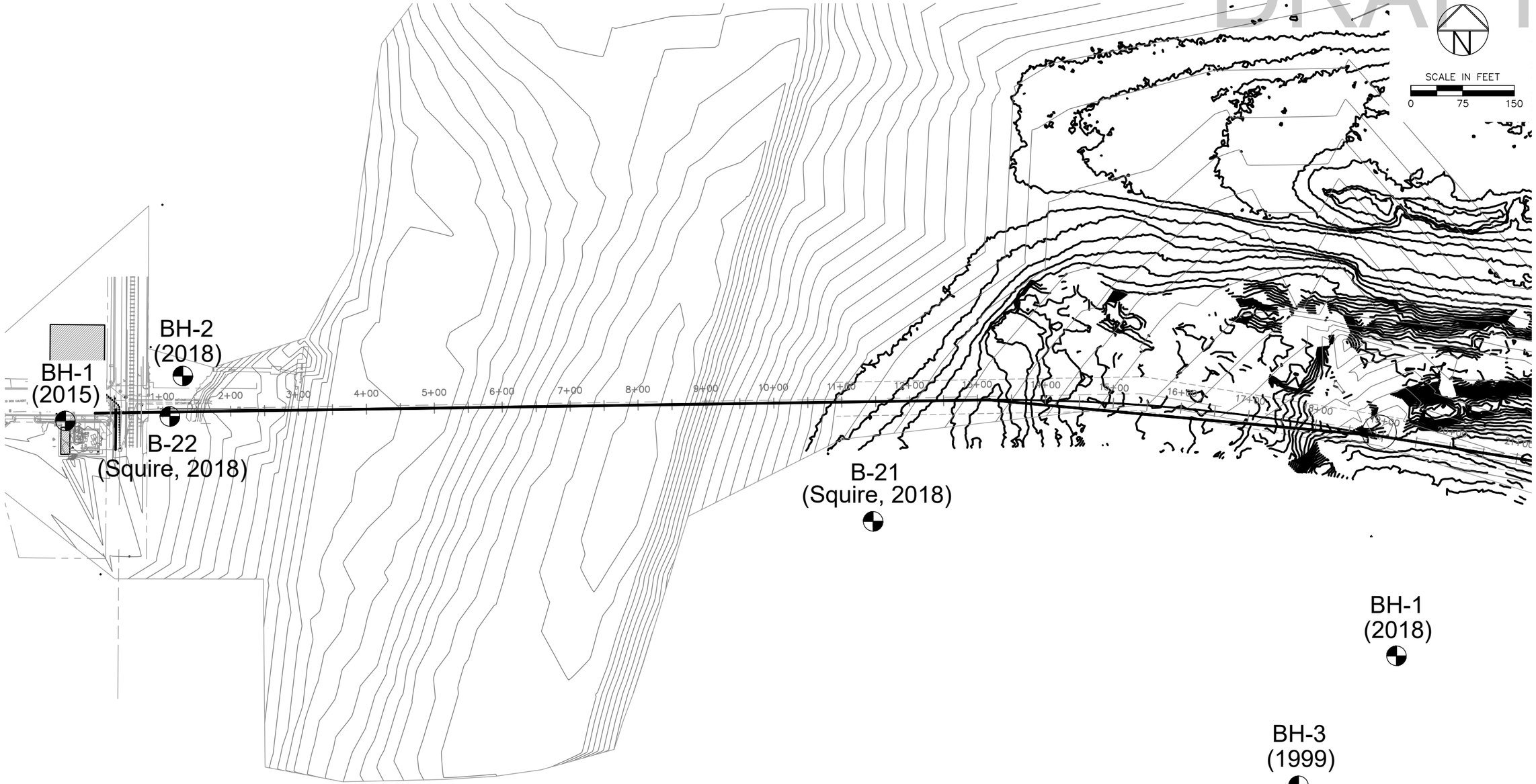
BORING LOCATIONS

PUMP STATION NO. 17 FORCE MAIN REPLACEMENT
COOS BAY, OREGON

FIGURE NO.
2A

FILE NAME: FIG 2A

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NOTE:
BASE MAP PROVIDED BY THE DYER PARTNERSHIP.

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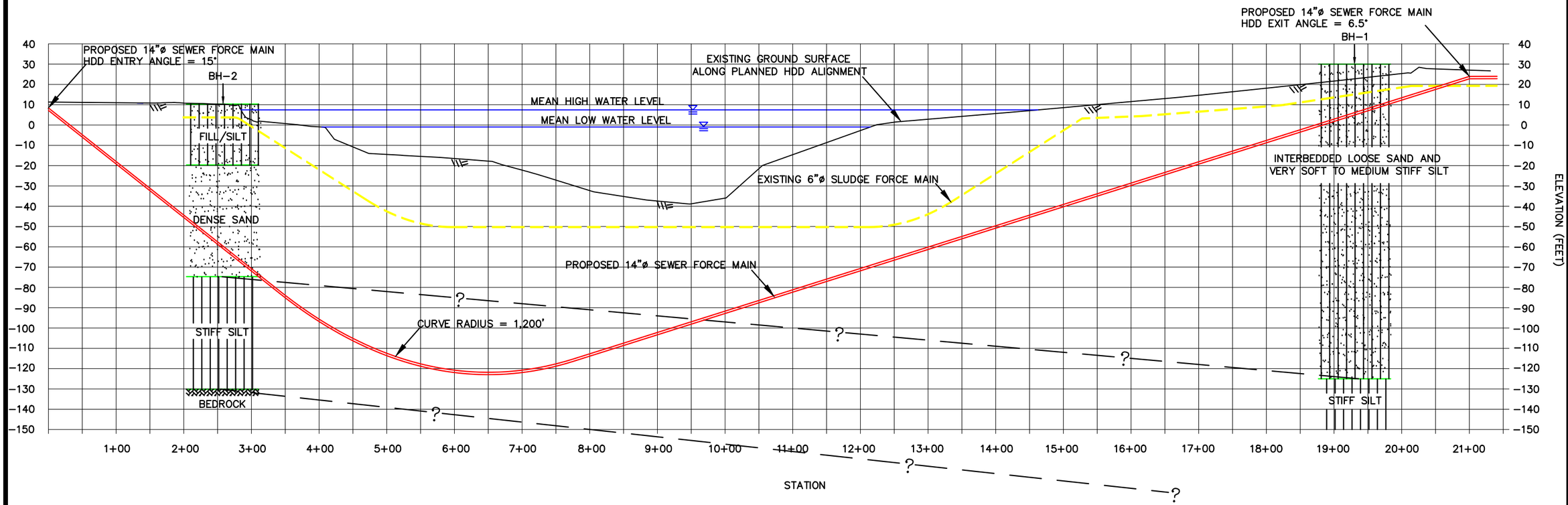
PROPOSED HDD ALIGNMENT

PUMP STATION NO. 17 FORCE MAIN REPLACEMENT
COOS BAY, OREGON

FIGURE NO.
3A

FILE NAME:FIG 3A

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NOTES:
1. WATER LEVEL DATA PROVIDED BY THE DYER PARTNERSHIP.
2. GROUND SURFACE PROFILE BASED ON FIGURE 3A PROVIDED BY THE DYER PARTNERSHIP.

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EXISTING GROUND SURFACE PROFILE

PUMP STATION NO. 17 FORCE MAIN REPLACEMENT
COOS BAY, OREGON

FIGURE NO.
4A

FILE NAME:FIG 4A

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Appendix B

Boring Logs (Current and Previous)

Professional Geotechnical Services

Foundation Engineering, Inc.

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DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the sample examinations and laboratory test results. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

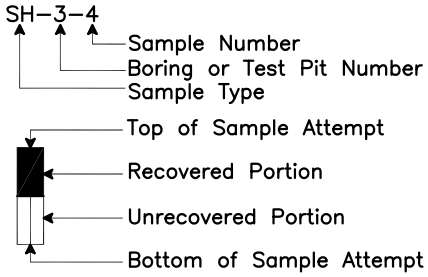
VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS



C – Pavement Core Sample
CS – Rock Core Sample
OS – Oversize Sample (3–inch split–spoon)
S – Grab Sample
SH – Thin–walled Shelby Tube Sample
SS – Standard Penetration Test Sample (split–spoon)

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split–spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%).

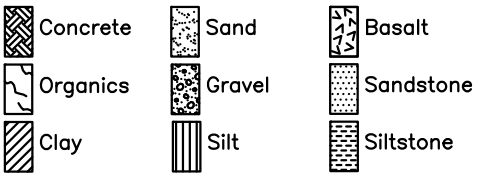
UNIFIED SOIL CLASSIFICATION SYMBOLS

G – Gravel	W – Well Graded
S – Sand	P – Poorly Graded
M – Silt	L – Low Plasticity
C – Clay	H – High Plasticity
Pt – Peat	O – Organic

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or Field Vane shear devices.

TYPICAL SOIL/ROCK SYMBOLS



WATER TABLE



Water Table Location

(1/31/16) Date of Measurement

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7857 SW CIRRUS DRIVE, BUILDING 24
BEAVERTON, OR 97008
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SYMBOL KEY

EXPLORATION LOGS

DRAFT

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT*	S_u** (tsf)	Term	SPT*	Term
Easily penetrated several inches by fist.	0 – 2	< 0.125	Very Soft	0 – 4	Very Loose
Easily penetrated several inches by thumb.	2 – 4	0.125–0.25	Soft	4 – 10	Loose
Can be penetrated several inches by thumb with moderate effort.	4 – 8	0.25 – 0.50	Medium Stiff	10 – 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	8 – 15	0.50 – 1.0	Stiff	30 – 50	Dense
Readily indented by thumbnail.	15 – 30	1.0 – 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	>30	> 2.0	Hard		

* SPT N–value in blows per foot (bpf)
** Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Non–plastic	0 – 3	Cannot be rolled into a thread at any moisture.
Low Plasticity	3 – 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 – 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and re–rolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least ¼ inch thick.
Laminated	Alternating layers less than ¼ inch thick.
Fissured	Contains shears and partings along planes of weakness.
Slickensided	Partings appear glossy or striated.
Blocky	Breaks into small lumps that resist further breakdown.
Lensed	Contains pockets of different soils.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

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COMMON TERMS

SOIL DESCRIPTIONS

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Explanation of Common Terms Used in Rock Descriptions

Field Identification		UCS (psi)	Strength	Hardness (ODOT)
Indented by thumbnail.	R0	< 100	Extremely Weak	Extremely Soft
Crumbles under firm blows with geological hammer, can be peeled by a pocket knife.	R1	100–1,000	Very Weak	Very Soft
Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with geological hammer.	R2	1,000–4,000	Weak	Soft
Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of geological hammer.	R3	4,000–8,000	Medium Strong	Medium Hard
Specimen requires more than one blow of geological hammer to fracture it.	R4	8,000–16,000	Strong	Hard
Specimen requires many blows of geological hammer to fracture it.	R5	>16,000	Very Strong	Very Hard

Term	Weathering Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric.
Moderately Weathered	Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Highly Weathered (Predom. Decomp.)	Rock can be excavated with geologist's pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock "fabric" may be evident (relict texture). May be reduced to soil with hand pressure.

Spacing (meters)	Spacing	Spacing Term	Bedding/Foliation
< 0.06	< 2 in.	Very Close	Very Thin (Laminated)
0.06 – 0.30	2 in. – 1 ft.	Close	Thin
0.30 – 0.90	1 ft. – 3 ft.	Moderately Close	Medium
0.90 – 3.0	3 ft. – 10 ft.	Wide	Thick
> 3.0	> 10 ft.	Very Wide	Very Thick (Massive)

Vesicle Term	Volume
Some vesicles	5 – 25%
Highly vesicular	25 – 50%
Scoriaceous	> 50%

Stratification Term	Description
Lamination	<1 cm (0.4 in.) thick beds
Fissile	Preferred break along laminations
Parting	Preferred break parallel to bedding
Foliation	Metamorphic layering and segregation of minerals

RQD %	Designation	RQD %	Designation
0 – 25	Very Poor	75 – 90	Good
25 – 50	Poor	90 – 100	Excellent
50 – 75	Fair		

Rock Quality Designation (RQD) is the cumulative length of intact pieces 4 inches or longer excluding breaks caused by drilling and handling divided by run length, expressed as a percentage.

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COMMON TERMS

ROCK DESCRIPTIONS

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples
1–2	Loose to medium dense silty SAND, scattered to trace shells (SM); brown, moist, medium to high plasticity silt, fine sand, (fill).	0.0	
3		27.0	
3–4	Loose SAND, some silt, scattered shells (SM); brown to grey, wet, medium to high plasticity, fine sand, (fill).	3.0	
5			SS-1-1 (8)
10–11	Grey and scattered wood fragments and fibers below ±10 feet.		SS-1-2 (5)
15		15.0	
15–17	Very soft SILT, some organics (MH to OH); dark grey, wet, medium to high plasticity, organics consist of wood fibers, (estuarine deposits).	15.0	SS-1-3 (1)
20		10.0	
20–21	Medium stiff organic SILT (OH); grey-brown, wet, medium to high plasticity, organics consist of wood fibers, (estuarine deposits).	20.0	SS-1-4 (5)
22		8.5	
22–25	Loose SAND, some silt and organics, scattered shells (SM); grey, wet, medium to high plasticity silt, fine sand, organics consist of wood fibers, (estuarine deposits).	21.5	SS-1-5 (9)
30			SS-1-6 (7)
35–36	Medium dense below ±35 feet.		SS-1-7 (13)
40			SS-1-8 (8)
41		-11.0	
42–44	Medium stiff SILT, some sand and organics, scattered shells (MH to OH); grey, wet, medium to high plasticity, organics consist of wood and plant fibers, (estuarine deposits).	41.0	
45			SS-1-9 (4)

SPT, N-Value ▲ Recovery ⊡ | Moisture, % ● RQD., % ⊞ | 0 | 50 | 100 | >>

Backfill/ Installations/ Water Table

- Capped with sand
- Backfilled with bentonite chips (±1 to 15 feet) and grout (±15 to 171.5 feet)
- Ground water level observed prior to drilling

Project No.: 2181034

Surface Elevation: 30.0 feet (Approx.)

Date of Boring: April 20, 2018

Foundation Engineering, Inc.

Boring Log: BH-1

Pump Station No. 17

Force Main Replacement

Coos Bay, Oregon

Last edited: 5/10/18 WG

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	SPT, N-Value / Recovery; Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
51	Field vane on SH-1-10: S_u = ±0.40 tsf at ±50 and ±52 feet.	-20	SH-1-10		
52					
53					
54					
55	Very soft SILT, some sand and organics, scattered shells (MH to OH); grey, wet, medium to high plasticity, organics consist of wood and plant fibers, (estuarine deposits).	-25.0 55.0	SS-1-11	0	
56					
57					
58					
59					
60	Some shells from ±60 to 65 feet.		SH-1-12		
61	Field vane on SH-1-12: S_u = ±0.60 tsf at ±61 feet.				
62					
63					
64					
65			SS-1-13	0	
66					
67					
68					
69					
70			SS-1-14	0	
71					
72					
73					
74					
75			SH-1-15		
76	Field vane on SH-1-15: S_u = ±0.26 tsf at ±75 feet.				
77					
78					
79					
80	Loose silty SAND, some organics and shells (SM); grey, wet, medium to high plasticity silt, fine sand, organics consist of wood and plant fibers, (estuarine deposits).	-50.0 80.0	SS-1-16	5	
81					
82					
83					
84					
85	Very soft organic SILT, trace to some sand, some shells (OH); grey, wet, medium to high plasticity, fine sand, organics consist of wood fibers, (estuarine deposits).	-55.0 85.0	SS-1-17	1	
86					
87					
88					
89					
90	Very soft to soft SILT, some sand and organics, trace shells (MH to OH); grey, moist to wet, medium plasticity, fine sand, organics consist of wood fibers, (estuarine deposits).	-60.0 90.0	SS-1-18	3	
91					
92					
93					
94					
95			SH-1-19		
96					
97					
98					
99					

Project No.: 2181034

Surface Elevation: 30.0 feet (Approx.)

Date of Boring: April 20, 2018

Foundation Engineering, Inc.

Boring Log: BH-1

Pump Station No. 17

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Last edited: 5/10/18 WG

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 — 50 — 100)	Backfill/ Installations/ Water Table
101	Scattered shells below ±100 feet.	-70	SS-1-20	0	
105			SS-1-21	3	
110	Loose to medium dense silty SAND, some organics, scattered shells (SM); grey, wet, medium to high plasticity silt, fine sand, organics consist of wood fibers, (estuarine deposits).	-80.0 110.0	SS-1-22	7	
115			SS-1-23	16	
120			SS-1-24	6	
125	Soft to medium stiff SILT, trace sand (MH); grey, wet, medium to high plasticity, fine sand, (estuarine deposits).	-95.0 125.0	SS-1-25	2	
130			SS-1-26	4	
135	Some wood fibers and scattered shells below ±135 feet.		SS-1-27	8	
140			SS-1-28	3	
145	Sandy below ±145 feet.		SS-1-29	5	
149					

Project No.: 2181034

Surface Elevation: 30.0 feet (Approx.)

Date of Boring: April 20, 2018

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Boring Log: BH-1

Pump Station No. 17

Force Main Replacement

Coos Bay, Oregon

Last edited: 5/10/18 WG

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth -120	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
151 152 153 154	Loose silty SAND, some organics, scattered shells (SM); grey, wet, medium to high plasticity silt, fine sand, organics consist of wood fibers, (estuarine deposits).	150.0	SS-1-30	4	
155 156 157 158 159	Medium stiff SILT, some organics, scattered shells (MH); grey, wet, medium to high plasticity, organics consist of wood fibers, (estuarine deposits).	-125.0 155.0	SS-1-31	6	
160 161 162 163 164	Stiff sandy SILT, some organics, scattered shells (MH); grey, wet, medium to high plasticity, fine sand, organics consist of wood fibers, (estuarine deposits).	-130.0 160.0	SS-1-32	12	
165 166 167	Stiff organic sandy SILT (OH); grey-brown, wet, medium to high plasticity, fine sand, organics consist of wood fibers and twigs, (estuarine deposits).	-135.0 165.0	SS-1-33	13	
168 169 170 171	Very stiff SILT with sand laminations (MH to SM); brown silt and grey sand, moist, medium to high plasticity silt, fine sand, (estuarine deposits).	-138.0 168.0	SS-1-34	18	
	BOTTOM OF BORING	-141.5 171.5			

Project No.: 2181034

Surface Elevation: 30.0 feet (Approx.)

Date of Boring: April 20, 2018

Foundation Engineering, Inc.

Boring Log: BH-1

Pump Station No. 17

Force Main Replacement

Coos Bay, Oregon

Last edited: 5/10/18 WG

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	SPT, N-Value / Moisture, % / Recovery / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
1	ASPHALTIC CONCRETE (±2 inches)	10.2			Capped with AC cold patch, gravel, and PCC
2	Dense CRUSHED ROCK (GP); grey, wet, ±1-inch minus, angular, (base rock/fill).	0.2			
3	Very loose silty SAND with silt laminations, scattered shells (SM); grey, wet, medium to high plasticity silt, fine sand, (estuarine deposits).	7.8			
4		2.5			
5			SS-2-1	1	Backfilled with bentonite chips (±12 to 18 feet) and grout (±18 to 145.3 feet)
6					
7					
8					
9					
10	Very soft SILT, some sand and organics, scattered shells (MH to OH); grey to dark grey, wet, medium to high plasticity, fine sand, organics consist of fine roots and wood fibers, (estuarine deposits).	0.3			
11		10.0	SS-2-2	0	
12					
13					
14					
15	Silty sand laminations below ±15 feet.		SH-2-3		
16	Field vane on SH-2-3: S_u = ±0.25 tsf at ±15 feet,				
17	S_u = ±0.23 tsf at ±17 feet.		SS-2-4	0	
18					
19					
20			SS-2-5	5	
21	Medium dense fine to medium-grained sand lens from				
22	±21 to 22 feet.				
23					
24					
25			SS-2-6	0	
26					
27					
28					
29					
30	Dense SAND, some silt (SP-SM); brown, wet, medium to high plasticity, fine to medium sand, (estuarine deposits).	-19.7			
31		30.0	SS-2-7	28	
32					
33					
34					
35			SS-2-8	31	
36					
37					
38					
39					
40			SS-2-9	39	
41					
42					
43					
44					
45	Fine sand, some silt laminations from ±45 to 50 feet.		SS-2-10	42	
46					
47					
48					
49					

Project No.: 2181034

Surface Elevation: 10.3 feet (Approx.)

Date of Boring: April 17, 2018

Boring Log: BH-2

Pump Station No. 17

Force Main Replacement

Coos Bay, Oregon

Foundation Engineering, Inc.

Last edited: 5/10/18 WG

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Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., %	Backfill/ Installations/ Water Table
51	Very dense from ±50 to 55 feet and iron-stained below ±50 feet.		-39.67	SS-2-11	63	
55	Orange-brown below ±55 feet.			SS-2-12	35	
60	Medium dense SAND, some silt (SP-SM); grey, wet, medium to high plasticity silt, fine sand, (estuarine deposits).		-49.7 60.0	SS-2-13	30	
65	Silty with some wood fibers below ±65 feet.			SS-2-14	23	
70	Stiff SILT, some sand to sandy SILT, some organics (MH); grey, wet, medium to high plasticity silt, fine sand, organics consist of wood fibers, (estuarine deposits).		-59.7 70.0	SS-2-15	9	
73	Sidewall caving noted between ±70 and 75 feet.		-62.7 73.0			
75	Dense silty SAND, scattered to some organics, scattered shells (SM); grey, wet, medium to high plasticity silt, fine sand, organics consist of wood fibers, (estuarine deposits).			SS-2-16	43	
80	Medium dense below ±80 feet.			SS-2-17	24	
85	Stiff SILT, some sand, trace gravel and shells (MH); grey, moist, medium to high plasticity, fine sand, fine to coarse subrounded to rounded decomposed gravel, (estuarine deposits).		-74.7 85.0	SS-2-18	12	
90	Brown with scattered shells from ±90 to 95 feet and no gravel below ±90 feet.			SS-2-19	10	
95	Scattered wood fibers from ±95 to 110 feet.			SH-2-20		
				SS-2-21	12	

Project No.: 2181034

Surface Elevation: 10.3 feet (Approx.)

Date of Boring: April 17, 2018

Boring Log: BH-2

Pump Station No. 17

Force Main Replacement

Coos Bay, Oregon

Foundation Engineering, Inc.

Last edited: 5/10/18 WG

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth -89.67	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
101	Trace fine sand below ±100 feet.		SS-2-22	14	
105			SH-2-23		
110	Brown below ±110 feet.		SS-2-24	15	
115			SH-2-25		
120	Very stiff below ±120 feet.		SS-2-26	18	
125			SH-2-27		
130	Sandy with some wood fibers below ±130 feet.		SS-2-28	19	
135	Field vane on SH-2-29: S_u = ±0.27 tsf at ±135 feet.	-125.7	SH-2-29		
136	Medium dense silty SAND (SM); grey, wet, medium to high plasticity silt, fine sand, (estuarine deposits).	136.0			
139	Some silt, fine to medium sand, and wood fibers below ±138 feet.				
140		-130.2	SS-2-30	50/5"	
141	Extremely weak to very weak (R0 to R1) silty SANDSTONE; grey, slightly weathered, fine sand, (Coaledo Formation).	140.5			
145		-134.7			
	Very weak (R1) silty SANDSTONE; grey, fresh, fine sand, (Coaledo Formation).	145.0	SS-2-31	50/1st 3"	
	BOTTOM OF BORING	-135.0 145.3			

Project No.: 2181034

Surface Elevation: 10.3 feet (Approx.)

Date of Boring: April 17, 2018

Foundation Engineering, Inc.

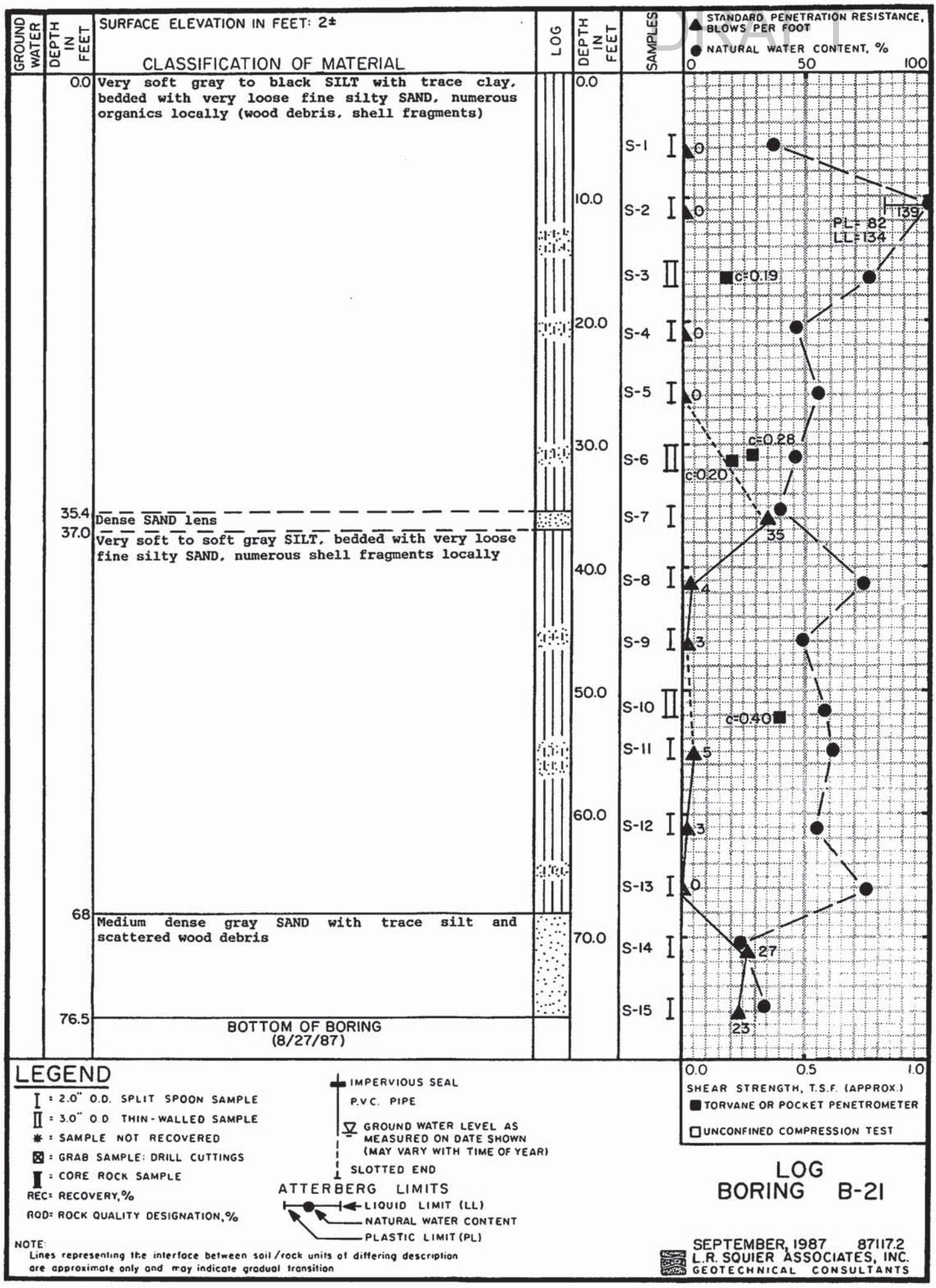
Boring Log: BH-2

Pump Station No. 17

Force Main Replacement

Coos Bay, Oregon

Last edited: 5/10/18 WG



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LEGEND

- I = 2.0" O.D. SPLIT SPOON SAMPLE
- II = 3.0" O.D. THIN-WALLED SAMPLE
- * = SAMPLE NOT RECOVERED
- ⊠ = GRAB SAMPLE: DRILL CUTTINGS
- ▮ = CORE ROCK SAMPLE
- REC= RECOVERY,%
- ROD= ROCK QUALITY DESIGNATION,%

IMPERVIOUS SEAL
P.V.C. PIPE
GROUND WATER LEVEL AS MEASURED ON DATE SHOWN (MAY VARY WITH TIME OF YEAR)
SLOTTED END

ATTERBERG LIMITS
LIQUID LIMIT (LL)
NATURAL WATER CONTENT
PLASTIC LIMIT (PL)

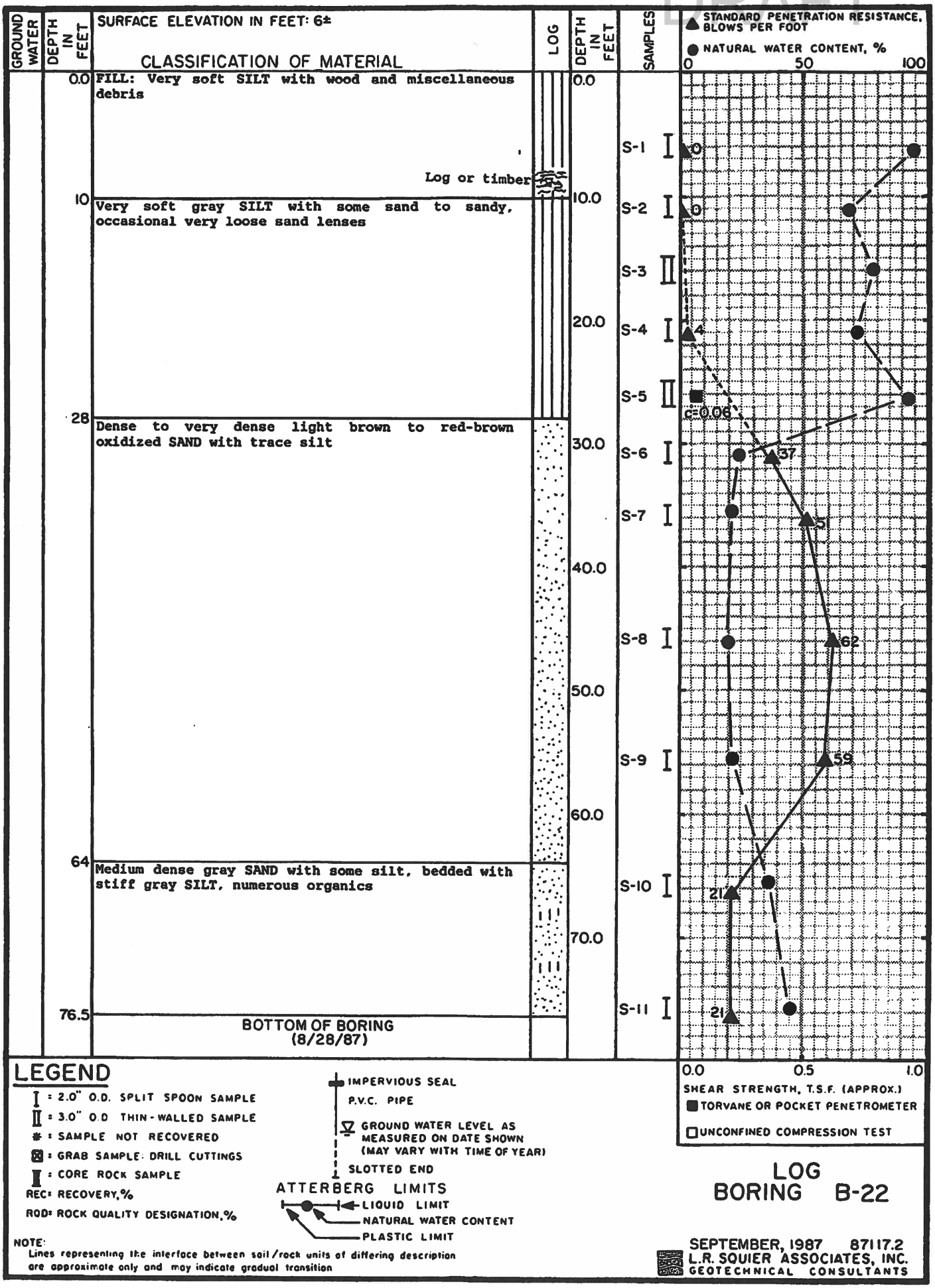
NOTE:
Lines representing the interface between soil/rock units of differing description are approximate only and may indicate gradual transition

LOG BORING B-21

SEPTEMBER, 1987 87117.2
L.R. SQUIER ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

FIGURE 4

DRAFT



LEGEND

- I = 2.0" O.D. SPLIT SPOON SAMPLE
- II = 3.0" O.D. THIN-WALLED SAMPLE
- * = SAMPLE NOT RECOVERED
- = GRAB SAMPLE: DRILL CUTTINGS
- = CORE ROCK SAMPLE
- REC = RECOVERY, %
- ROD = ROCK QUALITY DESIGNATION, %

IMPERVIOUS SEAL
P.V.C. PIPE
GROUND WATER LEVEL AS MEASURED ON DATE SHOWN (MAY VARY WITH TIME OF YEAR)
SLOTTED END

ATTERBERG LIMITS
LIQUID LIMIT
NATURAL WATER CONTENT
PLASTIC LIMIT

NOTE:
Lines representing the interface between soil/rock units of differing description are approximate only and may indicate gradual transition

LOG BORING B-22

SEPTEMBER, 1987 87117.2
L.R. SQUIER ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

FIGURE 5

DRAFT

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 – 50 – 100)	Installations/ Water Table
1	Dense CRUSHED ROCK (GP); grey, moist, ±¾-inch minus, angular, (fill).		11.3			Capped with gravel
2	Loose SAND, some silt, some shell fragments (SP-SM); grey, wet, fine sand, (fill).		0.8			
3						
4						
5				SS-1-1	4	Backfilled with bentonite chips (±0.5 to 7 feet) and bentonite grout (±7 to 75 feet).
6						
7						
8						
9						
10			2.0			
11	Very soft SILT, scattered organics (ML); grey, wet, low plasticity, organics consist of wood fibers and debris, (estuarine deposits).		10.0	SS-1-2	0	
12						
13						
14						
15	Soft with trace sand below ±15 feet.			SH-1-3		
16	Field vane on SH-1-3: S_u = ±0.2 tsf at ±15 feet.					
17	Field vane on SH-1-3: S_u = ±0.3 tsf at ±17 feet.			SS-1-4	3	
18	No organics below ±17 feet.					
19						
20			-8.0			
21	Medium dense SAND, some silt (SP-SM); grey, wet, fine sand, (estuarine deposits).		20.0	SS-1-5	12	
22						
23						
24						
25	Light grey below ±25 feet.			SS-1-6	28	
26						
27						
28						
29						
30				SS-1-7	25	
31						
32						
33						
34						
35	Dense from ±35 to 45 feet.			SS-1-8	37	
36						
37						
38						
39						
40	Iron-stained at ±40 feet.			SS-1-9	36	
41						

Project No.: 2151028

Surface Elevation: 12.0 feet (Approx.)

Date of Boring: April 28, 2015

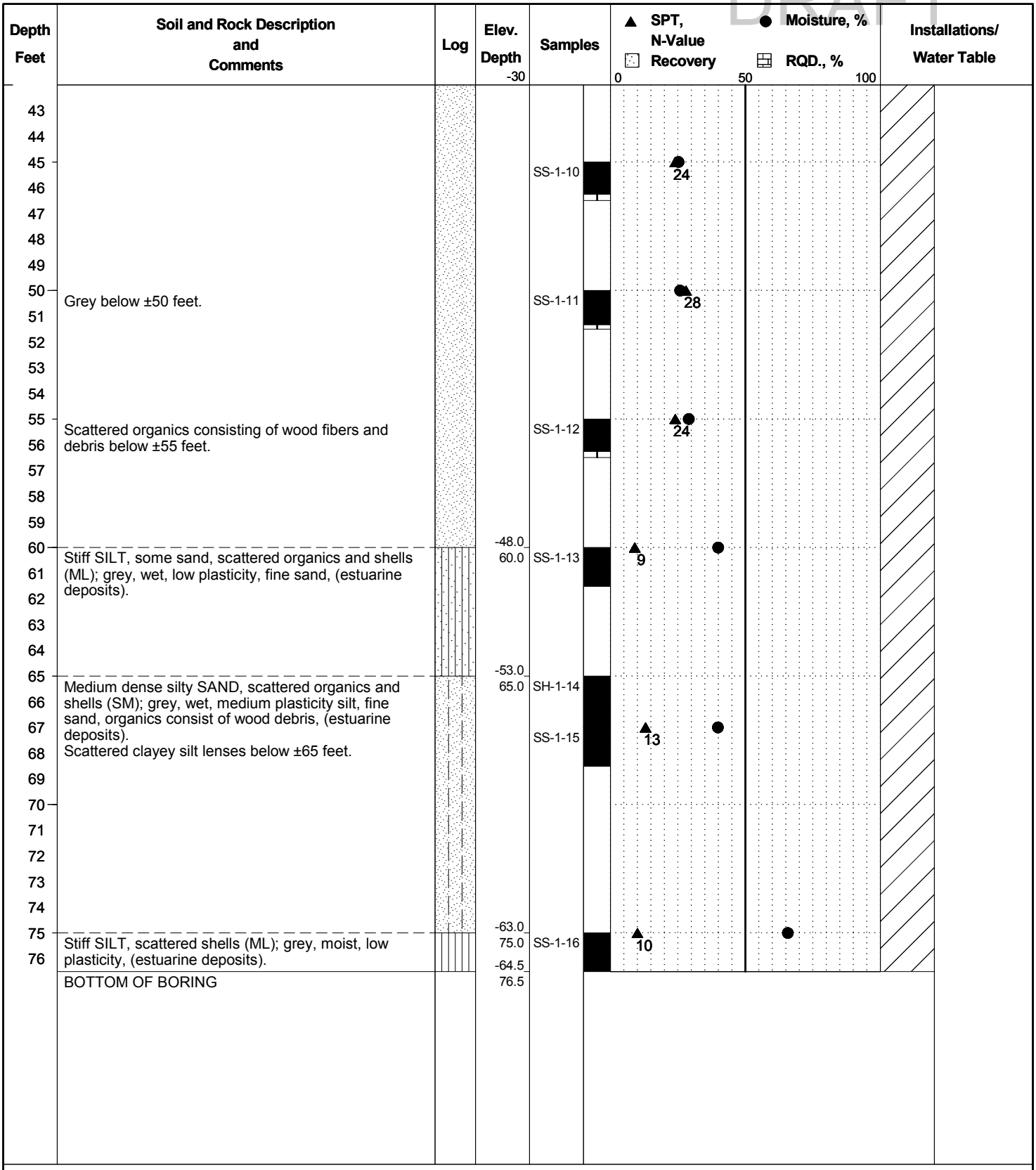
Boring Log: BH-1 (2015)

Pump Station No. 1 Improvements

Coos Bay, Oregon

Foundation Engineering, Inc.

DRAFT



Project No.: 2151028

Surface Elevation: 12.0 feet (Approx.)

Date of Boring: April 28, 2015

Boring Log: BH-1 (2015)

Pump Station No. 1 Improvements

Coos Bay, Oregon

Foundation Engineering, Inc.

DRAFT

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Moisture, % / Recovery / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
1–4	Loose SAND; grey, wet, fine to medium sand (Fill).		0.0	SS-3-1	9	Borehole backfilled with bentonite chips.
5–9	Soft, clayey SILT; abundant organics, black, wet (Alluvium).		4.5	SS-3-2 SH-3-3	2	
10–14	Loose SAND; trace sea shells, grey, wet, medium sand (Alluvium). Contains scattered organic layers and wood debris.		9.5	SS-3-4	7	
15–19				SS-3-5	6	
20–24				SS-3-6	10	
25–29				SS-3-7	9	
30–34				SS-3-8	8	
35–37	Grades to fine to medium SAND; trace silt.			SS-3-9	8	
38–39	Medium stiff SILT; grey, moist, low to medium plasticity (Alluvium).		37.5			

Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Boring Log: BH-3

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Foundation Engineering, Inc.

DRAFT

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 — 50 — 100)	Backfill/ Installations/ Water Table
41				SS-3-10	5	
42						
43						
44						
45				SS-3-11	6	
46						
47						
48	Medium stiff, clayey SILT; grey, moist to wet, medium plasticity (Alluvium).		48.0			
49						
50				SS-3-12	6	
51						
52	Medium stiff, clayey SILT; grey, wet, medium plasticity (Alluvium).					
53						
54						
55				SS-3-13	6	
56						
57						
58						
59						
60	Scattered wood fragments and sea shells noted.			SS-3-14	5	
61						
62						
63						
64						
65				SS-3-15	5	
66						
67						
68						
69						
70				SS-3-16	5	
71						
72						
73						
74						
75				SS-3-17	6	
76						
77						
78	Medium stiff, clayey SILT; grey, wet, medium plasticity (Alluvium).					
79						

Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Boring Log: BH-3

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Foundation Engineering, Inc.

DRAFT

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	▲ SPT, N-Value ● Moisture, % ⊡ Recovery ⊞ RQD., % 0 50 100	Backfill/ Installations/ Water Table
81				SS-1-18		
	BOTTOM OF BORING		81.5			

Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Foundation Engineering, Inc.

Boring Log: BH-3

Port of Coos Bay Eastside Development

Coos Bay, Oregon

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Appendix C

Laboratory Test Results

Professional
Geotechnical
Services

Foundation Engineering, Inc.

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Table 1C. BH-1 Natural Water Content, Percent Fines & Atterberg Limits

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	% Fines	LL	PL	PI	USCS Classification
SS-1-1	5.0 - 6.5	26.8					
SS-1-2	10.0 - 11.5	28.0	10.1				
SS-1-3	15.0 - 16.5	69.1					
SS-1-4	20.0 - 21.5	118.8					
SS-1-5	25.0 - 26.5	37.3					
SS-1-6	30.0 - 31.5	37.3	9.8				
SS-1-7	35.0 - 36.5	30.9					
SS-1-8	40.0 - 41.5	40.1					
SS-1-9	45.0 - 46.5	60.5	77.4	79	48	31	MH-OH
SH-1-10	50.0 - 50.5	67.4					
SH-1-10	51.5 - 52.0	61.1					
SS-1-11	55.0 - 56.5	60.3	70.0				
SH-1-12	60.5 - 61.0	65.4					
SS-1-13	65.0 - 66.5	68.2	81.5	85	56	29	MH-OH
SS-1-14	70.0 - 71.5	61.1					
SH-1-15	75.0 - 77.0	64.3					
SS-1-16	80.0 - 81.5	61.3	38.4				
SS-1-17	85.0 - 86.5	66.4					
SS-1-18	90.0 - 91.5	59.0	62.7				
SH-1-19	95.0 - 97.0	62.4					
SS-1-20	100.0 - 101.5	51.1					
SS-1-21	105.0 - 106.5	59.8	82.2	75	43	32	MH-OH
SS-1-22	110.0 - 111.5	38.9					
SS-1-23	115.0 - 116.5	38.4	38.4				
SS-1-24	120.0 - 121.5	36.4					
SS-1-25	125.0 - 126.5	59.9	91.1	81	50	31	MH-OH
SS-1-26	130.0 - 131.5	59.8					
SS-1-27	135.0 - 136.5	55.7	92.5	80	47	33	MH-OH
SS-1-28	140.0 - 141.5	53.0					
SS-1-29	145.0 - 146.5	47.3	46.8				

DRAFT

Table 1C. BH-1 Natural Water Content, Percent Fines & Atterberg Limits

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	% Fines	LL	PL	PI	USCS Classification
SS-1-30	150.0 - 151.5	44.2					
SS-1-31	155.0 - 156.5	55.8					
SS-1-32	160.0 - 161.5	56.3					
SS-1-33	165.0 - 166.5	77.1					
SS-1-34	170.0 - 171.5	51.1					

DRAFT

Table 2C. BH-2 Natural Water Content, Percent Fines & Atterberg Limits

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	% Fines	LL	PL	PI	USCS Classification
SS-2-1	5.0 - 6.5	48.8					
SS-2-2	10.0 - 11.5	67.4					
SH-2-3	15.0 - 17.0	79.0					
SS-2-4	17.0 - 18.5	81.8	77.2	96	67	29	MH-OH
SS-2-5	20.0 - 21.5	63.6					
SS-2-6	25.0 - 26.5	86.4	93.7	61	39	22	MH-OH
SS-2-7	30.0 - 31.5	23.9	10.3				
SS-2-8	35.0 - 36.5	23.6					
SS-2-9	40.0 - 41.5	20.7	8.6				
SS-2-10	45.0 - 46.5	22.3					
SS-2-11	50.0 - 51.5	20.2					
SS-2-12	55.0 - 56.5	25.3	14.4				
SS-2-13	60.0 - 61.5	23.2					
SS-2-14	65.0 - 66.5	35.7	26.3				
SS-2-15	70.0 - 71.5	48.3					
SS-2-16	75.0 - 76.5	38.6	40.7				
SS-2-17	80.0 - 81.5	36.1	27.6				
SS-2-18	85.0 - 86.5	42.5					
SS-2-19	90.0 - 91.5	54.6	45.0				
SH-2-20	95.0 - 97.0	N/R					
SS-2-21	97.0 - 98.5	50.4					
SS-2-22	100.0 - 101.5	48.4					
SH-2-23	105.0 - 107.0	N/R					
SS-2-24	110.0 - 111.5	53.5	93.8	84	41	43	MH-OH
SH-2-25	115.0 - 117.0	N/R					
SS-2-26	120.0 - 121.5	58.1					
SH-2-27	125.0 - 127.0	N/R					
SS-2-28	130.0 - 131.5	32.4					
SH-2-29	135.0 - 137.0	38.4					
SS-2-30	140.0 - 141.5	34.7					
SS-2-31	145.0 - 145.3	20.3					

Note: N/R denotes an attempted sample that resulted in no recovery of the sample.

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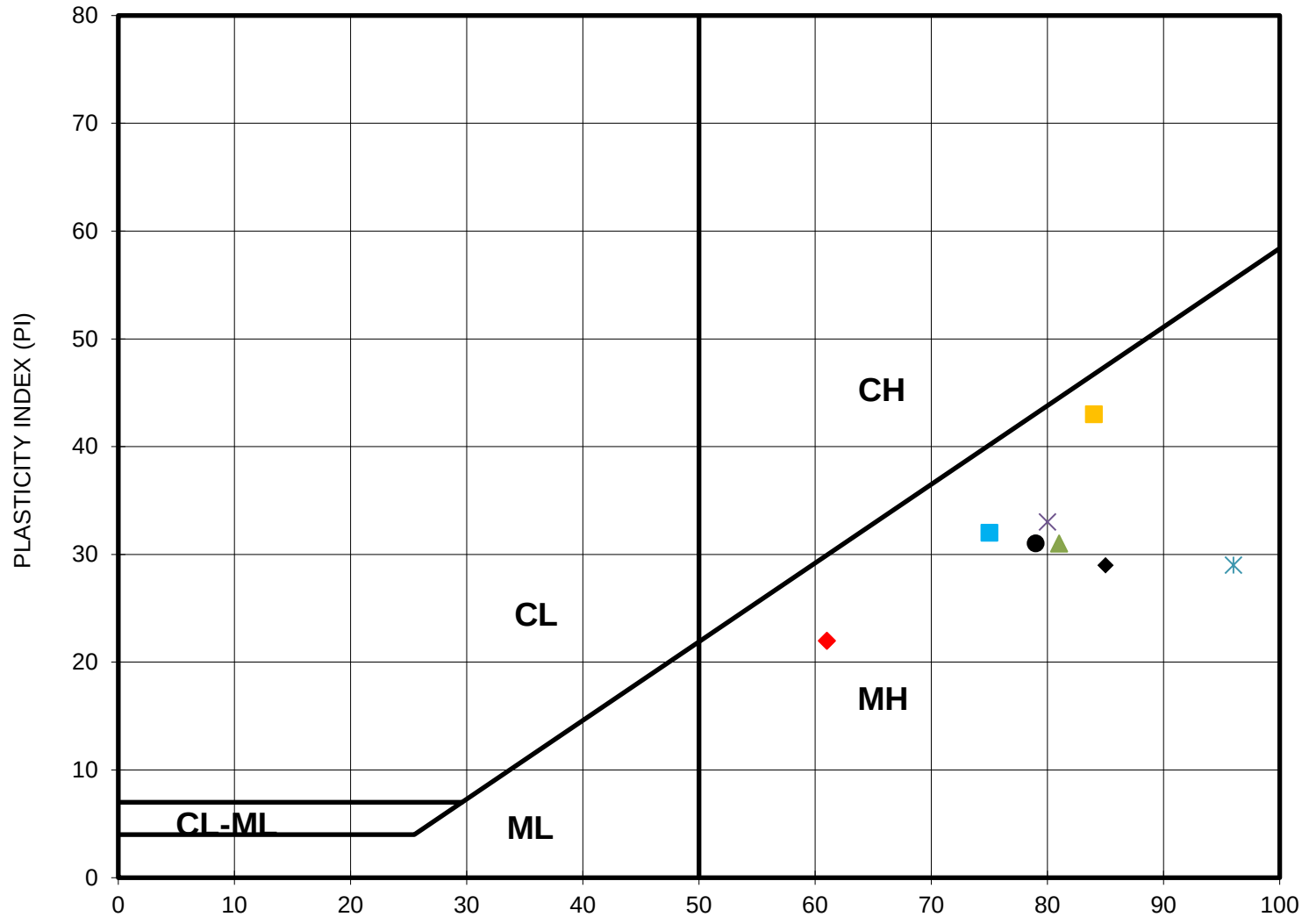
Table 3C. Field Vane Shear Strength Measurements

Sample Number	Test Depth (feet)	Shear Strength (tons/ft^2)
SH-1-10	50	0.40
SH-1-10	52	0.40
SH-1-12	61	0.60
SH-1-15	75	0.26
SH-1-19	96	0.47
SH-2-3	15	0.25
SH-2-3	17	0.23
SH-2-29	135	0.27

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ATTERBERG LIMITS TEST - ASTM D4318

PLASTICITY CHART



	Depth	Material Description	USCS	WC	LL	PL	PI	% Fines
● SS-1-9	45 - 46.5	medium to high plasticity SILT	MH	61	79	48	31	77
◆ SS-1-13	65 - 66.5	medium to high plasticity SILT	MH	68	85	56	29	82
■ SS-1-21	105 - 106.5	medium to high plasticity SILT	MH	60	75	43	32	82
▲ SS-1-25	125 - 126.5	medium to high plasticity SILT	MH	60	81	50	31	91
✕ SS-1-27	135 - 136.5	medium to high plasticity SILT	MH	56	80	47	33	93
✳ SS-2-4	17 - 18.5	medium to high plasticity SILT	MH	82	96	67	29	77
◆ SS-2-6	25 - 26.5	medium to high plasticity SILT	MH	86	61	39	22	94
■ SS-2-24	110 - 111.5	medium to high plasticity SILT	MH	54	84	41	43	94

FOUNDATION ENGINEERING, INC.
Professional Geotechnical Services

820 NW CORNELL AVENUE
CORVALLIS, OR 97330
BUS. (541) 757-7645

Pump St. No. 17 Force Main Replacement
Project 2182034

FIGURE 1C

APPENDIX M: Staheli Trenchless Consultants Memorandum

5405 196th Street SW
Lynnwood, WA 98036
Phone: 425-205-4930
www.StaheliTrenchless.com

To: **Andrew Hall, P.E.**
The Dyer Partnership
1330 Teakwood Avenue
Coos Bay, OR 97420

From: **Kimberlie Staheli, P.E.; Ph.D.**
Jake Andresen, MS
Staheli Trenchless Consultants

Subject: **Trenchless Feasibility Memorandum**
Pump Station No. 17 Force Main Replacement
Coos Bay, Oregon

Date: **June 7, 2018**

1.0 Introduction

The following memorandum is intended to inform pre-design efforts of a 12–inch nominal diameter Sewer Force Main crossing of the Isthmus Sough at the Marshfield Range Channel as a part of Pump Station No. 17 Force Main Replacement in Coos Bay, Oregon. The purpose of the memo is a preliminary evaluation of the feasibility of the force main installation with the trenchless technology of horizontal directional drilling (HDD). STC has been provided with the following information regarding the existing site conditions.

- Boring Log BH-1 and Boring Log BH-2 with Corresponding Boring Location Map
  Date of Boring – April 19, 2018, Transmitted to STC April 24, 2018
  Foundation Engineering, Inc.
- Army Cops of Engineers Bathymetry Data – Isthmus Sough
- As-Built Drawing of FSL Force Main – Drawing Number G10
  Dated November 4, 1989
  Brown and Caldwell
- Foundation Investigation, Facultative Sludge Lagoon, City of Coos Bay, Oregon
  Dated September 18, 1987
  L.R. Squier Associates Inc
- Subsurface Exploration, Pressure Sludge Line Alignment, City of Coos Bay, Oregon
  Dated September 15, 1987
  L.R. Squier Associates Inc.

2.0 Technical Feasibility

2.1 Concept Level Subsurface Geology and Existing Conditions

Based upon the available geotechnical information, the soils on the east and west banks of the Isthmus Slough have soils of similar engineering properties in the upper 30 feet bgs (below ground surface), but vary significantly at depth. The assumed geologic profile on the east bank is based upon the interpretation

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presented in BH-1 from Foundation Engineering Inc. STC has also referenced BH-21 presented in the Subsurface Exploration for a Pressure Sludge Line. The soils include loose to medium dense sand deposits (SP and SM) interbedded with very soft to stiff silt estuarine deposits (ML and OL). Based upon the results of SPT tests performed at 5-foot intervals, a competent layer such as the Coaledo Formation was not encountered. The boring was terminated in a stiff to very stiff silt layer at approximately 160 feet below grade. Historical boring BH-21 indicates a similar interpretation of the surface soils as primarily very soft to soft silt material. The boring indicates a medium dense sand with increased blow counts of 23 and 27 from 68-feet bgs (below ground surface) to the boring termination at 76.5 bgs, which was not encountered at the location of BH-1.

The assumed geologic profile on the west bank is based upon the interpretation presented in BH-2 from Foundation Engineering Inc. BH-22 from the Subsurface Exploration for a Pressure Sludge Line has been referenced. Above 30 feet bgs, the soil material includes very loose sand and very soft silt deposits. The profile transitions to dense sand at 30 feet, alternating between medium dense to dense sand deposits and stiff silt estuarine deposits to a depth of 141 feet bgs. The boring was terminated at 145-feet in very weak sandstone, interpreted as the Coaledo Formation.

2.2 Risk Considerations for HDD

1. Low strength Soils on the East Bank of Isthmus Slough

Low strength soils extend to a depth of up to 160 feet below grade on the east bank of the Isthmus Slough at the location of BH-1. HDD efforts require steering operations in order to construct a curved bore so as to complete the surface to surface installation. The steering action requires material of a certain stiffness which is not evident at this location. Therefore, a bore with entry on the east bank may extend to excessive depth before encountering soils with sufficient stiffness to redirect the drilling bit to the surface, placing the installation at high risk for substantial line and grade deviation. The risk may be mitigated by a bore designed with the entry on the west bank of the Isthmus Slough, a location where the borings indicate competent material at a comparatively shallow depth. A bore designed with vertical curves completed prior to existing the more competent layer at depth has less anticipated risk of losing the design grade. Horizontal curves required to stay within easements should be minimized. If such curves are required, the risk may be mitigated by using a bend radius no less than 3000-feet.

2. *Low Strength Soils on the West bank of Isthmus Slough*

The Coaledo formation is considered competent material for HDD, as is the medium dense to dense sand and stiff silt material encountered below 30 feet at the location of BH-2. The overlying low strength material will provide low resistance to inadvertent returns and have a high collapse potential. A conductor casing is an oversized steel pipe commonly used to bridge soft soils by seating the casing in competent material prior to the HDD bore. A conductor casing installed to an approximate depth of 35 to 40 feet and seated into the dense sand layer may be appropriate to mitigate hydrofracture and collapse risk during the installation effort by isolating the HDD bore from the surrounding formation.

3. Inadvertent Returns

Inadvertent returns refer to a condition wherein drilling fluid escapes from the bore and migrates to the ground surface or slough bed. Inadvertent return risk is associated with low strength soils, sections of the bore near the surface with low confining stress (hydrofracture), and preferential flow paths created by nearby utilities or underground features. Given the interpretation of the geologic profile, risk for inadvertent return is anticipated within the low strength soils at the entry and exit locations with low overburden, and beneath the Isthmus Slough when transitioning out of competent material into the low strength surface material. As discussed above, a conductor casing installed along the alignment at the entry location may be

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appropriate to mitigate inadvertent return risk at this location. As the confining stress decreases over the bore, drilling mud will likely escape to the surface on the east bank prior to completion of the bore. If a sensitive area is present, a relief well may be appropriate to mitigate contamination risk by providing a path of least resistance to direct drilling fluid to a designated containment area. Further drill fluid containment measures may be warranted at the edge of the slough, such as barriers to prevent inadvertent returns near the exit point interfering with the slough. Fluid release risk from the bore beneath the Slough may be controlled by maintaining a sufficient depth of cover between the slough bed and HDD bore and constructing the bore in competent material to the extent possible.

4. Existing Utility Conflicts

STC understands that an existing 6-inch diameter polyethylene pipe crosses the Isthmus Slough, oriented approximately parallel to the proposed new installation, which has not been positively located near the slough crossing location. Sufficient clearance from all existing utilities is important to the success of an HDD installation. Pressurized drilling fluid will migrate along preferential flow paths created by existing underground features such as pipelines and piles, increasing risk of inadvertent return, bore collapse, and drilling advancement. The existing force main should be positively located prior to construction to confirm no conflicts exist with the proposed new installation. Other utilities which must be crossed by the HDD construction should positively located in the field also.

5. Railroad Crossing

The Coos Bay Rail Link is located parallel to N Front Street on the west bank of the Isthmus Slough. The proposed alignment crosses the railroad tracks near the west termination of the HDD bore, where the bore will be at a relatively shallow depth. The risk associated with the crossing is primarily associated with the owner and operator requirements for utilities installed beneath the asset. A common requirement for crossing railroads with an HDD is a steel casing and a minimum clearance beneath the rail features.

3.0 Concept Level HDD Alignment and Vertical Profile

As documented in the risks above, two primary concerns regarding an HDD bore beneath the Isthmus Slough are reaching competent soils at depth to facilitate steering and to avoid disturbance to the Railroad and Slough. Assuming a drill rig positioning on the west bank of the Slough, the drill rig placement should be placed sufficiently far from the rail tracks and edge of the Slough to achieve the requisite depth. Refer to Figure 1 for the proposed drill rig positioning. With regard to the HDD bore vertical profile, an entry angle of up to 15-degrees may be appropriate to achieve depth at a greater rate to minimize the drilling length in low strength soils, with the target being the Coaledo Formation. A bend radius on the order of 1200-feet within the competent material may be appropriate to steer the bore to the surface prior to entering the soft soil formation where the presence of competent material has not been confirmed beneath the east bank of the Slough. A concept level vertical profile is provided below in Figure 2.

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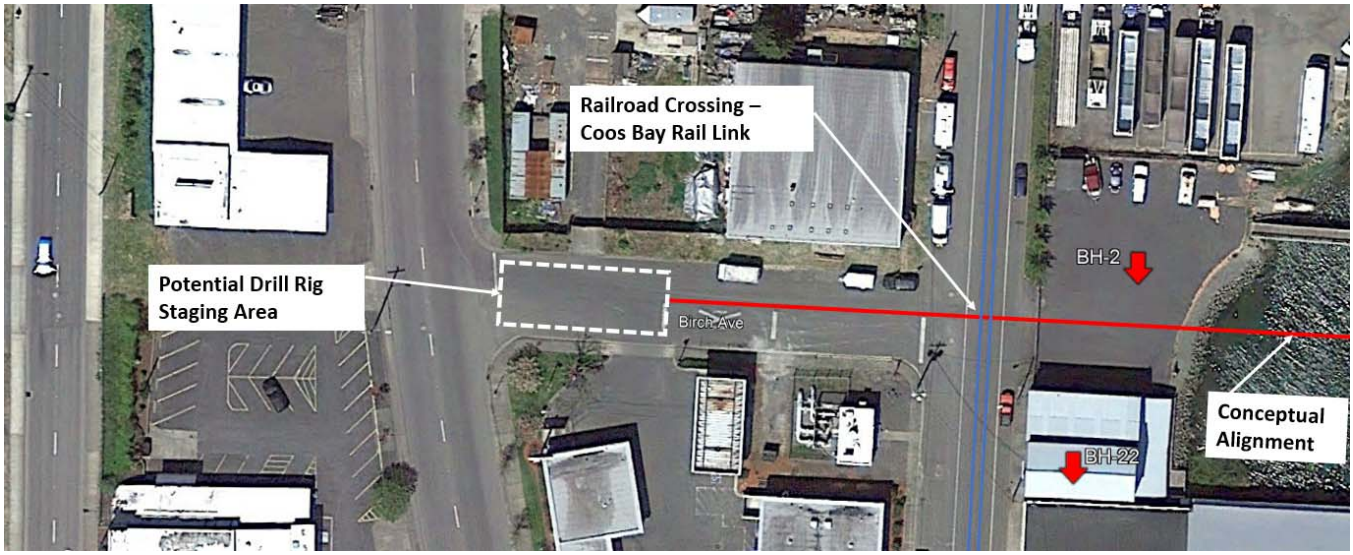


Figure 1 Proposed Drill Rig Staging

4.0 Conclusions

An HDD installation of a 12-inch nominal diameter force main crossing the Isthmus Slough is considered technically feasible, based upon the available geotechnical information. Appropriate drill rig positioning and setback from existing features and the Slough will be key elements for the success of the bore. Proper risk management concerning the low strength material in the upper soil layers including consideration for drilling fluid inadvertent returns at high risk sections of the bore. Any future site investigation and design should include positive location of the existing 6-inch force main and confirmation of the requirements for boring beneath the existing railroad track on the west bank. Please refer to Figure 2 for a preliminary vertical profile and geologic cross section as provided by Dyer. In addition to the conclusions presented above regarding the proposed installation, the following design criteria have been identified and incorporated into the concept level HDD vertical profile presented in Figure 2

- Based upon the constraints outlined in this report and the interpretation of the geologic information, drill rig positioning on the west bank of the Isthmus Slough will likely have a lower risk of losing the design line and grade when advancing an HDD crossing.

- Soils encountered during the field investigation exhibit both favorable and unfavorable engineering properties with respect to the steering capability of HDD equipment. Vertical curves necessary to construct the bore should be designed in the zone of soils anticipated to display greater strength and density. Horizontal curves should be minimized and constructed with a relatively large bend radius on the order of 3000-feet to control the risk of deviations from the design alignment.

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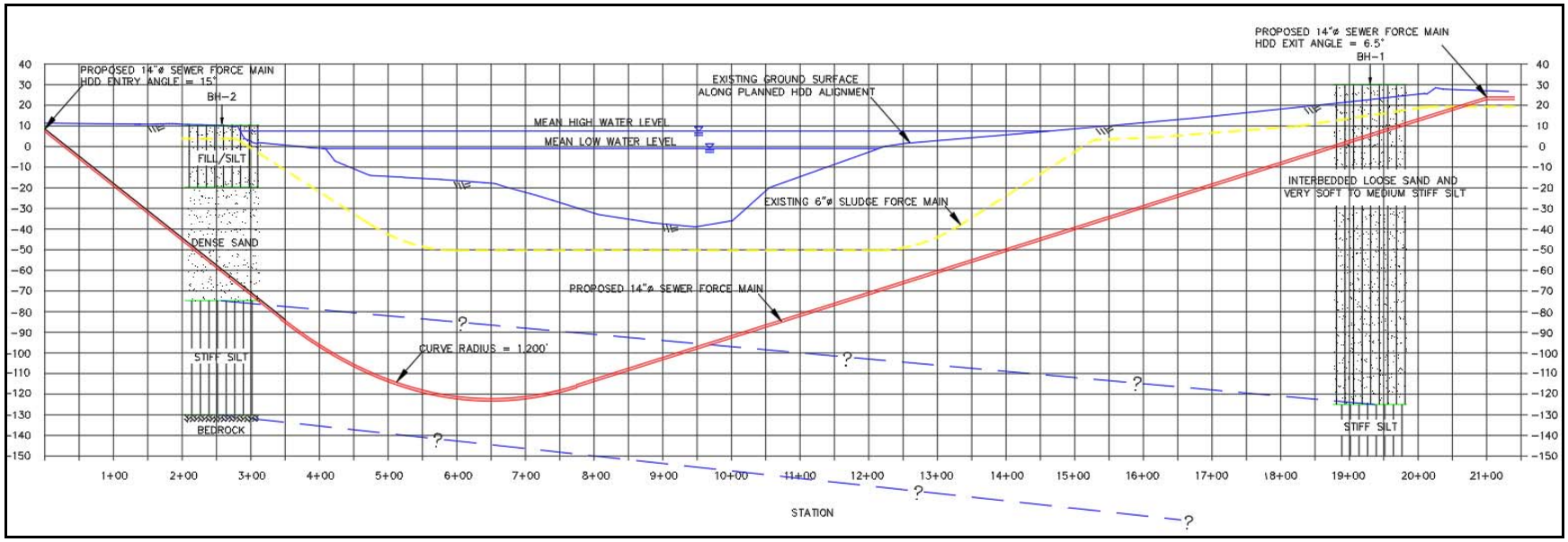


Figure 2 Preliminary HDD Profile

APPENDIX N: PSU Population Forecast Report

Forecasts for Total Population

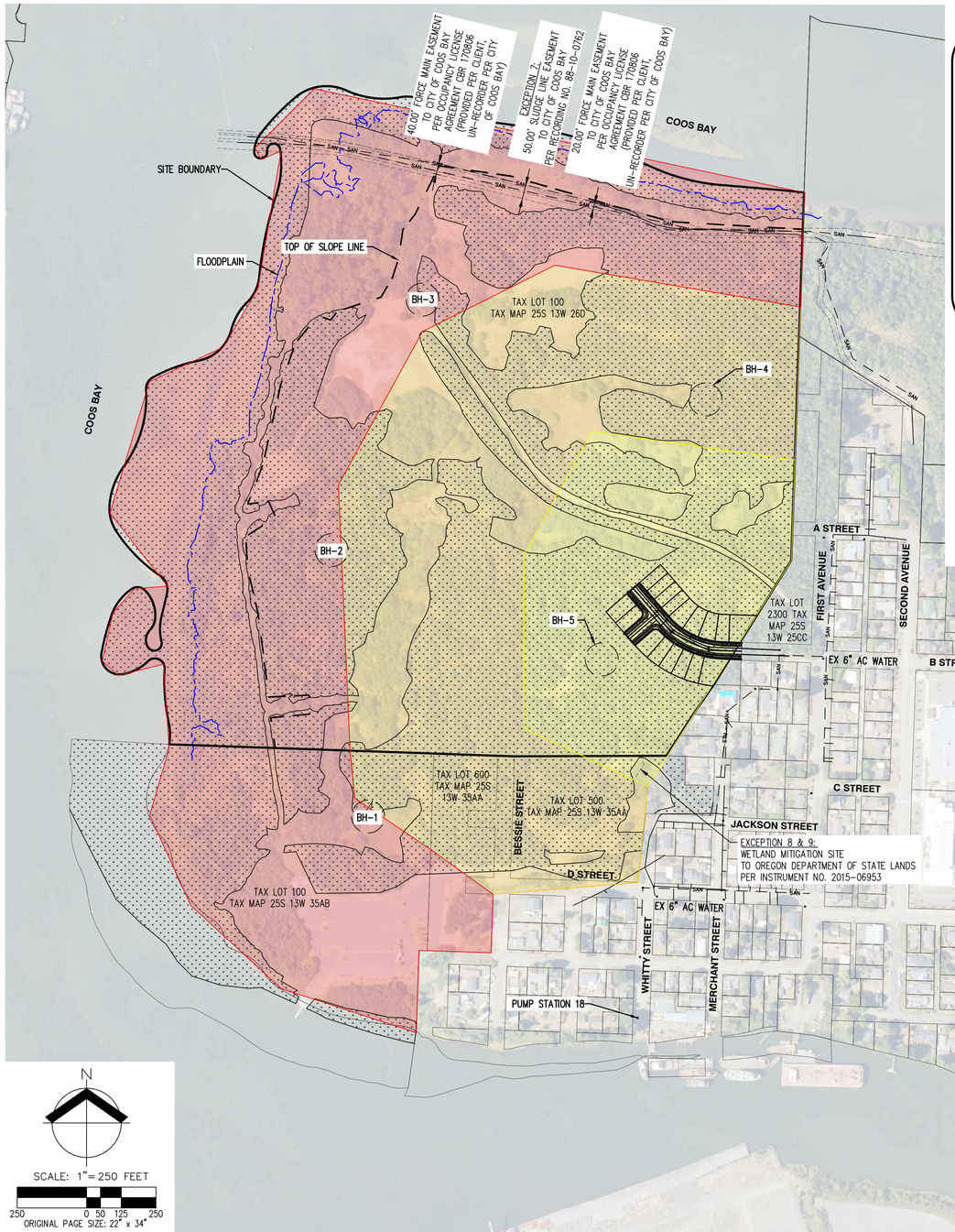
Area / Year	2018	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2068
Coos County	63,471	63,795	63,895	63,855	63,552	63,066	62,536	62,011	61,490	60,974	60,462	60,157
Bandon UGB	3,422	3,462	3,609	3,733	3,816	3,897	3,959	4,050	4,173	4,240	4,280	4,319
CoosBay UGB	16,824	17,057	17,543	17,874	18,117	18,301	18,451	18,676	18,994	19,145	19,214	19,300
Coquille UGB	3,950	3,918	3,932	3,961	3,989	4,016	4,041	4,050	4,069	4,070	4,061	4,061
Lakeside UGB	1,696	1,747	1,868	2,004	2,143	2,288	2,436	2,573	2,747	2,852	2,923	2,984
MyrtlePoint UGB	2,575	2,574	2,609	2,631	2,674	2,717	2,745	2,770	2,807	2,822	2,828	2,836
NorthBend UGB	9,919	9,979	10,095	10,148	10,152	10,126	10,095	10,079	10,079	10,050	10,007	9,989
Powers UGB	707	710	719	726	732	738	743	747	754	756	755	756
Outside UGB Area	24,378	24,348	23,521	22,778	21,929	20,984	20,065	19,065	17,867	17,039	16,393	15,912

Final Population Forecasts prepared by: Population Research Center, Portland State University, June 30th, 2018.
Final forecasts represent populations as of July 1 of each year

Year	Population	Growth Rate
2018	16,824	-
2020	17,057	0.69%
2025	17,543	0.57%
2030	17,874	0.38%
2035	18,117	0.27%
2038	18,227	0.20%

Coos Bay UGB Projected Growth Rate (2018-2038)	0.40%

Appendix D: Full Development Residential Buildout Exhibit



LEGEND

- SITE BOUNDARY
- WETLAND
- ZONE 1 LATERAL SPREAD HAZARD
- ZONE 2 LATERAL SPREAD HAZARD
- ZONE 3 LATERAL SPREAD HAZARD
- BOREHOLE LOCATION

NOTES:

1. THIS MAP IS BASED ON RESEARCHED DOCUMENTS, NO FIELD WORK WAS CONDUCTED. MAP TO BE USED FOR PLANNING PURPOSES ONLY. BOUNDARIES SHOWN ARE BASED ON COUNTY GIS TAX LOT INFORMATION AND ARE CONSIDERED APPROXIMATE. LIMITED SURVEY RECORDS WITHIN THE AREA.
2. FLOODPLAIN BOUNDARY IS PER GRAPHICAL OVERLAY OF FEMA MAP NUMBER 41011C032E WITH AN EFFECTIVE DATE OF MARCH 17, 2014.
3. EASEMENTS SHOWN ARE BASED ON A REVIEW OF TICOR TITLE COMPANY OF OREGON ORDER NUMBER: 360626048176 WITH A EFFECTIVE DATE OF: MARCH 2, 2026:
4. EXCEPTIONS NOT MAPPED; EXCEPTIONS 5 AND 6 BASED ON EXISTING CONDITIONS PLAN.

RESIDENTIAL LOT BREAKDOWN:

NUMBER OF LOTS = 17

TOTAL DEVELOPED AREA = 2.7 ACRES

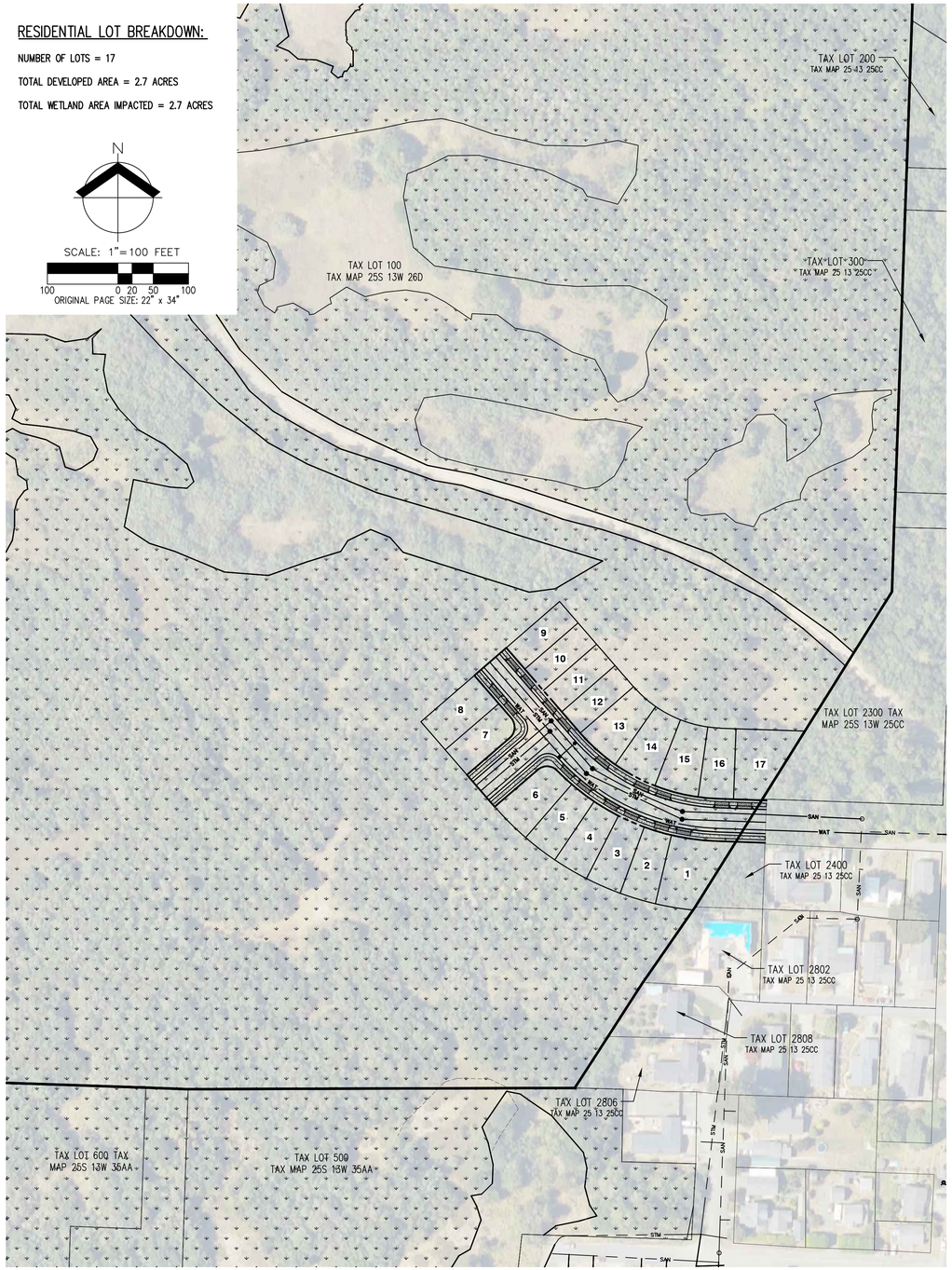
TOTAL WETLAND AREA IMPACTED = 2.7 ACRES

N

SCALE: 1"=100 FEET

100 0 20 50 100

ORIGINAL PAGE SIZE: 22" x 34"



DATE: 04/10/2026 AKS JOB: 12975

AKS ENGINEERING & FORESTRY, LLC
3700 RIVER RD N, STE 1
KEIZER, OR 97303
503.400.6028
WWW.AKS-ENG.COM

ENGINEERING · SURVEYING · NATURAL RESOURCES
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FULL DEVELOPMENT RESIDENTIAL BUILDOUT

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

CITY OF COOS BAY
COOS BAY, OR

Appendix E: Market Analysis

JOHNSON
ECONOMICS



MARKET ANALYSIS FOR THE EASTSIDE HOUSING AND INFRASTRUCTURE FEASIBILITY STUDY IN COOS BAY, OREGON

PREPARED FOR
AKS ENGINEERING & FORESTRY, LLC
APRIL 2026

JOHNSON ECONOMICS, LLC
621 SW Alder St, Suite 506
Portland, Oregon 97205

I. Introduction

Johnson Economics was retained to evaluate the feasibility of housing and infrastructure development on a site (identified as "Eastside") in Coos Bay. This analysis evaluates the market viability of different types of residential and commercial development—up to 500 housing units plus neighborhood commercial space—depending on the total area of buildable land. It considers the types, scales, and value ranges of residential and commercial development the market can reasonably support, as well as evaluates potential public funding sources and strategies.

II. Subject Site

The site for the Eastside project is roughly 120 acres in size, across the bay from the downtown area, on the southeast side of Coos Bay. Currently, only neighborhood roads provide access to the site. The surrounding parcels are primarily single-family homes, with an elementary school and a middle school to the southeast.

Figure 2.1: The Subject Site

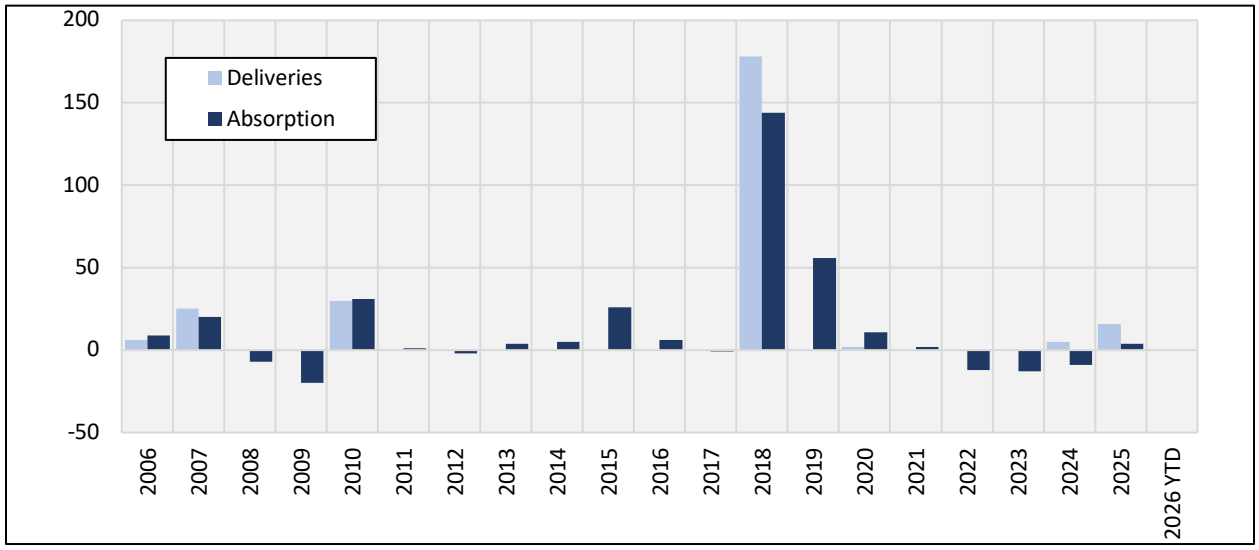


SOURCE: City of Coos Bay

III. Rental Apartment Market Analysis

Rental apartment construction has been quite limited in Coos County in recent years. Since 2006, about 290 units have been delivered (newly constructed) in the county, and 280 have been absorbed (leased by tenants), in net terms. In Coos Bay, deliveries were limited to seven units in 2007 and 16 in 2025. The largest new multifamily project in the county, completed in 2018, was a 178-space mobile home park. 81% of these spaces were absorbed the same year, and the rest the year after. Since 2022, net absorption has been negative, which could indicate a decrease in demand for rental apartments or another change in housing demand, such as a preference for newer or for-sale housing.

Rental Apartment Deliveries and Absorption, Coos County, 2006-2026 YTD

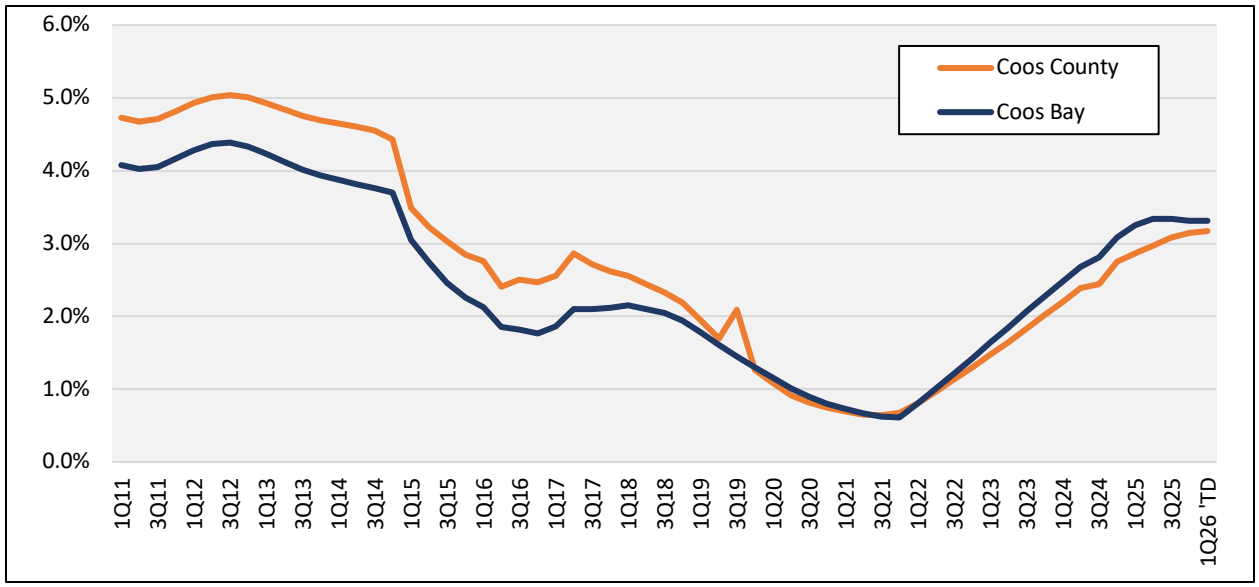


SOURCE: CoStar, Johnson Economics

Though vacancy rates in Coos County and Coos Bay have fluctuated over the last 15 years, they have stayed below the 5% threshold that typically indicates a balanced market in terms of supply and demand. Vacancy in Coos Bay has been historically lower than countywide vacancy, although the city's rates have surpassed the county's in more recent years. The highest vacancy rates occurred in the several years following the 2008 recession, and then rates continued to decrease to a low of 0.6% in the city and 0.7% in the county in late 2021. Vacancy has increased steadily since 2021 and has leveled off slightly; current rates are 3.3% in the city and 3.2% in the county as of early 2026.

Typically, low vacancy rates such as those seen in Coos Bay indicate higher demand for housing than there is supply available. Limited construction in recent years, as observed above, is likely contributing to this issue.

RENTAL APARTMENT VACANCY RATES, COOS COUNTY AND COOS BAY, 2011-2026 YTD

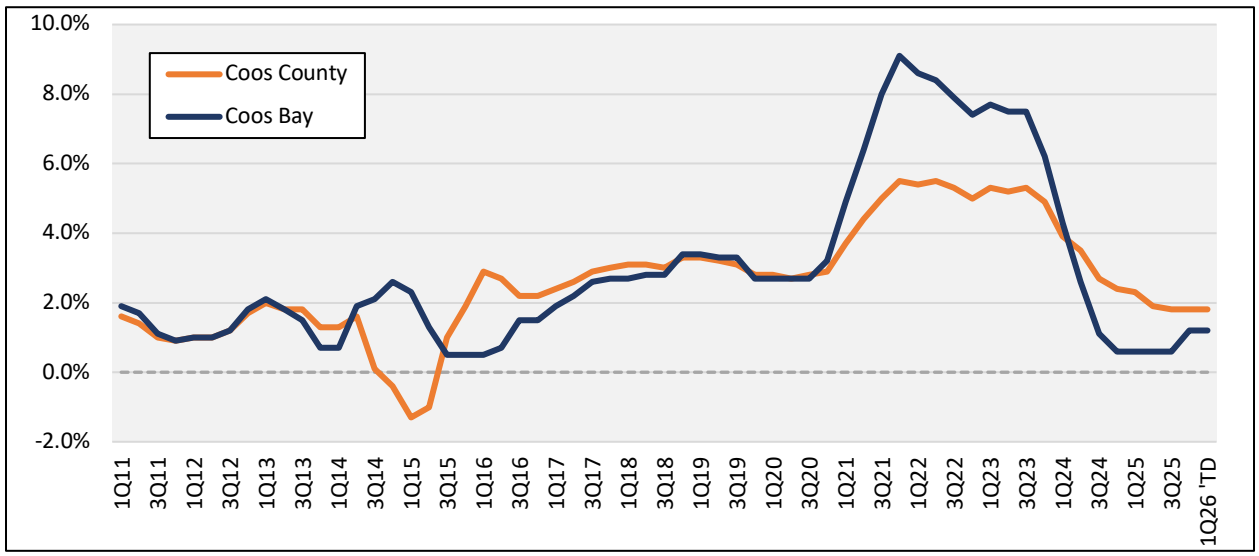


SOURCE: CoStar, JOHNSON ECONOMICS

Both Coos County and Coos Bay have experienced steady, positive rent growth in recent years. The city saw its highest rent growth, 9.1%, in late 2021, and this period of strong growth continued through late 2023. By the end of 2024, rent growth in Coos Bay dropped below 1%, and is currently at 1.2% as of early 2026 (first chart below). Current lease rates per square foot (second chart below) are $1.28 in Coos County and $1.27 in Coos Bay.

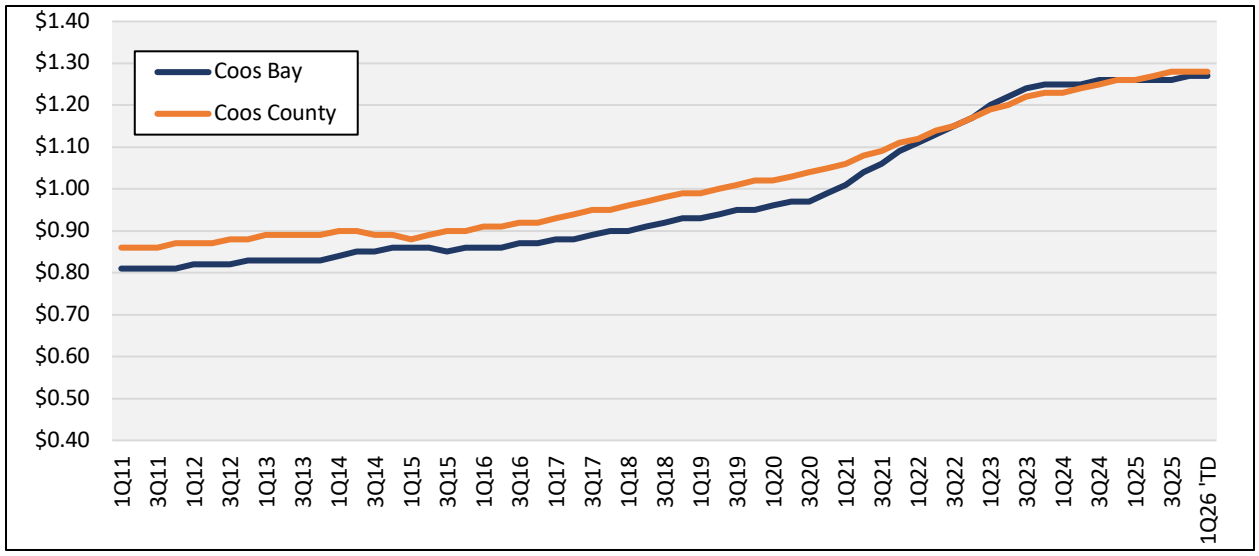
The combination of no new construction, very low vacancy, and high rent growth from 2021 to 2023 suggests that Coos Bay is housing constrained in the rental market; the housing supply cannot adequately meet current demand.

RENTAL APARTMENT RENT GROWTH, YEAR-OVER-YEAR, COOS COUNTY AND COOS BAY, 2011-2026 YTD



SOURCE: CoStar, JOHNSON ECONOMICS

RENTAL APARTMENT LEASE RATES PER SQUARE FOOT, COOS COUNTY AND COOS BAY, 2006-2026 YTD



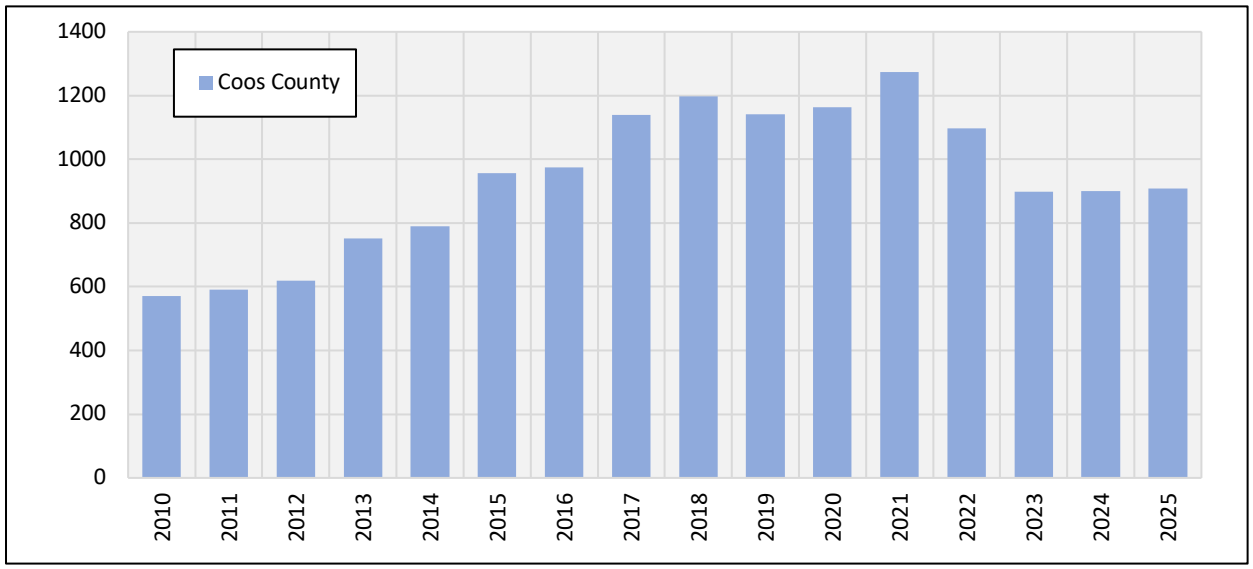
SOURCE: CoStar, JOHNSON ECONOMICS

IV. For-Sale Housing Market Analysis

All Homes

Home sales in Coos County averaged around 1,100 transactions per year over the 2016-22 period – roughly double the number of units in the early 2010s. The transaction volume has fallen to around 900 units annually over the past three years, reflecting the impact of higher mortgage rates. City level data is not available.

Coos County Total Home Sales (2010-2025)

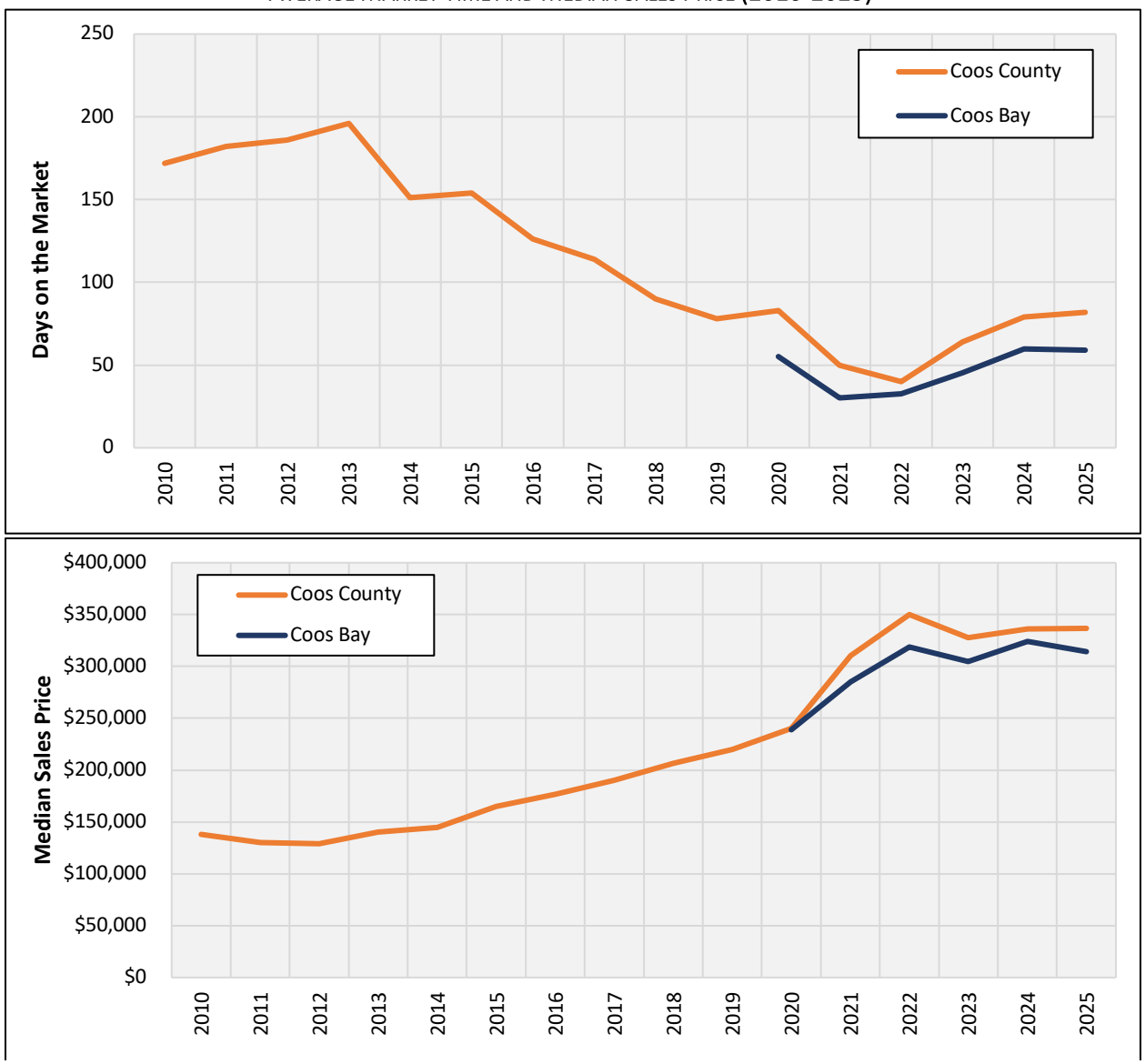


SOURCE: RMLS, Johnson Economics

While the sales pace has fallen over the last few years, the average market time for listed units has remained relatively stable, after declining over the past decade. As of year-end 2025, the average market time in Coos County was 82 days, compared to the high of 196 in 2013. Data is only available for the last five years for Coos Bay, but on average, the market time for listed units in the city is 20 days shorter than in the county. As of year-end 2025, the average market time in Coos Bay was 59 days. Generally, 90 to 120 days is considered a healthy market, with a good supply-demand balance and moderate price growth; by this metric, Coos County and Coos Bay appear to experience higher demand than supply.

The reduction in available supply relative to demand generated moderately strong price gains in Coos County over the second half of the last decade, followed by stronger growth during the COVID pandemic in 2021-22. Prices have leveled off since then and are currently close to where they would have been if the pre-COVID price trend had continued through the pandemic. The average annual price increase in the county has been 7.7% per year over the past five years and 1.4% per year over the past two years, after a year of negative growth in 2023. In Coos Bay, the price gains have been similar: 6.0% per year over the past five years, and 1.6% per year over the past two years. As of late 2025, the median home price year-to-date is $337,000 in Coos County, compared to $314,000 in Coos Bay.

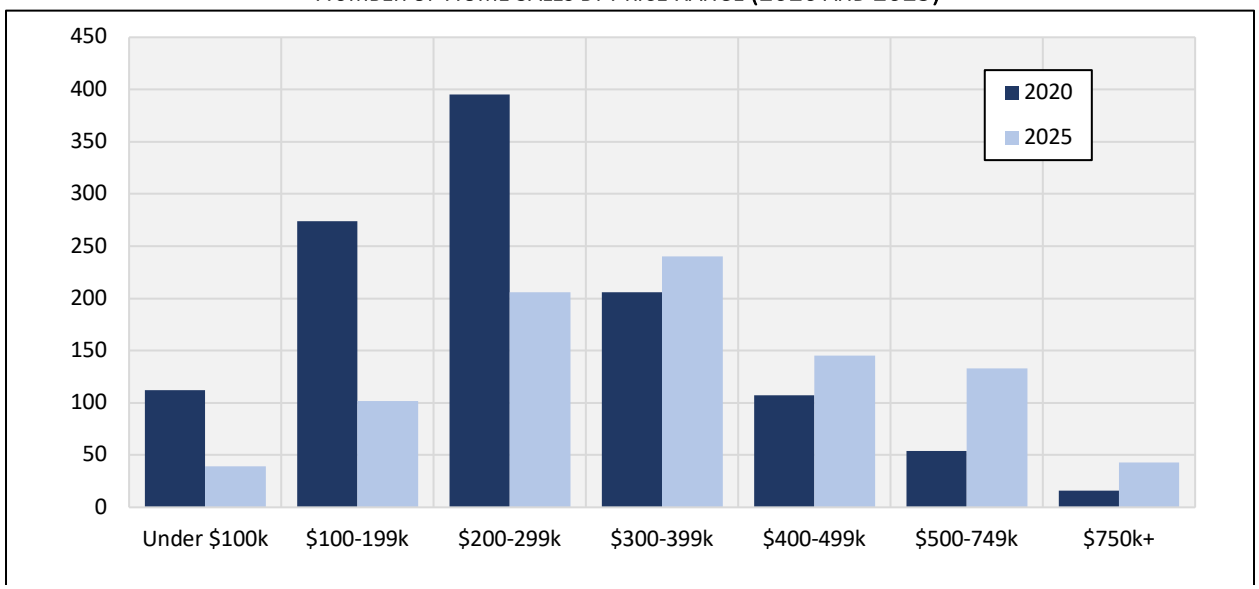
AVERAGE MARKET TIME AND MEDIAN SALES PRICE (2010-2025)



SOURCE: RMLS, JOHNSON ECONOMICS

In 2020, Coos County saw the highest number of home sales in the $200,000-$299,000 range, and about the same number of sales both above $299,000 and below $200,000. In 2025, home sales had shifted to higher price ranges. This is partly reflective of nationwide inflation but also represents real increases in home prices. The number of homes sold at $300,000 and above increased, and the number of homes sold below that level decreased significantly. In addition, the number of homes sold above $500,000 almost tripled over the 5-year period. The median home price in Coos County was $337,000 in 2025, compared to $240,000 in 2020. This represents a total increase of 40%, or about 7% per year.

NUMBER OF HOME SALES BY PRICE RANGE (2020 AND 2025)



SOURCE: RMLS, JOHNSON ECONOMICS

TRENDS BY HOUSING TYPE

Detached homes are defined as single-family, for-sale homes on individual lots for this analysis. Attached homes include townhomes and duplexes, where two or more for-sale homes are on one lot. Neither of these categories include condominiums, manufactured homes, or mobile homes. Data is only available from 2020 through 2025.

The charts below illustrate the total home sales volume in Coos County, where the Coos Bay portion is shown as a section of the Coos County whole. Detached homes make up a significantly larger portion of the market than attached homes do, both in the county and city. Coos County has averaged 760 detached home sales and 65 attached homes sales per year over the last five years. Sales in Coos Bay make up about 40% of sales in Coos County, both for detached and attached single-family homes: Coos Bay has averaged 300 detached home sales and 26 attached per year since 2020.

The five-year trend for detached homes follows the overall home sales trend, while the trend for attached homes is slightly different. Attached homes did not see the same drop in sales from 2022 to 2023 that detached homes and overall home sales did; there have been slight decreases, but 2022 and 2024 attached home sales were about the same. This could point to an increase in demand for attached homes in Coos County and Coos Bay. The chart below shows the total number of sales in Coos County (light blue), overlaid with the portion of these that are in Coos Bay (dark blue).

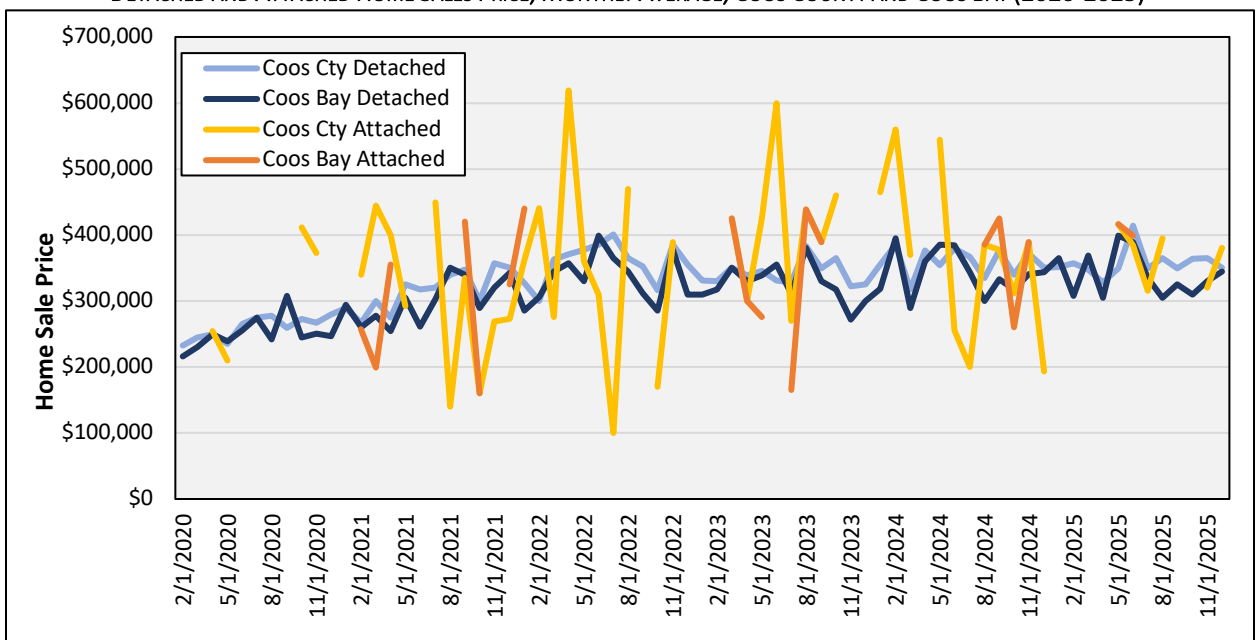
DETACHED AND ATTACHED HOME SALES VOLUME, COOS COUNTY AND COOS BAY (2020-2025)



SOURCE: RMLS, JOHNSON ECONOMICS

Overall, the five-year home price trends for both detached and attached homes appear to follow the wider market trend. There is more variation in attached home sale prices, but this is because far fewer units of this type are sold in the subject markets, so any one sale of an attached home has a high impact on the monthly average. The yearly average in 2025 ranged from $340,000 in Coos Bay to $357,000 in Coos County for detached homes, and $368,000 in Coos County to $398,000 in Coos Bay for attached homes.

DETACHED AND ATTACHED HOME SALES PRICE, MONTHLY AVERAGE, COOS COUNTY AND COOS BAY (2020-2025)

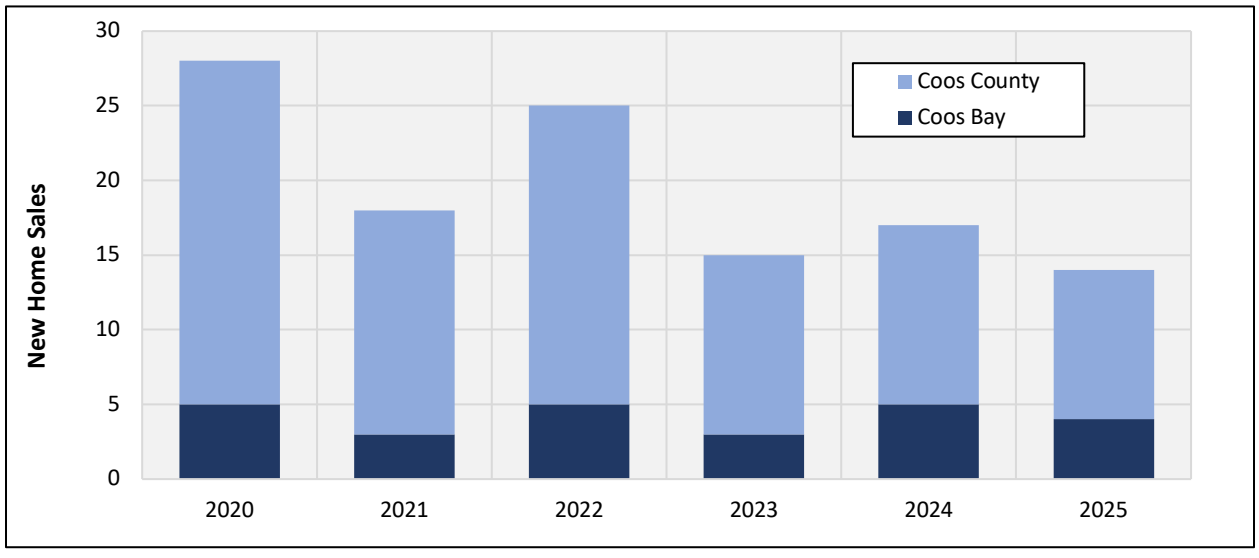


SOURCE: RMLS, JOHNSON ECONOMICS

NEW HOMES

RMLS only tracks new home sales over the most recent 72-month period, so new homes sales trends begin in 2020. In both Coos County and Coos Bay, there have been far fewer sales of new homes than existing homes due to a lack of new supply. In 2020, 1,164 total homes were sold in Coos County; only 28 of these (2.4%) were new homes. In 2025, 908 new homes were sold, and only 14 of these (1.5%) were new. Since 2020, only about 5 new homes have been sold per year in Coos Bay, which is only 1.5% of the city's average total home sales of 330 per year. The chart below shows the total number of new home sales in Coos County (light blue), overlaid with the portion of these that are in Coos Bay (dark blue).

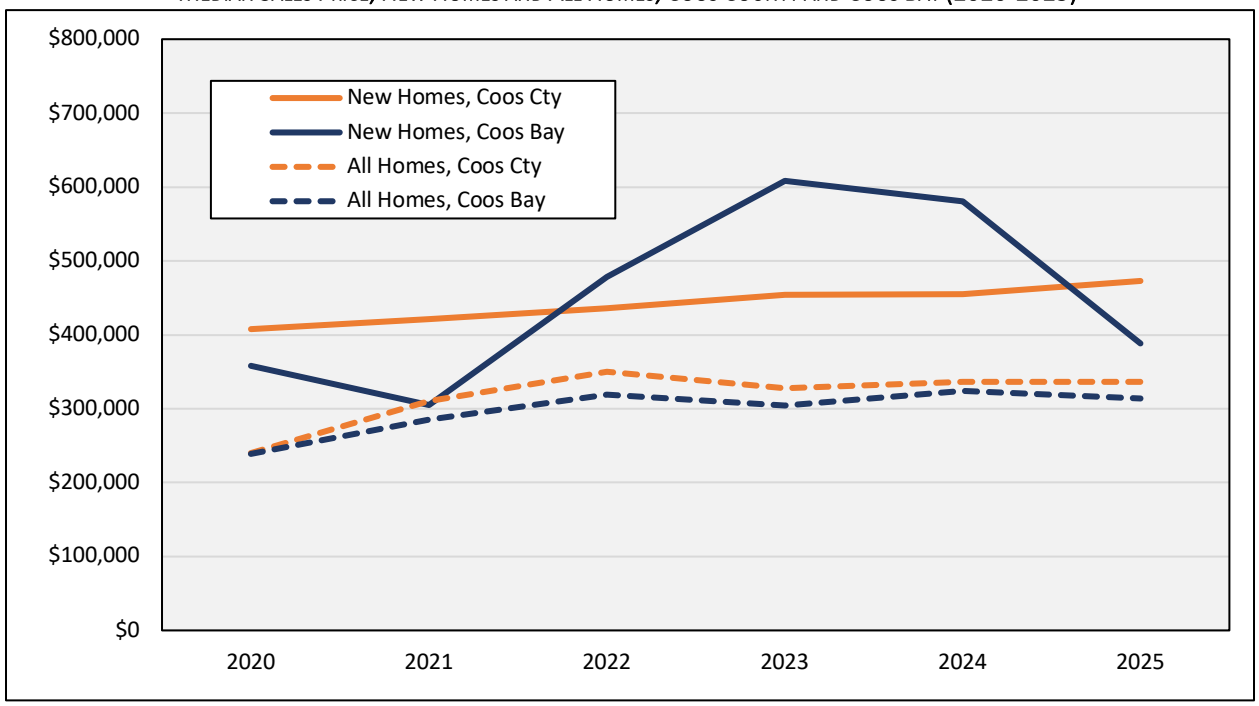
NEW HOME SALES, COOS COUNTY AND COOS BAY (2020-25)



SOURCE: RMLS, JOHNSON ECONOMICS

As noted in other charts above, Coos Bay experiences greater variation than Coos County due to its smaller market size, as illustrated in the median sales price chart below. Over the last 6 years, the median sales price of new homes in Coos County has been about 40.7%, or $124,000, higher than the median sales price of all homes. In Coos Bay, new homes have averaged prices 51.5%, or $155,000, higher than the average of all homes.

MEDIAN SALES PRICE, NEW HOMES AND ALL HOMES, COOS COUNTY AND COOS BAY (2020-2025)

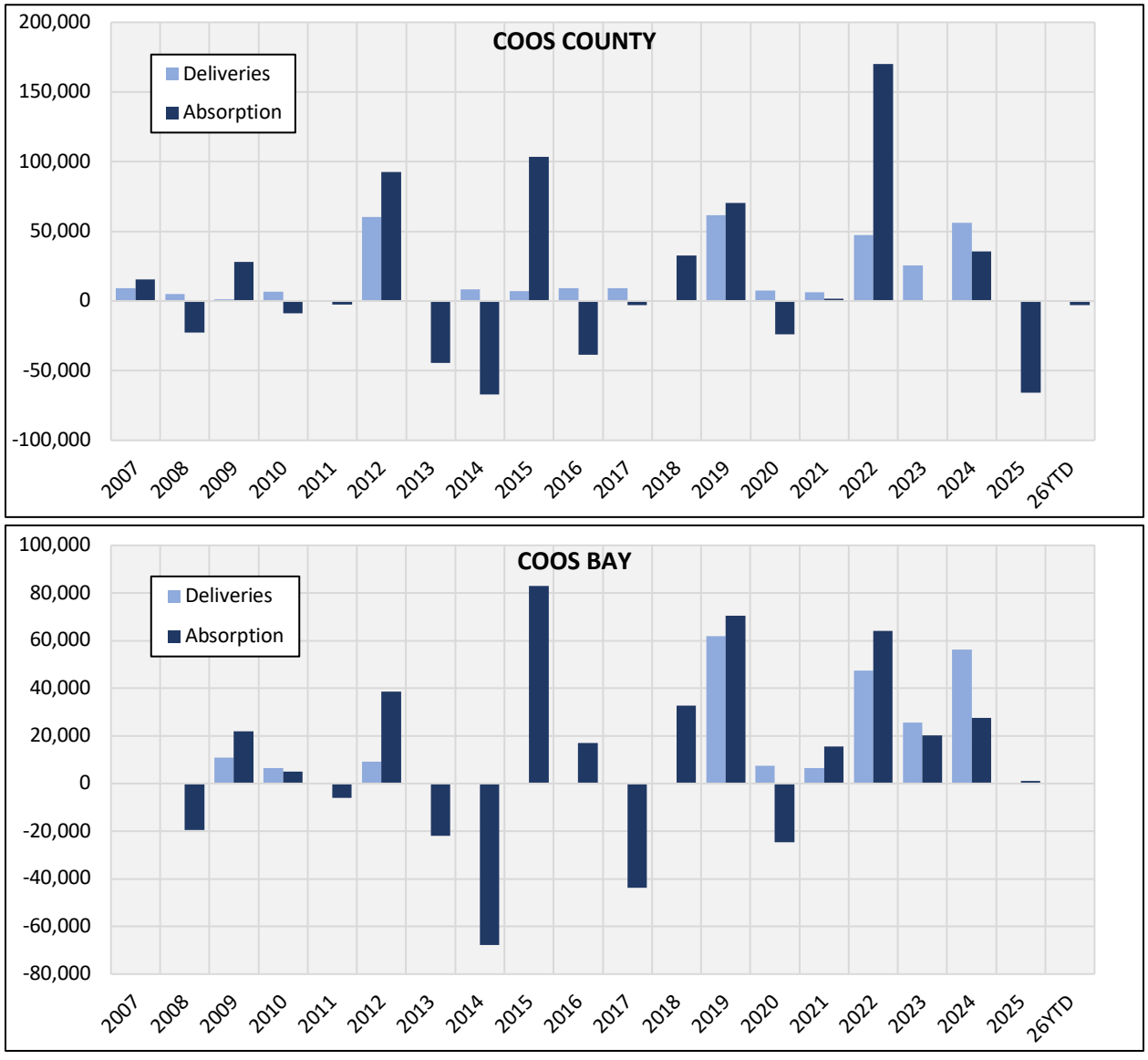


SOURCE: RMLS, JOHNSON ECONOMICS

V. COMMERCIAL MARKET ANALYSIS

For this analysis, the commercial market is defined as the market for retail and office space. Coos Bay and Coos County have seen limited commercial development in recent years; most new construction has been in large shopping centers within the City of Coos Bay. Over the last decade, 223,000 square feet of commercial space has been delivered in Coos County, with 205,000 SF of that in Coos Bay. In the same period, 175,000 SF of commercial space was absorbed in the county, compared to 180,000 SF in Coos Bay. Coos County saw 66,000 SF of negative absorption, or vacancy, in 2025; this and high absorption in 2022 account for that difference. In terms of the last few years, the deliveries from 2022-2023 were in Coos Bay Village, an 84,000-square-foot retail center along Highway 101 in Coos Bay. All spaces in this development have been absorbed. The delivery in 2024 was Teakwood Plaza, a three-building, 56,000 SF shopping center also along Hwy 101, about a mile north of Coos Bay Village. Some of this has been absorbed as well, though there is still some vacancy.

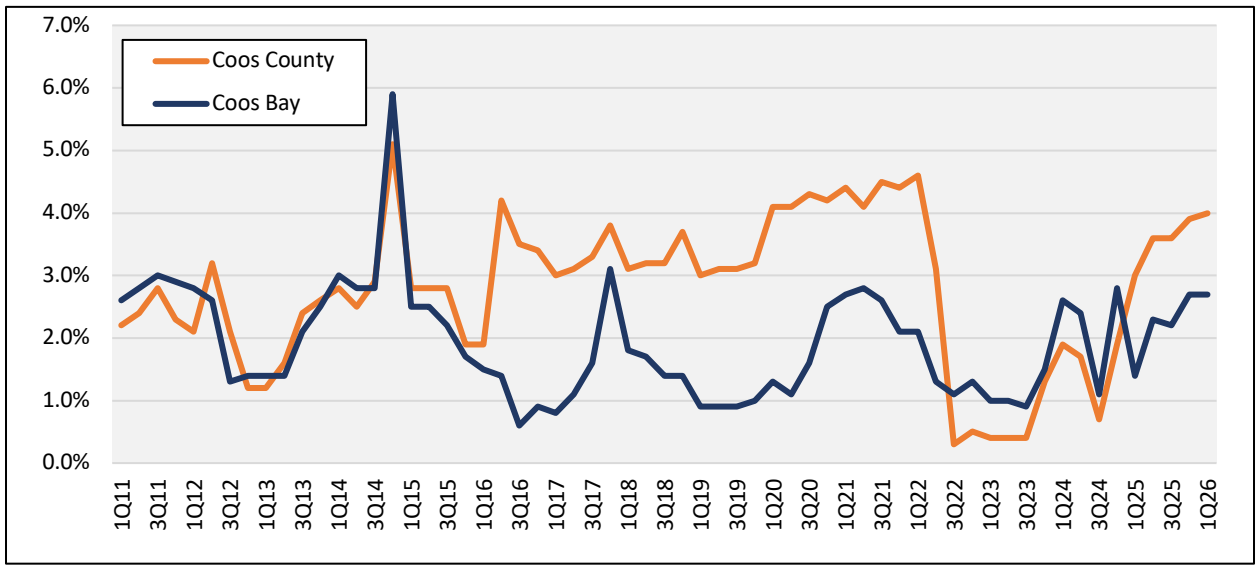
COMMERCIAL DELIVERIES AND ABSORPTION, COOS COUNTY AND COOS BAY (2007-2026)



SOURCE: CoStar, JOHNSON ECONOMICS

Vacancy rates have trended well below the 5% level that typically represents a balanced market, especially within the City of Coos Bay. Since 2015, vacancy rates within the city have fluctuated between 1% and 3%. Coos County has seen slightly higher vacancy rates, between 3% and 5%, until 2022, when the vacancy rate dropped below 1%. Currently, vacancy rates are 4.0% in Coos County and 2.7% in Coos Bay.

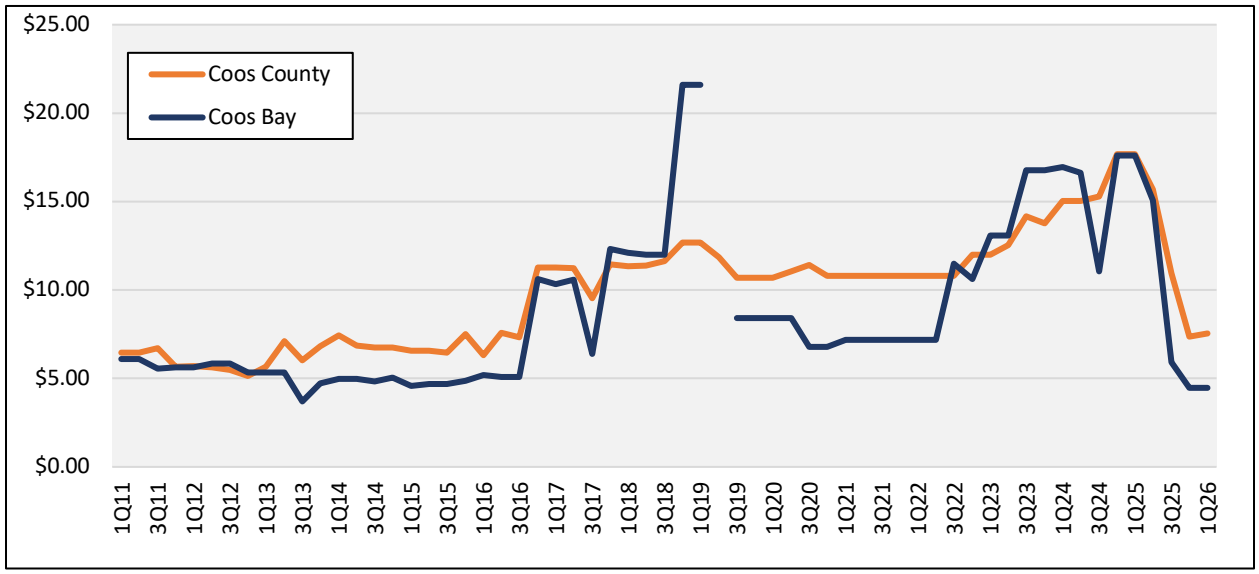
COMMERCIAL VACANCY, COOS COUNTY AND COOS BAY (2011-2026)



SOURCE: CoStar, JOHNSON ECONOMICS

Commercial lease rates in Coos County and Coos Bay have been on an upward trend, with a few periods of stagnant growth and a few periods of rapid growth. Lease rates increased 68% from early 2016 to late 2018 in Coos County, and after a period of flat growth, increased again, this time by 64% from late 2022 to late 2024. Since then, lease rates have dropped sharply—by 57%—over the last year in Coos County. Coos Bay has largely followed this trend as well, though with greater variability.

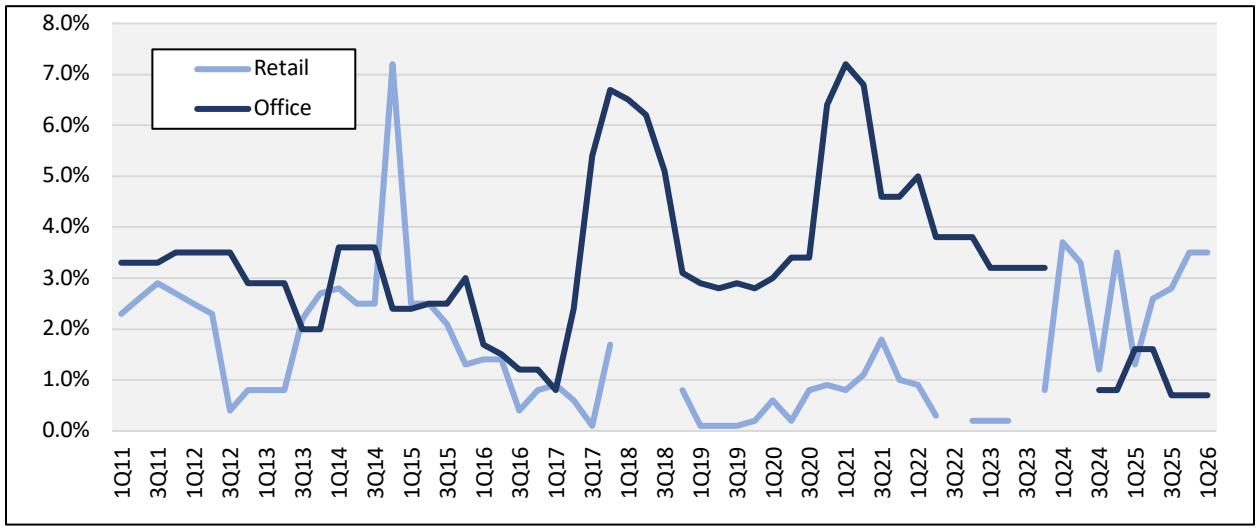
COMMERCIAL LEASE RATES PER SQUARE FOOT, COOS COUNTY AND COOS BAY (2011-2026)



SOURCE: CoStar, JOHNSON ECONOMICS

Office vacancy rates were particularly high from 2017-2022, reaching a high of 7.2% in early 2021 during the COVID pandemic. However, retail vacancy over this period was particularly low, staying below 2% through late 2023. After the new retail construction in the city from 2022-2024, Coos Bay experienced some fluctuation in vacancy rates, though the rate stayed below the 5% threshold. As of early 2026, retail vacancy is 3.5% in Coos Bay and office vacancy is 0.7%.

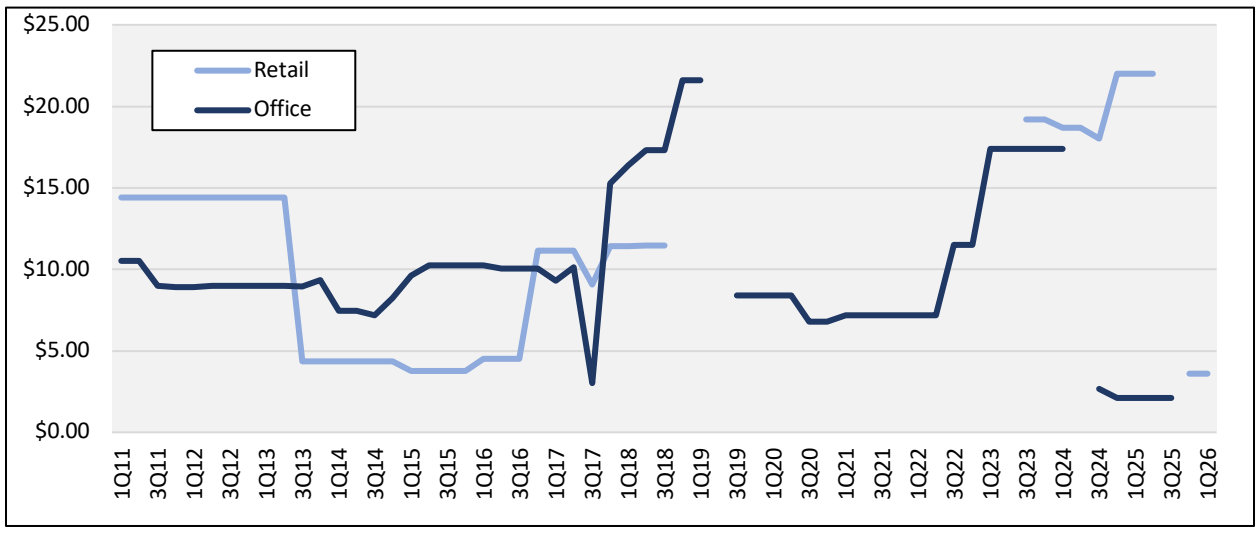
RETAIL AND OFFICE VACANCY, COOS BAY (2011-2026)



SOURCE: CoStar, JOHNSON ECONOMICS

CoStar is missing much of the time series data for retail and office lease rates in Coos Bay. From the limited data available, it appears that both retail and office lease rates rose from around 2019 through 2024; office lease rates increased by over 100% over this period, reaching a high of $17.40 per square foot in late 2024. Retail lease rates reached their peak of $22.00 per square foot in late 2025. As of early 2026, both office and retail rates have dropped under $5.00 PSF, though this is likely attributable to large variability from the small market size in Coos Bay, and does not accurately reflect the market.

RETAIL AND OFFICE LEASE RATES, COOS BAY (2011-2026)



SOURCE: CoStar, JOHNSON ECONOMICS

VI. Residential and Commercial Potential at Eastside

Residential Potential

The rental apartment market in Coos Bay appears undersupplied, given the city's low vacancy rates, lack of new construction, and strong rent growth in recent years. In Coos Bay, the current average lease rate is $1.27 PSF, according to CoStar, and the average unit size in Coos Bay is 830 square feet. We would expect new units to garner 50-60% premiums to the city's average lease rate, depending on unit size, project format, and neighborhood amenities. Existing rental apartment units in Coos Bay are mostly duplexes/townhomes or small, low-rise apartment complexes. For the Eastside site, we would recommend similar low-rise formats, such as walk-up or garden apartments, and some rental townhomes. A mid-rise project or two may be feasible with ground floor, neighborhood-serving commercial space, such as a small grocery store, café, or office space for professional services.

The for-sale residential market also appears undersupplied. This is primarily evidenced by the city's short market time, though steadily increasing home prices and low sales of new homes contribute. Based on current sales trends, we would recommend that detached single-family homes make up about 70-80% of for-sale housing at Eastside, with the remaining 20-30% as attached homes such as duplexes or townhomes. Achievable pricing for these would be in line with recent sales of new homes in Coos Bay, depending on specific square footage and neighborhood amenities.

Commercial Potential

In the area around the Eastside side, across the bay from Downtown Coos Bay and north of the Bunker Hill Eastside Bridge, there is one small grocery store and two small cafes/restaurants. We would expect additional commercial demand with the proposed significant increase in housing units on the Eastside site. Given the site's proximity to the elementary and middle school, there is potential for capturing commercial traffic throughout the day: a coffee shop may see strong demand from parents who have dropped off students at school in the morning, while a small grocery store or other food/beverage establishment may see good demand from surrounding residents in the afternoon and evening. Professional services could see demand from both groups.

We would not recommend larger or speculative retail on the Eastside site. There are already several new large retail buildings on the north side of Coos Bay along Highway 101 (Coos Bay Village and Teakwood Plaza). Teakwood Plaza, built in 2024, has at least one vacant unit. Additionally, we would not expect adequate demand for speculative retail at the Eastside site, as the area does not benefit from highway access and is in a primarily residential neighborhood.

Achievable Pricing

Based on the preceding analysis, we estimate the following to be achievable at the Eastside site. Achievable residential pricing, both for rentals and for-sale units, may vary with neighborhood amenities. These could include commercial space, parks, and proximity to other types of housing. Commercial lease rates assume triple net (NNN) leases.

Market Typology Matrix

Major Category	Subtype	Density (units per acre)	Size (sq. feet per unit)	Market Value
Rental residential	Walk-up or garden apartments	20 - 25	650 - 1,100	$1,321 - $2,096 /month
	Rental townhomes	12 - 15	1,300 - 1,700	$2,477 - $3,023 /month
For-sale residential	Single-family detached homes	5 - 8	1,100 - 1,900	$346,133 - $597,867 (sale price)
	Large lot detached homes	0.2 - 0.4	3,000 - 3,500	$1,132,800 - $1,321,600 (sale price)
	For-sale townhomes	10 - 15	1,300 - 1,700	$409,067 - $534,933 (sale price)
Commercial	Small grocery	<1	8,000 - 12,000	$12,000 - $15,000 /month
	Café	<1	1,800 - 2,200	$3,900 - $4,033 /month
	Professional service/office	<1	1,200 - 1,600	$2,400 - $2,667 /month

SOURCE: JOHNSON ECONOMICS

VII. DEVELOPMENT VIABILITY

This section evaluates the viability of developing the property for residential uses.

COSTS TO DEVELOP

The cost to develop this property is unusually high. Preliminary construction cost estimates, including site development as well as home construction, were developed by AKS and were used in this assessment. The total hard costs for site development estimated at $5.3 million reflecting a cost per lot of $313,000 assuming 17 lots. These costs include significant charges for ground surcharge as well as deep soil mixing buttresses. The resulting high-cost basis serves as a challenge to project viability.

DEVELOPMENT SCENARIOS

Two alternative development scenarios were evaluated for the site. These included a traditional mid density single family residential program providing 17 homes on the 2.7 acres. The following table summarizes this assumed program and key financial metrics.

PROJECT NAME: Eastside Housing & Feasibility Study
SUMMARY OF RETURNS/MID DENSITY DEVELOPMENT PROGRAM

Physical Characteristics	
Start Year:	1
Gross Land Area/Acreage:	2.70
Gross to Net Reduction:	80.0%
Net Developable Area/Acreage:	2.16
Number of Lots/Units:	17
Average Lot Size (Acres):	0.13
Average Home Size/SF:	1,500
Income/Cost Variables (2026 $s)	
Average Lot Development Cost/Finished Lot:	$313,004
Average Lot Sales Price/Finished Lot:	$118,001
Average Lot Price per S.F./Finished Lot:	$21.32
Home/Lot Ratio:	4.0
Average Achievable Home Price:	$472,005

SOURCE: Johnson Economics

Development Costs (2026 $s)	Total	Per Unit
Land Acquisition:	$0	$0
Land Development		
Hard Costs:	$4,973,061	$292,533
Soft Costs:	$348,000	$20,471
Total Land Development Costs	$5,321,061	$313,004
Home Development		
Construction Costs	$5,610,000	$330,000
Overhead/Profit @ 10%	$561,000	$33,000
SDCs/Fees	$816,000	$48,000
Total Home Development Costs	$6,987,000	$411,000
Total Development Costs	$12,308,061	$724,004
Value at Completion (2026 $s)	$8,024,085	$472,005
Measures of Return		
Value as a % of Cost:	65.2%	

The assumed average home price was $472,000 for an average home size of 1,500 square feet.

The total development cost per lot under this scenario was $313,000. This number does not account for any land acquisition cost. The cost to develop homes on the site was just under $6.7 million, reflecting an average home development cost of $411,000 per home. The total development cost was $12.3 million, reflecting an average development cost per home of $724,000.

When development costs are reconciled with achievable pricing the value as a percent of cost is only 65.2%. This excludes a typical developer profit which we would expect to add an additional 15% to the total development costs.

The second scenario evaluated was a low density residential solution providing a total of nine lots with an average lot size of 3/10 of an acre. The average home size in this scenario was 3,000 square feet, with an assumed achievable average home price of $1.13 million.

PROJECT NAME: Eastside Housing & Feasibility Study

SUMMARY OF RETURNS/LOW DENSITY DEVELOPMENT PROGRAM

Physical Characteristics	
Start Year:	1
Gross Land Area/Acreage:	2.70
Gross to Net Reduction:	90.0%
Net Developable Area/Acreage:	2.43
Number of Lots/Units:	9
Average Lot Size (Acres):	0.30
Average Home Size/SF:	3,000
Income/Cost Variables (2026 $s)	
Average Lot Development Cost/Finished Lot:	$591,229
Average Lot Sales Price/Finished Lot:	$283,200
Average Lot Price per S.F./Finished Lot:	$21.67
Home/Lot Ratio:	4.0
Average Achievable Home Price:	$1,132,800

Development Costs (2026 $s)	Total	Per Unit
Land Acquisition:	$0	$0
Land Development		
Hard Costs:	$4,973,061	$552,562
Soft Costs:	$348,000	$38,667
Total Land Development Costs	$5,321,061	$591,229
Home Development		
Construction Costs	$5,610,000	$623,333
Overhead/Profit @ 10%	$561,000	$62,333
SDCs/Fees	$816,000	$90,667
Total Home Development Costs	$6,987,000	$776,333
Total Development Costs	$12,308,061	$1,367,562
Value at Completion (2026 $s)	$10,195,200	$1,132,800
Measures of Return		
Value as a % of Cost:	82.8%	

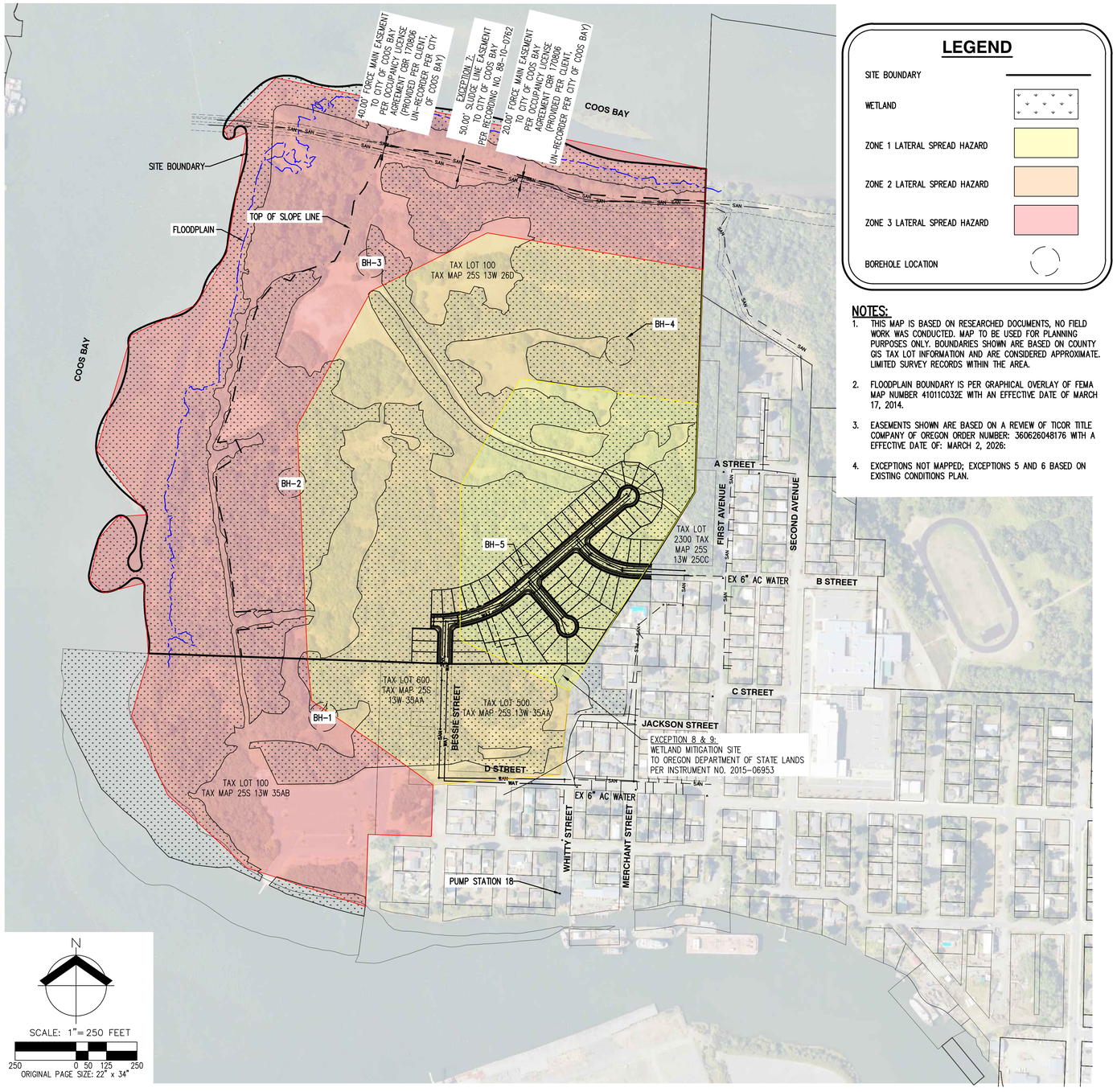
SOURCE: Johnson Economics

The total development cost under this scenario is $12.3 million or $1.37 million per home. As with the previous scenario, no allocation was made to account for land acquisition. The indicated value as a percent of cost for the low density program was 82.8%. While this is significantly closer to viable than the mid density solution, the overall estimated costs remain higher than the estimated value at completion.

CONCLUSIONS

In summary, the unusually high site development costs make either residential program unviable under current or anticipated achievable pricing. Including an appropriate developer return would just increase this viability gap as a developer would require a significant return to offset the risk associated with development of this kind. We would not expect this project to proceed and under either scenario, or any other likely scenario for the foreseeable future without significant public subsidy.

Appendix F: Alternative Site Exhibits



LEGEND

- SITE BOUNDARY
- WETLAND
- ZONE 1 LATERAL SPREAD HAZARD
- ZONE 2 LATERAL SPREAD HAZARD
- ZONE 3 LATERAL SPREAD HAZARD
- BOREHOLE LOCATION

NOTES:

1. THIS MAP IS BASED ON RESEARCHED DOCUMENTS, NO FIELD WORK WAS CONDUCTED. MAP TO BE USED FOR PLANNING PURPOSES ONLY. BOUNDARIES SHOWN ARE BASED ON COUNTY GIS TAX LOT INFORMATION AND ARE CONSIDERED APPROXIMATE. LIMITED SURVEY RECORDS WITHIN THE AREA.
2. FLOODPLAIN BOUNDARY IS PER GRAPHICAL OVERLAY OF FEMA MAP NUMBER 41011C032E WITH AN EFFECTIVE DATE OF MARCH 17, 2014.
3. EASEMENTS SHOWN ARE BASED ON A REVIEW OF TICOR TITLE COMPANY OF OREGON ORDER NUMBER: 360626048176 WITH A EFFECTIVE DATE OF: MARCH 2, 2026:
4. EXCEPTIONS NOT MAPPED; EXCEPTIONS 5 AND 6 BASED ON EXISTING CONDITIONS PLAN.

RESIDENTIAL LOT BREAKDOWN:

NUMBER OF LOTS = 68

TOTAL DEVELOPED AREA = 10.7 ACRES

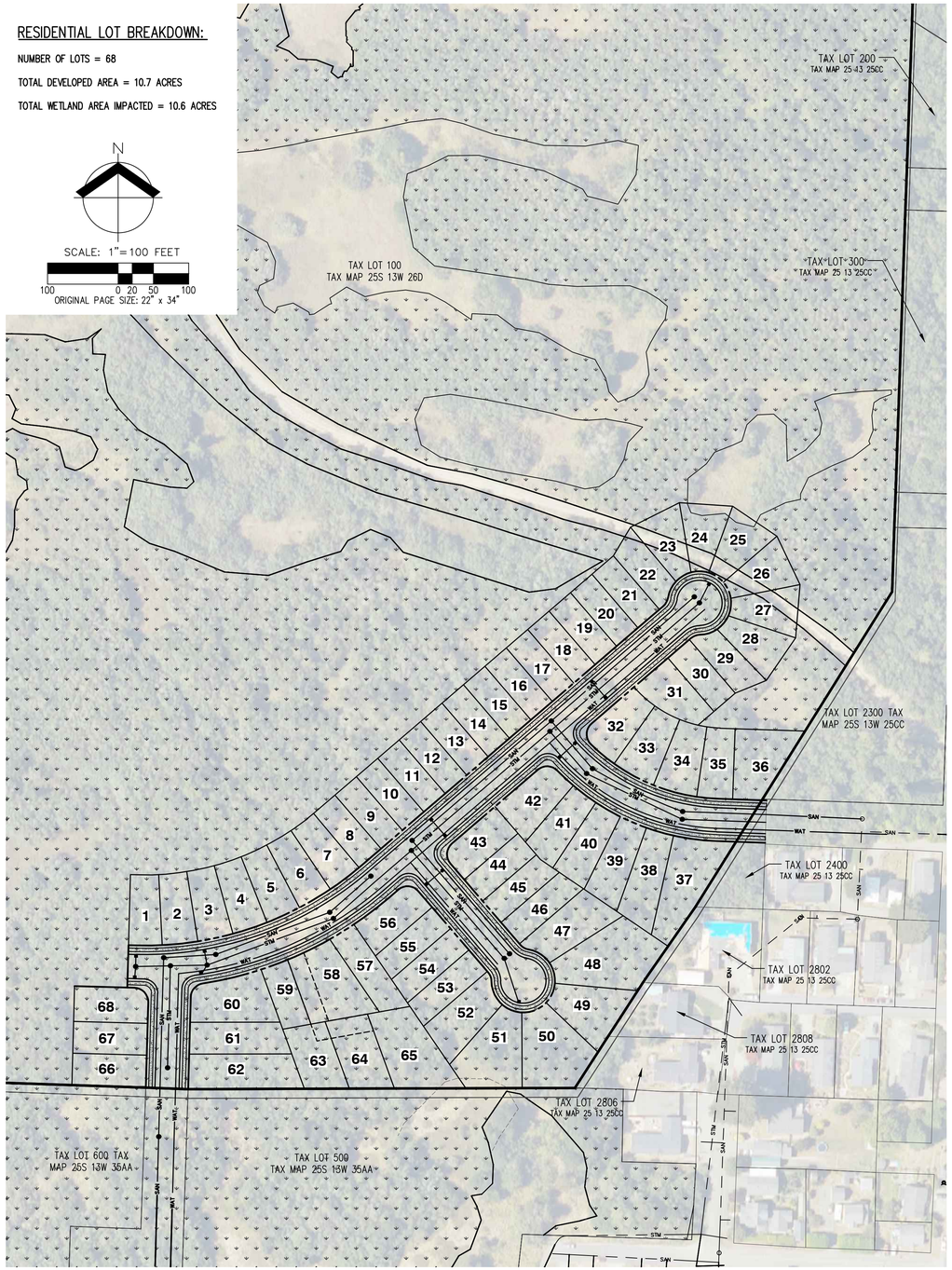
TOTAL WETLAND AREA IMPACTED = 10.6 ACRES

N

SCALE: 1"=100 FEET

100 0 20 50 100

ORIGINAL PAGE SIZE: 22" x 34"



DATE: 04/10/2026 AKS JOB: 12975

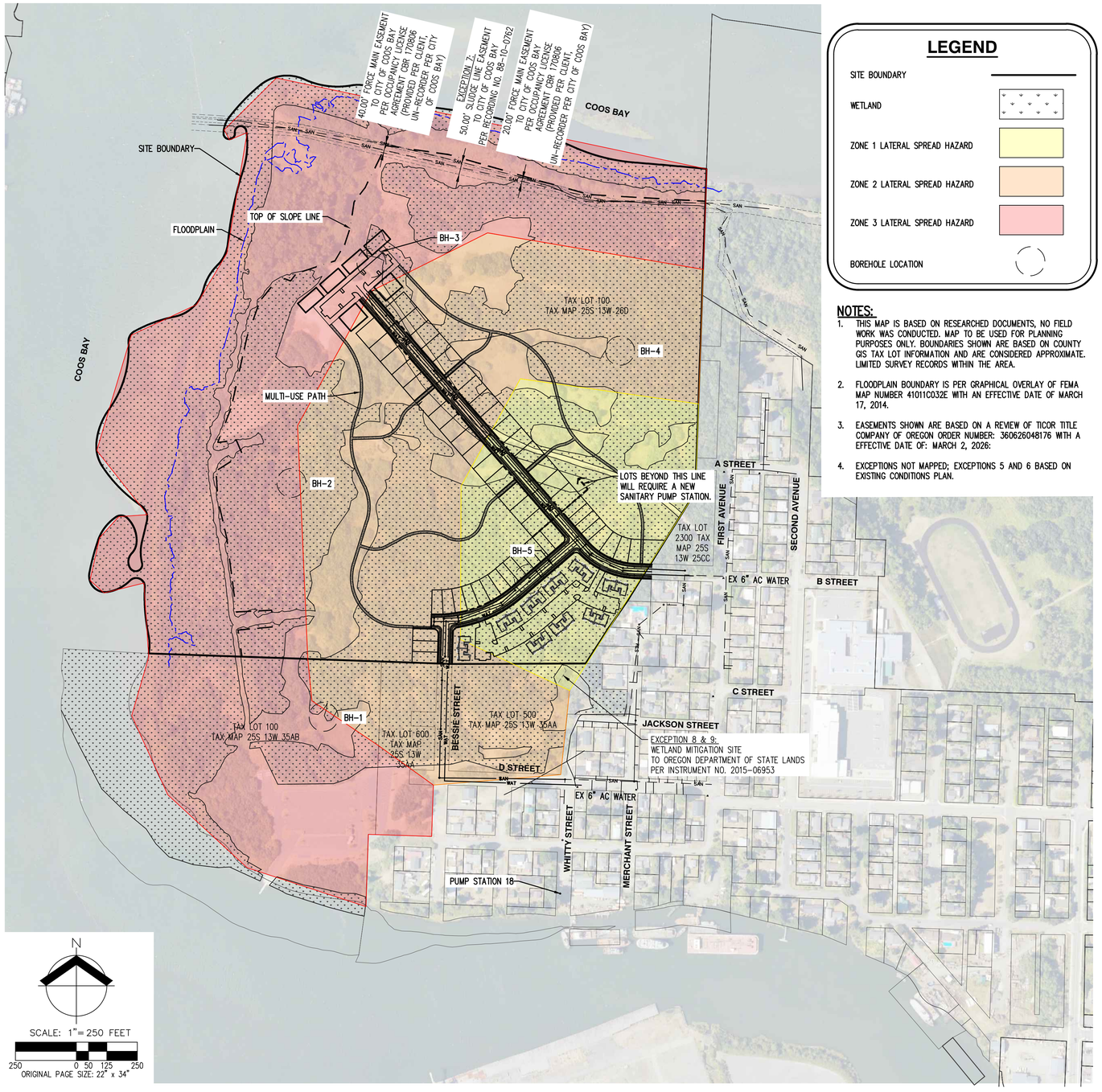
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503.400.6028
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ALTERNATIVE 1 - SMALL LOT

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

CITY OF COOS BAY
COOS BAY, OR



LEGEND

- SITE BOUNDARY
- WETLAND
- ZONE 1 LATERAL SPREAD HAZARD
- ZONE 2 LATERAL SPREAD HAZARD
- ZONE 3 LATERAL SPREAD HAZARD
- BOREHOLE LOCATION

NOTES:

1. THIS MAP IS BASED ON RESEARCHED DOCUMENTS, NO FIELD WORK WAS CONDUCTED. MAP TO BE USED FOR PLANNING PURPOSES ONLY. BOUNDARIES SHOWN ARE BASED ON COUNTY GIS TAX LOT INFORMATION AND ARE CONSIDERED APPROXIMATE. LIMITED SURVEY RECORDS WITHIN THE AREA.
2. FLOODPLAIN BOUNDARY IS PER GRAPHICAL OVERLAY OF FEMA MAP NUMBER 41011C032E WITH AN EFFECTIVE DATE OF MARCH 17, 2014.
3. EASEMENTS SHOWN ARE BASED ON A REVIEW OF TICOR TITLE COMPANY OF OREGON ORDER NUMBER: 360626048176 WITH A EFFECTIVE DATE OF: MARCH 2, 2026:
4. EXCEPTIONS NOT MAPPED; EXCEPTIONS 5 AND 6 BASED ON EXISTING CONDITIONS PLAN.

N

SCALE: 1"=250 FEET

250 0 50 125 250

ORIGINAL PAGE SIZE: 22" x 34"

SITE BREAKDOWN:

NUMBER OF COMMERCIAL BUILDINGS = 6

TOTAL SQUARE FEET OF FLOOR AREA = 33,500

TOTAL NUMBER OF COMMERCIAL PARKING SPACES = 64

NUMBER OF LOTS = 56

TOTAL DEVELOPED AREA = 17.7 ACRES

TOTAL WETLAND AREA WITHIN DEVELOPMENT = 13.5 ACRES

APARTMENT BUILDINGS = 9

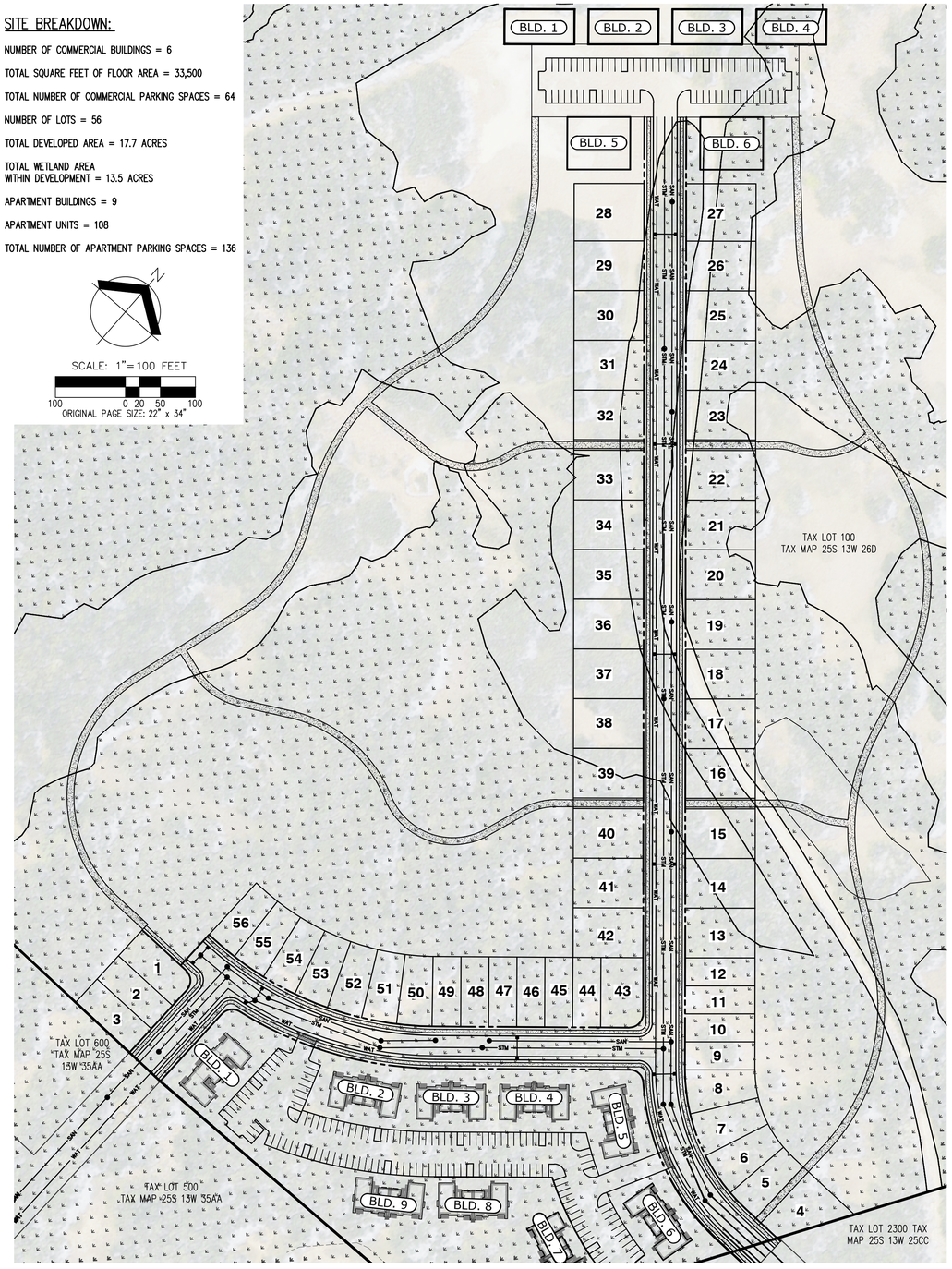
APARTMENT UNITS = 108

TOTAL NUMBER OF APARTMENT PARKING SPACES = 136

SCALE: 1"=100 FEET

100 0 20 50 100

ORIGINAL PAGE SIZE: 22" x 34"



DATE: 04/10/2026 AKS JOB: 12975

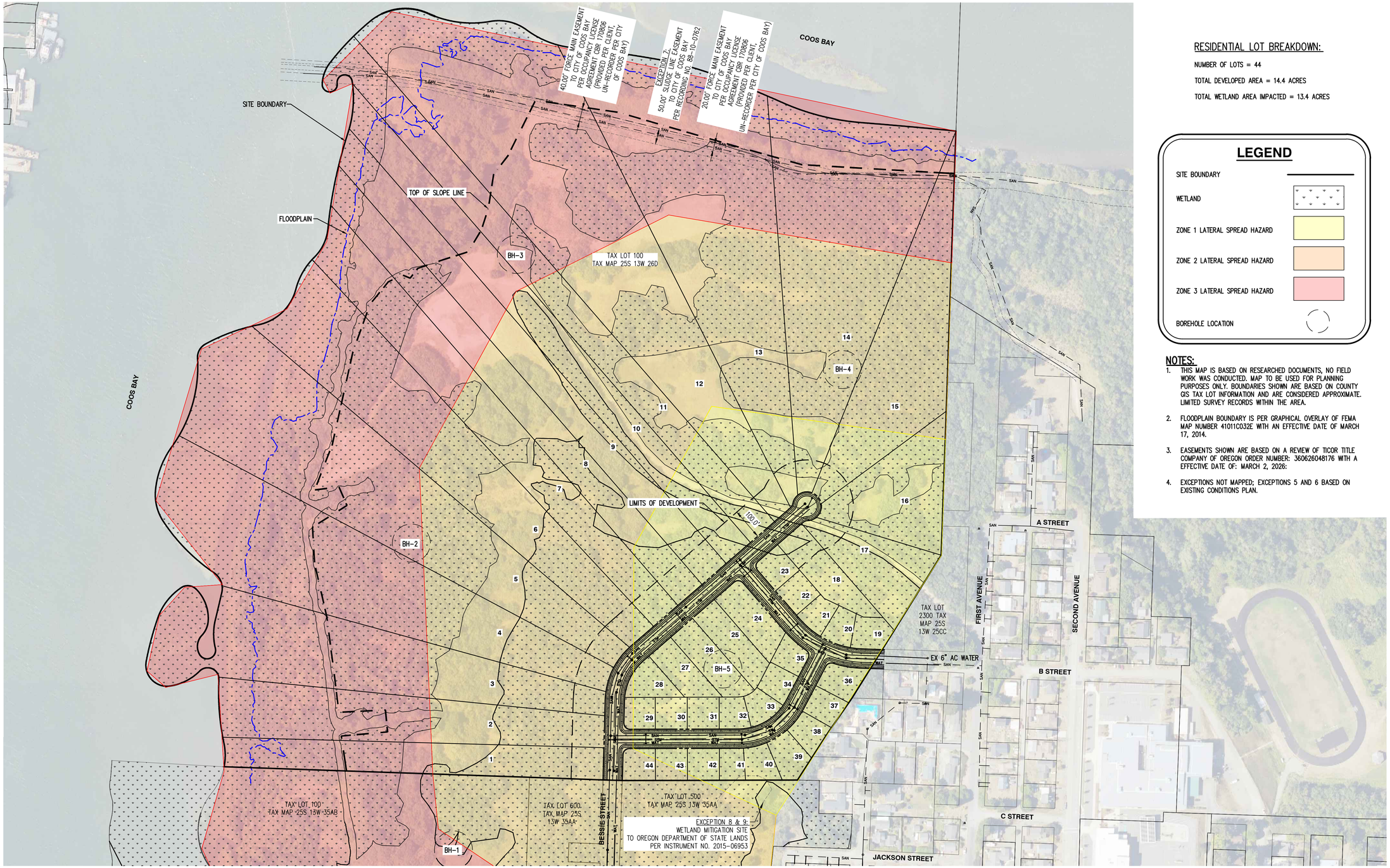
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ALTERNATIVE 2 - MULTIFAMILY & COMMERCIAL

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

CITY OF COOS BAY
COOS BAY, OR



RESIDENTIAL LOT BREAKDOWN:

NUMBER OF LOTS = 44

TOTAL DEVELOPED AREA = 14.4 ACRES

TOTAL WETLAND AREA IMPACTED = 13.4 ACRES

LEGEND

- SITE BOUNDARY
- WETLAND
- ZONE 1 LATERAL SPREAD HAZARD
- ZONE 2 LATERAL SPREAD HAZARD
- ZONE 3 LATERAL SPREAD HAZARD
- BOREHOLE LOCATION

NOTES:

1. THIS MAP IS BASED ON RESEARCHED DOCUMENTS, NO FIELD WORK WAS CONDUCTED. MAP TO BE USED FOR PLANNING PURPOSES ONLY. BOUNDARIES SHOWN ARE BASED ON COUNTY GIS TAX LOT INFORMATION AND ARE CONSIDERED APPROXIMATE. LIMITED SURVEY RECORDS WITHIN THE AREA.
2. FLOODPLAIN BOUNDARY IS PER GRAPHICAL OVERLAY OF FEMA MAP NUMBER 41011C032E WITH AN EFFECTIVE DATE OF MARCH 17, 2014.
3. EASEMENTS SHOWN ARE BASED ON A REVIEW OF TICOR TITLE COMPANY OF OREGON ORDER NUMBER: 360626048176 WITH A EFFECTIVE DATE OF: MARCH 2, 2026:
4. EXCEPTIONS NOT MAPPED; EXCEPTIONS 5 AND 6 BASED ON EXISTING CONDITIONS PLAN.

N

SCALE: 1"=150 FEET

150 0 30 75 150

ORIGINAL PAGE SIZE: 22" x 34"

DATE: 04/10/2026 AKS JOB: 12975

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ALTERNATIVE 3 - LARGE LOT

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

CITY OF COOS BAY
COOS BAY, OR

Appendix G: Cost Spreadsheets

HARD COST ESTIMATE

PROJECT NAME: Eastside Housing & Feasability Study
AKS JOB NUMBER: 12975
ESTIMATED BY: BTW / JDO
DATE: 04/09/2026

	PHASE 1	TOTALS
UNITS:	17 UNITS	17 UNITS
CL LENGTH (LF):	605	605

HARD COST BASE ITEMS TOTAL:	COST	TOTAL COST
SCHEDULE 1 - STREETS AND PATHS	$ 234,183	$ 234,183
SCHEDULE 2 - STORM DRAINAGE	$ 131,473	$ 131,473
SCHEDULE 3 - SANITARY SEWER	$ 91,475	$ 91,475
SCHEDULE 4 - WATER	$ 112,405	$ 112,405
SCHEDULE 5 - MISCELLANEOUS	$ 4,470,100	$ 4,470,100
SCHEDULE 6 - TRAFFIC (OFFSITE)	$ 40,800	$ 40,800
SCHEDULE 7 - SOFT COST	$ 232,047	$ 232,047
TOTAL HARD COST BASE ESTIMATE	**$ 5,312,483**	**$ 5,312,483**
COST PER UNIT WITHOUT CONTINGENCY	$ 312,499	$ 312,499

ITEM	SCHEDULE 1 - STREETS AND PATHS	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
	LOCAL					
1 - 1	4" asphalt concrete	SY	$ 22.00	2,056	$ 45,232	$ 45,232
1 - 2	10" base rock	SY	$ 15.00	2,369	$ 35,535	$ 35,535
1 - 3	Standard curb and gutter	LF	$ 28.00	1,127	$ 31,556	$ 31,556
1 - 4	5' sidewalk	SF	$ 10.00	3,795	$ 37,950	$ 37,950
1 - 5	Driveways	SF	$ 18.00	3,100	$ 55,800	$ 55,800
1 - 6	Extra for ada ramps	EA	$ 2,245.00	6	$ 13,470	$ 13,470
1 - 7	Streetlights	EA	$ 3,660.00	4	$ 14,640	$ 14,640
	SCHEDULE 1 - STREETS AND PATHS				**$ 234,183**	**$ 234,183**

ITEM	SCHEDULE 2 - STORM DRAINAGE	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
2 - 1	12" PVC storm main	LF	$ 65.00	607	$ 39,455	$ 39,455
2 - 2	10" catch basin lead	LF	$ 44.00	27	$ 1,188	$ 1,188
2 - 3	Storm pvc lateral	EA	$ 1,720.00	17	$ 29,240	$ 29,240
2 - 4	Catch basin	EA	$ 2,850.00	2	$ 5,700	$ 5,700
2 - 5	48" storm manhole	EA	$ 5,670.00	3	$ 17,010	$ 17,010
2 - 6	Water quality facilities	AC	$ 14,400.00	2.7	$ 38,880	$ 38,880
	SCHEDULE 2 - STORM DRAINAGE				**$ 131,473**	**$ 131,473**

ITEM	SCHEDULE 3 - SANITARY SEWER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
3 - 1	8" PVC sanitary main	LF	$ 55.00	746	$ 41,030	$ 41,030
3 - 2	Sanitary PVC lateral	EA	$ 1,935.00	17	$ 32,895	$ 32,895
3 - 3	48" sanitary manhole	EA	$ 5,850.00	3	$ 17,550	$ 17,550
	SCHEDULE 3 - SANITARY SEWER				**$ 91,475**	**$ 91,475**

ITEM	SCHEDULE 4 - WATER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
4 - 1	8" DI water main	LF	$ 95.00	776	$ 73,720	$ 73,720
4 - 2	8" gate valve	EA	$ 2,420.00	3	$ 7,260	$ 7,260
4 - 3	Water service	EA	$ 1,075.00	17	$ 18,275	$ 18,275
4 - 4	Fire hydrants	EA	$ 6,575.00	2	$ 13,150	$ 13,150
	SCHEDULE 4 - WATER				**$ 112,405**	**$ 112,405**

HARD COST ESTIMATE

			PHASE 1		TOTALS
ITEM	**SCHEDULE 5 - MISCELLANEOUS**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
5 - 1	Mobilization & demobilization	LS	LUMP SUM	-	$ 200,000	**$ 200,000**
5 - 2	Franchise utilities	LOT	$ 10,000.00	17	$ 170,000	**$ 170,000**
5 - 3	Wetland mitigation	AC	$ 220,000.00	2.7	$ 594,000	**$ 594,000**
5 - 4	Ground surcharge	AC	$ 315,000.00	2.7	$ 850,500	**$ 850,500**
5 - 5	Deep soil mixing	AC	$ 886,000.00	2.7	$ 2,392,200	**$ 2,392,200**
5 - 6	Dredge sand recompaction	AC	$ 41,000.00	2.7	$ 110,700	**$ 110,700**
5 - 7	Erosion control	LS	LUMP SUM	-	$ 50,000	**$ 50,000**
5 - 8	Pump station improvements*	LS	LUMP SUM	-	$ 102,700	**$ 102,700**
	SCHEDULE 5 - MISCELLANEOUS				**$ 4,470,100**	**$ 4,470,100**

ITEM	**SCHEDULE 6 - TRAFFIC (OFFSITE)**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
6 - 1	Proportionate share of intersection improvements**	LS	LUMP SUM	-	$ 37,800	**$ 37,800**
6 - 2	600' of roadway and sidewalk improvements**	LS	LUMP SUM	-	$ 3,000	**$ 3,000**
	SCHEDULE 6 - TRAFFIC (OFFSITE)				**$ 40,800**	**$ 40,800**

ITEM	**SCHEDULE 7 - SOFT COST**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
7 - 1	Engineering Services (20%)***	LS	LUMP SUM	-	$ 232,047	**$ 232,047**
	SCHEDULE 7 - SOFT COST				**$ 232,047**	**$ 232,047**

General Notes:

*IT IS ASSUMED $1.3 MILLION IS THE PROPORTIONAL SHARE REPRESENTED TOTAL FOR THE PROJECT.

**IT IS ASSUMED $1.5 MILLION IS THE PROPORTIONAL SHARE REPRESENTED TOTAL FOR THE PROJECT.

***20% OF CONSTRUCTION COST DOES NOT INCLUDE GROUND SURCHARGE, WETLAND MITIGATION, DREDGE SAND RECOMPACTION, OR DEEP SOIL MIXING.

NOTE: SUMMARY INCLUDED ASSUMES 6 LOTS PER ACRE, WHICH APPROXIMATES TO A TOTAL OF 270 RESIDENTIAL DWELLINGS FOR THE SITE.

OUTSTANDING ITEMS NOT INCLUDED WITH COSTS:

- ADDITIONAL CUT/FILL GRADING
- SIGNAGE AND STRIPING
- SOFT COSTS OTHER THAN ENGINEERING SERVICES
- JURISDICTIONAL FEES
- COMPACTION/SOIL TESTING FOR CONSTRUCTION
- HOME CONSTRUCTION
- LAND PURCHASE
- SDC FEES

HARD COST ESTIMATE

PROJECT NAME: Eastside Housing & Feasability Study
AKS JOB NUMBER: 12975
ESTIMATED BY: BTW / JDO
DATE: 04/09/2026

	PHASE 1	TOTALS
UNITS:	**68 UNITS**	**68 UNITS**
CL LENGTH (LF):	**1,748**	**1,748**

HARD COST BASE ITEMS TOTAL:	COST	TOTAL COST
SCHEDULE 1 - STREETS AND PATHS	$ 751,698	$ 751,698
SCHEDULE 2 - STORM DRAINAGE	$ 495,433	$ 495,433
SCHEDULE 3 - SANITARY SEWER	$ 362,970	$ 362,970
SCHEDULE 4 - WATER	$ 391,955	$ 391,955
SCHEDULE 5 - MISCELLANEOUS	$ 7,928,200	$ 7,928,200
SCHEDULE 6 - TRAFFIC (OFFSITE)	$ 153,000	$ 153,000
SCHEDULE 7 - SOFT COST	$ 710,020	$ 710,020
TOTAL HARD COST BASE ESTIMATE	**$ 10,793,276**	**$ 10,793,276**
COST PER UNIT WITHOUT CONTINGENCY	$ 158,725	$ 158,725

ITEM	SCHEDULE 1 - STREETS AND PATHS	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
	LOCAL					
1 - 1	4" asphalt concrete	SY	$ 22.00	6,384	$ 140,448	$ 140,448
1 - 2	10" base rock	SY	$ 15.00	7,344	$ 110,160	$ 110,160
1 - 3	Standard curb and gutter	LF	$ 28.00	3,457	$ 96,796	$ 96,796
1 - 4	5' sidewalk	SF	$ 10.00	10,553	$ 105,530	$ 105,530
1 - 5	Driveways	SF	$ 18.00	11,913	$ 214,434	$ 214,434
1 - 6	Extra for ada ramps	EA	$ 2,245.00	18	$ 40,410	$ 40,410
1 - 7	Streetlights	EA	$ 3,660.00	12	$ 43,920	$ 43,920
	SCHEDULE 1 - STREETS AND PATHS				**$ 751,698**	**$ 751,698**

ITEM	SCHEDULE 2 - STORM DRAINAGE	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
2 - 1	12" PVC storm main	LF	$ 65.00	1,671	$ 108,615	$ 108,615
2 - 2	10" catch basin lead	LF	$ 44.00	307	$ 13,508	$ 13,508
2 - 3	Storm pvc lateral	EA	$ 1,720.00	68	$ 116,960	$ 116,960
2 - 4	Catch basin	EA	$ 2,850.00	14	$ 39,900	$ 39,900
2 - 5	48" storm manhole	EA	$ 5,670.00	11	$ 62,370	$ 62,370
2 - 6	Water quality facilities	AC	$ 14,400.00	10.7	$ 154,080	$ 154,080
	SCHEDULE 2 - STORM DRAINAGE				**$ 495,433**	**$ 495,433**

ITEM	SCHEDULE 3 - SANITARY SEWER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
3 - 1	8" PVC sanitary main	LF	$ 55.00	2,718	$ 149,490	$ 149,490
3 - 2	Sanitary PVC lateral	EA	$ 1,935.00	68	$ 131,580	$ 131,580
3 - 3	48" sanitary manhole	EA	$ 5,850.00	14	$ 81,900	$ 81,900
	SCHEDULE 3 - SANITARY SEWER				**$ 362,970**	**$ 362,970**

ITEM	SCHEDULE 4 - WATER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
4 - 1	8" DI water main	LF	$ 95.00	2,832	$ 269,040	$ 269,040
4 - 2	8" gate valve	EA	$ 2,420.00	7	$ 16,940	$ 16,940
4 - 3	Water service	EA	$ 1,075.00	68	$ 73,100	$ 73,100
4 - 4	Fire hydrants	EA	$ 6,575.00	5	$ 32,875	$ 32,875
	SCHEDULE 4 - WATER				**$ 391,955**	**$ 391,955**

HARD COST ESTIMATE

				PHASE 1		TOTALS
ITEM	**SCHEDULE 5 - MISCELLANEOUS**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
5 - 1	Mobilization & demobilization	LS	LUMP SUM	-	$ 510,000	**$ 510,000**
5 - 2	Franchise utilities	LOT	$ 10,000.00	81	$ 810,000	**$ 810,000**
5 - 3	Wetland mitigation	AC	$ 220,000.00	10.6	$ 2,332,000	**$ 2,332,000**
5 - 4	Ground surcharge	AC	$ 315,000.00	10.7	$ 3,370,500	**$ 3,370,500**
	~~Deep soil mixing~~	AC	$ 1,500,000.00	-	$ -	
5 - 5	Dredge sand recompaction	AC	$ 41,000.00	10.7	$ 438,700	**$ 438,700**
5 - 6	Erosion control	LS	LUMP SUM	-	$ 107,000	**$ 107,000**
5 - 7	Pump station improvements*	LS	LUMP SUM	-	$ 360,000	**$ 360,000**
	SCHEDULE 5 - MISCELLANEOUS				**$ 7,928,200**	**$ 7,928,200**

ITEM	**SCHEDULE 6 - TRAFFIC (OFFSITE)**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
6 - 1	Proportionate share of intersection improvements**	LS	LUMP SUM	-	$ 150,000	**$ 150,000**
6 - 2	600' of roadway and sidewalk improvements**	LS	LUMP SUM	-	$ 3,000	**$ 3,000**
	SCHEDULE 6 - TRAFFIC (OFFSITE)				**$ 153,000**	**$ 153,000**

ITEM	**SCHEDULE 7 - SOFT COST**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
7 - 1	Engineering Services (20%)***	LS	LUMP SUM	-	$ 710,020	**$ 710,020**
	SCHEDULE 7 - SOFT COST				**$ 710,020**	**$ 710,020**

General Notes:

*IT IS ASSUMED $360,000 IS THE SHARE OF PUMP STATION IMPROVEMENTS REPRESENTED TOTAL FOR THE PROJECT.

**IT IS ASSUMED $1.0 MILLION IS THE PROPORTIONAL SHARE OF OFFSITE TRAFFIC IMPROVEMENTS REPRESENTED TOTAL FOR THE PROJECT.

***20% OF CONSTRUCTION COST DOES NOT INCLUDE GROUND SURCHARGE, WETLAND MITIGATION, DREDGE SAND RECOMPACTION, OR DEEP SOIL MIXING. **OUTSTANDING ITEMS NOT INCLUDED WITH COSTS:**

- ADDITIONAL CUT/FILL GRADING
- SIGNAGE AND STRIPING
- SOFT COSTS OTHER THAN ENGINEERING SERVICES
- JURISDICTIONAL FEES
- COMPACTION/SOIL TESTING FOR CONSTRUCTION
- HOME CONSTRUCTION
- LAND PURCHASE
- SDC FEES

HARD COST ESTIMATE

PROJECT NAME: Eastside Housing & Feasability Study
AKS JOB NUMBER: 12975
ESTIMATED BY: BTW / JDO
DATE: 04/09/2026

	PHASE 1	TOTALS
UNITS:	164 UNITS	164 UNITS
CL LENGTH (LF):	2,558	2,558

HARD COST BASE ITEMS TOTAL:	COST	TOTAL COST
SCHEDULE 1 - STREETS AND PATHS	$ 1,446,141	$ 1,446,141
SCHEDULE 2 - STORM DRAINAGE	$ 634,871	$ 634,871
SCHEDULE 3 - SANITARY SEWER	$ 397,760	$ 397,760
SCHEDULE 4 - WATER	$ 474,285	$ 474,285
SCHEDULE 5 - MULTIFAMILY AND COMMERCIAL	$ 4,031,871	$ 4,031,871
SCHEDULE 6 - MISCELLANEOUS	$ 18,268,200	$ 18,268,200
SCHEDULE 7 - TRAFFIC (OFFSITE)	$ 368,000	$ 368,000
SCHEDULE 8 - SOFT COST	$ 2,429,986	$ 2,429,986
TOTAL HARD COST BASE ESTIMATE	**$ 28,051,114**	**$ 28,051,114**
COST PER UNIT WITHOUT CONTINGENCY	$ 171,043	$ 171,043

ITEM	SCHEDULE 1 - STREETS AND PATHS	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
	LOCAL					
1 - 1	4" asphalt concrete	SY	$ 22.00	8,745	$ 192,390	$ 192,390
1 - 2	10" base rock	SY	$ 15.00	10,119	$ 151,785	$ 151,785
1 - 3	Standard curb and gutter	LF	$ 28.00	4,989	$ 139,692	$ 139,692
1 - 4	5' sidewalk	SF	$ 10.00	19,041	$ 190,410	$ 190,410
1 - 5	10' pedestrian path	SF	$ 10.00	48,864	$ 488,640	$ 488,640
1 - 6	Driveways	SF	$ 18.00	10,578	$ 190,404	$ 190,404
1 - 7	Extra for ada ramps	EA	$ 2,245.00	12	$ 26,940	$ 26,940
1 - 8	Streetlights	EA	$ 3,660.00	18	$ 65,880	$ 65,880
	SCHEDULE 1 - STREETS AND PATHS				**$ 1,446,141**	**$ 1,446,141**

ITEM	SCHEDULE 2 - STORM DRAINAGE	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
2 - 1	12" PVC storm main	LF	$ 65.00	2,521	$ 163,865	$ 163,865
2 - 2	10" catch basin lead	LF	$ 44.00	269	$ 11,836	$ 11,836
2 - 3	Storm pvc lateral	EA	$ 1,720.00	56	$ 96,320	$ 96,320
2 - 4	Catch basin	EA	$ 2,850.00	16	$ 45,600	$ 45,600
2 - 5	48" storm manhole	EA	$ 5,670.00	11	$ 62,370	$ 62,370
2 - 6	Water quality facilities	AC	$ 14,400.00	17.7	$ 254,880	$ 254,880
	SCHEDULE 2 - STORM DRAINAGE				**$ 634,871**	**$ 634,871**

ITEM	SCHEDULE 3 - SANITARY SEWER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
3 - 1	8" PVC sanitary main	LF	$ 55.00	3,560	$ 195,800	$ 195,800
3 - 2	Sanitary PVC lateral	EA	$ 1,935.00	56	$ 108,360	$ 108,360
3 - 3	48" sanitary manhole	EA	$ 5,850.00	16	$ 93,600	$ 93,600
	SCHEDULE 3 - SANITARY SEWER				**$ 397,760**	**$ 397,760**

ITEM	SCHEDULE 4 - WATER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
4 - 1	8" DI water main	LF	$ 95.00	3,696	$ 351,120	$ 351,120
4 - 2	8" gate valve	EA	$ 2,420.00	7	$ 16,940	$ 16,940
4 - 3	Water service	EA	$ 1,075.00	56	$ 60,200	$ 60,200
4 - 4	Fire hydrants	EA	$ 6,575.00	7	$ 46,025	$ 46,025
	SCHEDULE 4 - WATER				**$ 474,285**	**$ 474,285**

HARD COST ESTIMATE

				PHASE 1		TOTALS
ITEM	**SCHEDULE 5 - MULTIFAMILY AND COMMERCIAL**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
5 - 1	Multifamily Development	LS	LUMP SUM	-	$ 2,982,735	**$ 2,982,735**
5 - 2	Commercial Development	LS	LUMP SUM	-	$ 1,049,136	**$ 1,049,136**
	SCHEDULE 5 - MULTIFAMILY AND COMMERCIAL				**$ 4,031,871**	**$ 4,031,871**

ITEM	SCHEDULE 6 - MISCELLANEOUS	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
6 - 1	Mobilization & demobilization	LS	LUMP SUM	-	$ 1,340,000	**$ 1,340,000**
6 - 2	Franchise utilities	LOT	$ 10,000.00	56	$ 560,000	**$ 560,000**
6 - 3	Wetland mitigation	AC	$ 220,000.00	13.5	$ 2,970,000	**$ 2,970,000**
6 - 4	Ground surcharge	AC	$ 315,000.00	17.7	$ 5,575,500	**$ 5,575,500**
6 - 5	Deep soil mixing	AC	$ 1,500,000.00	2.8	$ 4,200,000	**$ 4,200,000**
6 - 6	Dredge sand recompaction	AC	$ 41,000.00	17.7	$ 725,700	**$ 725,700**
6 - 7	Erosion control	LS	LUMP SUM	-	$ 177,000	**$ 177,000**
6 - 8	Pump station improvements*	LS	LUMP SUM	-	$ 720,000	**$ 720,000**
6 - 9	New Pump station	LS	LUMP SUM	-	$ 2,000,000	**$ 2,000,000**
	SCHEDULE 6 - MISCELLANEOUS				**$ 18,268,200**	**$ 18,268,200**

ITEM	SCHEDULE 7 - TRAFFIC (OFFSITE)	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
7 - 1	Proportionate share of intersection improvements**	LS	LUMP SUM	-	$ 365,000	**$ 365,000**
7 - 2	600' of roadway and sidewalk improvements**	LS	LUMP SUM	-	$ 3,000	**$ 3,000**
	SCHEDULE 7 - TRAFFIC (OFFSITE)				**$ 368,000**	**$ 368,000**

ITEM	SCHEDULE 8 - SOFT COST	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
X - 1	Engineering Services (20%)***	LS	LUMP SUM	-	$ 2,429,986	**$ 2,429,986**
	SCHEDULE 8 - SOFT COST				**$ 2,429,986**	**$ 2,429,986**

General Notes:

*IT IS ASSUMED $720,000 IS THE TOTAL SHARE FOR THE PROJECT.

**IT IS ASSUMED $1.0 MILLION IS THE PROPORTIONAL SHARE REPRESENTED TOTAL FOR THE PROJECT.

***20% OF CONSTRUCTION COST DOES NOT INCLUDE GROUND SURCHARGE, WETLAND MITIGATION, DREDGE SAND RECOMPACTION, OR DEEP SOIL MIXING

OUTSTANDING ITEMS NOT INCLUDED WITH COSTS:

- ADDITIONAL CUT/FILL GRADING
- SIGNAGE AND STRIPING
- SOFT COSTS OTHER THAN ENGINEERING SERVICES
- JURISDICTIONAL FEES
- COMPACTION/SOIL TESTING FOR CONSTRUCTION
- HOME CONSTRUCTION
- LAND PURCHASE
- SDC FEES

HARD COST ESTIMATE

PROJECT NAME: Eastside Housing & Feasability Study
AKS JOB NUMBER: 12975
ESTIMATED BY: BTW / JDO
DATE: 04/09/2026

	PHASE 1	TOTALS
UNITS:	**44 UNITS**	**44 UNITS**
CL LENGTH (LF):	**2,490**	**2,490**

HARD COST BASE ITEMS TOTAL:	COST	TOTAL COST
SCHEDULE 1 - STREETS AND PATHS	$ 918,985	$ 918,985
SCHEDULE 2 - STORM DRAINAGE	$ 580,127	$ 580,127
SCHEDULE 3 - SANITARY SEWER	$ 384,240	$ 384,240
SCHEDULE 4 - WATER	$ 462,475	$ 462,475
SCHEDULE 5 - MISCELLANEOUS	$ 10,784,400	$ 10,784,400
SCHEDULE 6 - TRAFFIC (OFFSITE)	$ 103,000	$ 103,000
SCHEDULE 7 - SOFT COST	$ 809,765	$ 809,765
TOTAL HARD COST BASE ESTIMATE	**$ 14,042,992**	**$ 14,042,992**
COST PER UNIT WITHOUT CONTINGENCY	$ 319,159	$ 319,159

ITEM	SCHEDULE 1 - STREETS AND PATHS	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
	LOCAL					
1 - 1	4" asphalt concrete	SY	$ 22.00	8,707	$ 191,554	$ 191,554
1 - 2	10" base rock	SY	$ 15.00	10,051	$ 150,765	$ 150,765
1 - 3	Standard curb and gutter	LF	$ 28.00	4,835	$ 135,380	$ 135,380
1 - 4	5' sidewalk	SF	$ 10.00	19,570	$ 195,700	$ 195,700
1 - 5	Driveways	SF	$ 18.00	7,942	$ 142,956	$ 142,956
1 - 6	Extra for ada ramps	EA	$ 2,245.00	18	$ 40,410	$ 40,410
1 - 7	Streetlights	EA	$ 3,660.00	17	$ 62,220	$ 62,220
	SCHEDULE 1 - STREETS AND PATHS				**$ 918,985**	**$ 918,985**

ITEM	SCHEDULE 2 - STORM DRAINAGE	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
2 - 1	12" PVC storm main	LF	$ 65.00	2,459	$ 159,835	$ 159,835
2 - 2	10" catch basin lead	LF	$ 44.00	343	$ 15,092	$ 15,092
2 - 3	Storm pvc lateral	EA	$ 1,720.00	44	$ 75,680	$ 75,680
2 - 4	Catch basin	EA	$ 2,850.00	17	$ 48,450	$ 48,450
2 - 5	48" storm manhole	EA	$ 5,670.00	13	$ 73,710	$ 73,710
2 - 6	Water quality facilities	AC	$ 14,400.00	14.4	$ 207,360	$ 207,360
	SCHEDULE 2 - STORM DRAINAGE				**$ 580,127**	**$ 580,127**

ITEM	SCHEDULE 3 - SANITARY SEWER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
3 - 1	8" PVC sanitary main	LF	$ 55.00	3,630	$ 199,650	$ 199,650
3 - 2	Sanitary PVC lateral	EA	$ 1,935.00	44	$ 85,140	$ 85,140
3 - 3	48" sanitary manhole	EA	$ 5,850.00	17	$ 99,450	$ 99,450
	SCHEDULE 3 - SANITARY SEWER				**$ 384,240**	**$ 384,240**

ITEM	SCHEDULE 4 - WATER	UNIT	UNIT PRICE	QTY	COST	TOTAL COST
4 - 1	8" DI water main	LF	$ 95.00	3,682	$ 349,790	$ 349,790
4 - 2	8" gate valve	EA	$ 2,420.00	8	$ 19,360	$ 19,360
4 - 3	Water service	EA	$ 1,075.00	44	$ 47,300	$ 47,300
4 - 4	Fire hydrants	EA	$ 6,575.00	7	$ 46,025	$ 46,025
	SCHEDULE 4 - WATER				**$ 462,475**	**$ 462,475**

HARD COST ESTIMATE

			PHASE 1		TOTALS
ITEM	**SCHEDULE 5 - MISCELLANEOUS**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
5 - 1	Mobilization & demobilization	LS	LUMP SUM	-	$ 670,000	**$ 670,000**
5 - 2	Franchise utilities	LOT	$ 10,000.00	44	$ 440,000	**$ 440,000**
5 - 3	Wetland mitigation	AC	$ 220,000.00	13.4	$ 2,948,000	**$ 2,948,000**
5 - 4	Ground surcharge	AC	$ 315,000.00	14.4	$ 4,536,000	**$ 4,536,000**
5 - 5	Deep soil mixing	AC	$ 1,500,000.00	0.74	$ 1,110,000	**$ 1,110,000**
5 - 6	Dredge sand recompaction	AC	$ 41,000.00	14.4	$ 590,400	**$ 590,400**
5 - 7	Erosion control	LS	LUMP SUM	-	$ 130,000	**$ 130,000**
5 - 8	Pump station improvements*	LS	LUMP SUM	-	$ 360,000	**$ 360,000**
	SCHEDULE 5 - MISCELLANEOUS				**$ 10,784,400**	**$ 10,784,400**

ITEM	**SCHEDULE 6 - TRAFFIC (OFFSITE)**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
6 - 1	Proportionate share of intersection improvements**	LS	LUMP SUM	-	$ 100,000	**$ 100,000**
6 - 2	600' of roadway and sidewalk improvements**	LS	LUMP SUM	-	$ 3,000	**$ 3,000**
	SCHEDULE 6 - TRAFFIC (OFFSITE)				**$ 103,000**	**$ 103,000**

ITEM	**SCHEDULE 7 - SOFT COST**	**UNIT**	**UNIT PRICE**	**QTY**	**COST**	**TOTAL COST**
7 - 1	Engineering Services (20%)***	LS	LUMP SUM	-	$ 809,765	**$ 809,765**
	SCHEDULE 7 - SOFT COST				**$ 809,765**	**$ 809,765**

General Notes:

*IT IS ASSUMED $360,000 IS THE TOTAL SHARE FOR THE PROJECT.

**IT IS ASSUMED $1.0 MILLION IS THE PROPORTIONAL SHARE REPRESENTED TOTAL FOR THE PROJECT.

***20% OF CONSTRUCTION COST DOES NOT INCLUDE GROUND SURCHARGE, WETLAND MITIGATION, DREDGE SAND RECOMPACTION, OR DEEP SOIL MIXING

OUTSTANDING ITEMS NOT INCLUDED WITH COSTS:

- ADDITIONAL CUT/FILL GRADING
- SIGNAGE AND STRIPING
- SOFT COSTS OTHER THAN ENGINEERING SERVICES
- JURISDICTIONAL FEES
- COMPACTION/SOIL TESTING FOR CONSTRUCTION
- HOME CONSTRUCTION
- LAND PURCHASE
- SDC FEES

Appendix H: Geotechnical Evaluation



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Port of Coos Bay
Eastside Development

Coos Bay, Oregon

Prepared for:

Richard P. Turi
Architecture and. Planning
Coos Bay, Oregon

April 21, 2000

Professional Geotechnical Services

Foundation Engineering, Inc.

Foundation Engineering, Inc.
Professional Geotechnical Services

Richard P. Turi
Richard P. Turi Architecture and Planning
1834 McPherson Avenue
North Bend, Oregon 97459

April 21 , 2000

Port of Coos Bay - Eastside Development
Phase 2 Geotechnical Investigation
Coos Bay, Oregon

Project 991001 22

Dear Mr. Turi:

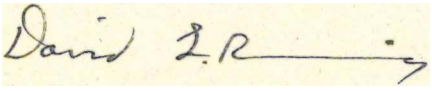
We have completed the requested geotechnical investigation for the above-referenced project.

Our report includes a description of our **work,** a discussion of ?ite conditions, a summary of laboratory testing, and a discussion of engineering analyses. A discussion of the geotechnical issues related to the proposed site development is also enclosed.

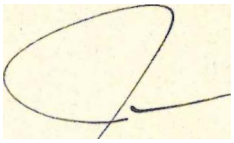
It has been a pleasure assisting you with this phase of your project. Please do not hesitate to contact us if you have any questions or if you require further assistance.

Sincerely,

FOUNDATION ENGINEERING, INC.



David L. Running, P.E.
Project Engineer



James . Maitland, P.E.
Principal

DLR/JKM/cs
enclosure

GEOTECHNICAL INVESTIGATION
PORT OF COOS BAY - EASTSIDE DEVELOPMENT
COOS BAY, OREGON

BACKGROUND

The Port of Coos Bay is considering developing a ± 114-acre parcel in the Eastside District of Coos Bay. The location of the property is shown on the Vicinity Map (Figure 1, Appendix A). The site was formerly used as a depository for materials dredged from the bay's shipping channel. We understand that the filling of the site was completed in approximately 1980.

A residential development is proposed which would include single-family residences, townhouses, apartments and some commercial property. Approximately 78.5 acres of the site would be used for the proposed development. The proposed layout of the development is shown on Figure 2 (Appendix A).

Foundation Engineering, Inc. (FEI) was retained by Richard P. Turi Architecture and Planning to perform a subsurface investigation of the site, evaluate the stability of the subsurface soils, and identify geotechnical issues related to the proposed development. Our original (Phase 1) work scope was outlined in a proposal dated August 30, 1999, and was authorized by a signed Technical/Professional Services Agreement dated September 20.

A Phase 2 work scope for supplemental services was outlined in a facsimile dated November 1 and verbally authorized on January 31, 2000. That work included conducting laboratory consolidation tests and evaluating the use of a surcharge to pre-consolidate the site. A preliminary analysis of the use of wick drains to reduce the duration of the surcharge program was also conducted.

FIELD EXPLORATION

We drilled five boreholes at the site on September 29 and 30, 1999. The boreholes were drilled with a CME 75, truck-mounted drill rig and mud-rotary techniques. The borings were advanced to maximum depths ranging from 46½ feet to 101½ feet. Sampling was conducted at ± 2½ to 5-foot intervals. Disturbed samples were obtained using a split-spoon sampler. The Standard Penetration Test (SPT), which is run when the split-spoon is driven, provides an indication of the relative stiffness or density of the soils. Relatively undisturbed soil samples were obtained using thin-walled Shelby tubes.

The boreholes were continually logged during drilling. The final logs (Appendix B) were prepared based on a review of the field logs and an examination of the soil samples in our laboratory. The approximate locations of the borings are shown on Figure 2. The surface and subsurface conditions are discussed below.

DISCUSSION OF SITE CONDITIONS

Surface Conditions

The surface of the site is gently rolling. The ground is predominantly covered by tall grass and scattered br[illegible]sh and trees. Sand is exposed at the ground surface across isolated portions of the property. The parcel is bordered by an earth embankment along the shoreline of the bay. We understand that this embankment was used to retain the dredge spoils during their placement.

Subsurface Conditions

The subsurface profile at the site consists of dredge fill underlain by alluvial slough deposits. We understand that the depth of the dredge fill could be as much as ± 25 to 30 feet at some locations. However, it is difficult to distinguish the contact between the fill and the alluvium since both are comprised of similar slough deposit materials.

The terrain at each of the borings is underlain by ± 4 to 7 feet of very loose to loose sand or silty sand. The surficial sand is typically followed by very soft to soft silt and clayey silt containing scattered organics. These soft deposits extended to depths of up to ± 70 feet below the surface. Standard Penetration Testing (SPT) indicated relatively low blow counts throughout the upper ± 50 to 60 feet of the profile with most values in the range of O to 3. At BH-2, BH-3 and BH-4, layers of Very loose to loose sand were encountered interbedded in the upper ± 40 feet of the deposit. Relatively low SPT blow counts ranging from 2 to 10 were recorded in these layers which range from ± 10 to 28 feet thick. Medium stiff to stiff clays and silts and medium dense sands were encountered at greater depths (± 50 to 70 feet below the surface).

LABORATORY TESTING

The laboratory work included natural water content determinations on soils taken from a range of depths to estimate the uniformity of the soil deposits. The results of those tests are summarized in Table 1C (Appendix C). One-dimensional consolidation tests were also performed on four, relatively undisturbed Shelby tube samples to determine the compressibility of the soils. The sample depths were selected to include both dredge fill materials (assumed to occupy the upper ± 25 to 30 feet of the profile) and the underlying, fine-grained, alluvial deposits. Table 1 provides a summary of the consolidation samples tested. Consolidation tests, conducted in our laboratory, are usually initiated using an applied pressure of 0.2 ksf. However, because all of the samples were very soft, we began these tests with smaller pressure increments (0.05 ksf and 0.1 ksf) to establish the upper (relatively flat) portion of the consolidation curves. The consolidation test results are presented in Figures 1C, 2C, 3C and 4C (Appendix C).

Table 1. Summary of Consolidation Samples

Sample Number	Sample Depth (feet)	Soil Description
SH-3-3	7½ - 9½	Dark grey SILT; some clay (Dredge Fill)
SH-1-3	15 - 17	Grey SILT; some clay (Dredge Fill)
SH-4-7	32 - 34	Grey, clayey SILT (Alluvium)
SH-2-10	45 - 47	Grey SILT; some clay (Alluvium)

GEOTECHNICAL ISSUES

Settlement Issues

The methods of soil deposition at the site have created a relatively thick profile of loose/soft, saturated materials. That is, a profile consisting of ±25 to 30 feet of former slough deposits loosely placed by dredging over ±30 to 35 feet of submerged soils, loosely deposited by the backwater of the bay. Tests, performed on samples taken from various locations and depths, indicate natural moisture contents ranging from ±30% to ±130% with an average of ±75%. The highest moisture contents (±127% to ±130%) were recorded in samples which appeared to contain abundant organics.

The sand in the upper ±4 to 7 feet of the profile is loose and susceptible to settlement. The relatively high moisture contents and the low SPT blow counts suggest that the fine-grained soils throughout the upper ±60 feet of the deposit are also very compressible and, therefore, will have high potential for consolidation if new ground pressures are applied to the site. Consolidation is a time-dependent process which occurs as soils are compressed and pore water is forced out of the void spaces. The rate of consolidation is primarily a function of the rate at which the pore water is able to drain.

The results of the consolidation tests indicate preconsolidation pressures ranging from 1.5 ksf to 1.6 ksf for the four samples tested. In-situ ground pressures at the sample depths were estimated assuming reasonable unit weights for the soils. Comparison of the estimated in-situ pressures and preconsolidation pressures suggest that the dredge fill (SH-1-3 and SH-3-3) is slightly overconsolidated. Sample SH-4-7, taken from the upper portion of the underlying native slough deposits, appears to be normally consolidated (SH-4-7), while SH-2-10, taken from 45 to 47 feet, is slightly underconsolidated.

The field and laboratory test results suggest that the fine-grained dredge fill and the upper portion of the underlying slough deposits have essentially become stable (in terms of settlement) under their own weight while the lower portions of the soft slough deposits are still undergoing consolidation as the result of the placement of the dredge fill. Therefore, the addition of new structures to the site or any grading operations which result in an increase in ground pressure are expected to result in deep-seated settlement. Long-term consolidation could impact roadways, structures and utilities. A significant portion of the settlement (primary consolidation) may occur relatively quickly. However, considering the composition of the soils, the presence of scattered organics and the thickness of the deposits, long-term settlement (secondary compression) is also likely to be a significant component.

Utility Construction Issues

The sand occupying the upper ±4 to 7 feet of the soil profile has essentially created a working surface within the property which is able to support vehicle traffic. The fine-grained soils directly underlying the sand are soft, wet and compressible. Utility trenches extending more than ±4 to 7 feet below the existing ground surface will likely extend into these soft and wet soils. Therefore, trench side Wall stability and bottom stabilization could be significant concerns for deeper utilities.

Seismic Issues

The Oregon Structural Specialty Code (OSSC) classifies the Coos Bay area as lying within a region (Zone 4) which has the greatest risk of being impacted by a seismic event. A relatively high peak ground acceleration (pga) of 0.4g (on rock) is recommended for the design of structures in this area based on an earthquake having a return period of 475 years. More detailed Seismic Design Maps for the State of Oregon, prepared by Geomatrix (1995), indicate a similar peak ground acceleration of 0.37g (on rock) for an earthquake having a 500-year return period.

The site is underlain by a relatively deep d_eposit of soft, fine-grained soils. Such deposits can cause amplification of ground accelerations and displacements as earthquake motions are attenuated upward from the bedrock to the ground surface. Ground motion amplification can cause relatively large surface accelerations to be triggered by relatively small to moderate earthquakes.

The relatively low SPT values in the sandy soils in the upper ±40 feet of the profile and the shallow ground water levels suggest that liquefaction will also likely be an issue at some locations during moderate to large earthquakes. Liquefaction may lead to significant ground subsidence during or immediately following an earthquake. Liquefaction issues are discussed in more detail in subsequent sections of this report.

METHODS FOR IMPROVING THE SUBSURFACE CONDITIONS

Long-term settlement due to consolidation of the deep, fine-grained deposits could be mitigated using a surcharge program. The surcharge would consist of a temporary fill applying ground pressures greater than those anticipated from future site grading and permanent structures. The weight of the surcharge pre-induces long-term settlement anticipated from future site development within a much shorter duration. Because the portion of the site proposed for development covers ± 78.5 acres, we anticipate that a rolling surcharge covering ± 1 to 2 acres at a time would be required to reduce the surcharge material to a workable volume.

Surcharging is not expected to be very effective in densifying the loose sand deposits underlying the site. Densification of these granular soils typically requires vibration to rearrange the particles. The sand in the upper ± 4 to 7 feet of the profile could be partially excavated and recompacted using conventional equipment (i.e., excavators, dozers and rollers). However, the deeper deposits encountered froni ± 19 ½ to 29 ½ foet in BH-1, from ± 9 ½ feet to 37,½ feet in BH-3, from ± 21 to 31 feet in BH-4 will likely not substantially density from a surcharge or surface compaction and mc1y remain susceptible to liquefaction in the event of an earthquake. Conv_entional methods for densifying the deeper sand deposits (e.g., dynamic deep compaction, vibrating mandrel, etc.) are not expected to be practical because of the scattered locations of the deposits. These vibration compaction methods also would not be effective in consolidating the fine-grained soils.

Pile foundations could be used in conjunction with a surcharge program to help mltlgate seismic issues. The piles would support new structures and transfer the loads below the limits of the liquefiable soils. However, roads and utilities not supported on deep foundations may still be susceptible to damage from liquefaction and corresponding ground subsidence.

ENGINEERING ANALYSIS

Consolidation Settlement

W• performed settlement analyses using the computer program SETTLG in combination with the field and laboratory data to estimate potential consolidation settlement from site grading and to evaluate the suitability of using a surcharge to preconsolidate the fine-grained soils. The soil profile at BH-1 was selected for the analysis to represent the "worst case" condition. The consolidation test results were used to estimate the densities and compressibility properties of the dredge fill and underlying fine-grained alluvium. Other soil layers were assigned reasonable densities and consolidation index properties.

A unit weight of 120 pcf was assumed for the surcharge fill material. Fill heights ranging from 2 feet to 15 feet were selected providing ground pressures ranging from 240 psf to 1,800 psf. Surcharge lateral dimensions of 1OOx100 feet and 1,000x 1,000 feet were assumed and the resulting settlement was evaluated at three locations: 1) the corner of the surcharge, 2) midway between the corner and center of the surcharge, arid 3) at the center of the surcharge.

The variation of settlement with fill height for 100x100 foot and 1,000x1 ,000 foot surcharges is shown on Figures 3 and 4, respectively .. The results indicate that the site will be extremely sensitive to grading operations. That is, large settlements are anticipated for relatively small increases in ground pressure. Settlements, due to primary consolidation, ranging. from ± 12 to 60 inches were estimated for the center of surcharge fills 2 to 15 feet in height {corresponding to ground pressures of 240 to 1,800 psf). Long-term, secondary compression would be expected to add ± 1 to 4 inches of settlement if fill remains in place indefinitely.

It should be understood that the soil profiles encountered in the borings vary with location and are typically comprised of alternating layers of sand, silt and clay containing variable amounts of organics. Consequently, we anticipate that the actual settlements would also vary significantly with location. Therefore, the estimated consolidation settlements and durations for completing primary consolidation presented herein should be considered as approximate only.

Time Rate of Settlement

The results of the laboratory testing were used to estimate the progression of primary consolidation with time for fill ranging from 2 feet to 15 feet in height (i.e., ground pressures ranging from 300 psf to 1,800 psf). The results, plotted on Figure 5, indicate that it could take ± 10 to 15 years to complete 90% of the consolidation settlement caused by the weight of new structures or additional permanent fill. It is possible that the actual duration may be longer considering that the lower portion of the original slough deposit appears to still be undergoing consolidation under the weight the dredge fill placed 20 years ago.

The principle reason for the relatively long consolidation duration is the length of the drainage path. The soft, compressible soils encountered in BH-1 extend as much as ± 60 feet below the existing ground surface. Therefore, water squeezed out of these deposits by the weight of the new fill has to drain through as much as 60 feet of soil to reach the ground surface and complete consolidation.

The results of the settlement analysis can be used to evaluate the suitability of using a surcharge program (applying ground pressures greater than the anticipated permanent ground pressures) to pre-induce consolidation settlements. As an example, assume that the addition of new permanent fill and structures will add ground pressures equivalent to ± 5 feet of surcharge fill {± 600 psf). Long-term consolidation settlement associated with this ground pressure could be as high as ± 34 inches and would be expected to occur over of period of 15 years or more.

For this case, a surcharge capable of inducing at least ±40 inches of settlement would be recommended to pre-induce more than the estimated long-term consolidation settlement and provide an additional factor of safety against settlement caused by future grading operations. We estimate that a 10-foot high (±1,200 psf) surcha.rge could induce the required settlement in ±,2 years. A 15-foot high (1,800 psf) surcharge could reduce the required surcharge period to ±10 months. Assuming that a rolling surcharge covering ±1 to 2 acres at a time would be used, a surcharge fill volume of ±1.6,000 c.y. to ±49,000 c.y. would be required. Therefore, the theoretical time required to complete a rolling surcharge of the entire 78.5-acre property could be ±40 to 150 years, assuming surcharge durations ranging from 1 to 2 years at each location.

Surcharge Combined with Wick Drains

Vert.ical wick drains could be used to speed the consolidation process by improving the drainage of the consolidating soils. Wick drains typically consist of a band-shaped (rectangular- cross-section) plastic core sheathed in a geotextile filter fabric. The core provides a free-draining path for water to escape while the geotextile helps to prevent fines from clogging the core.

We performed an analysis to develop a preliminary estimate of the reduction in surcharge duration if wick drains are used. We assumed an equivalent drain diameter of 0.16 feet, a drain length of ±60 feet and drain spacings of 8 feet, 10 feet and 12 feet. "Ideal" conditions were assumed. That is, we did not account for any reduction in flow capacity due to soil disturbance around the drains or resistance within the drains. . It should be understood that the results presented herein are preliminary only and are not intended for design. More detailed analysis would be required to establish design recommendations, if wick drains are considered a viable option based on the results of this preliminary work.

Estimated settlements for a 10-foot high surcharge with and without wick drains are plotted in Figure 6. For the example given above, where a target settlement of ±40 inches is required, the results indicate that the ±2 year surcharge duration (without drains) could be reduced to ±2 tp 4 months (with drains). Assuming that a rolling surcharge covering ±1 to 2 acres at a time would be used with a duration of 4 months at each location, the time required to complete a surcharge of the ±78.5-acre property could, theoretically, be reduced to ±13 to 26 years. The actual total surcharge time will depend upon such factors as the actual height and unit weight of the surcharge fill, the speed at which the surcharge can be moved across the site, and the flow capacity and spacing of the drains used.

We reviewed bids from a previous project incorporating wick drains to estimate the costs of their installation. Unit costs for wick drains typically range from $0.45 to $0.70 per linear foot (including installation). Assuming a drain length of 60.feet, a unit cost of $0.60 per linear foot and spacings ranging from 8 feet to 10 feet, we estimate that the costs of installing wick drains could range from $11,000 to $24,500 per acre.

liquefaction Analysis

We performed an analysis to evaluate the susceptibility of the and deposits to liquefacti<;rn and subsidence during an earthquak . The soil profile at BH-3 was selected to represent the worst *case* condition. Peak ground accelerations at the ground surface ranging from 0.1 g to 0.4g were used in the analysis, corresponding to small to large earthquakes. The results suggest partial liquefaction of the ± 18-foot thick sand deposit for a pga of 0.1 g and complete liquefaction of the deposit for pga's of 0.2g and higher. We estimate that ground settlements as a result of the liquefaction of this layer could be as much as 9 inches.

We anticipate that potentially liquefiable, loose sand deposits similar to those encountered in BH-1, BH-3 and BH-4 are scattered across the site at various depths. Some of the low plasticity silts underlying the site may also be susceptible to liquefaction_. Therefore, ground settlements of varying magnitudes are expected to occur at several locations on the property during or immediately following an earthquake.

SUMMARY/CONCLUSIONS

Based on the results of our laboratory tests, it appears that the upper portion of the soft, slough deposits have consolidated under the weight of the dredge fill, while some of the lower soils may still be undergoing consolidation. Both the dredge spoils and the slough deposits have retained high water contents and high levels of saturation and are extremely compressible. Therefore, the introduction of new fill or structures is expected to lead to large settlements. Long-term consolidation settlement could take as mu9h as ± 10 to 15 years to complete.

The results of our settlement analysis indicate that a surcharge would be effective in reducing the time required to induce estimated settlements resulting from the construction of new structures or fill. The actual surcharge height requirements will depend upon several factors including: 1) the anticipated new ground pressures associated with the planned development, 2) the unit weight of the surcharge fill used, and 3) the acceptable duration of the surcharge program. Our preliminary calculations indicate that the installation of wick drains may reduce the required surcharge durations by a factor of ± 3. The actual reduction in consolidation time and the costs of installing the wick drains will depend upon the capacity and the spacing of the drains used.

The soil pr'ofiles encountered in the borings vary with location and are typically comprised of alternating layers of sand, silt and clay containing variable amounts of organics. Therefore, the estimated consolidation settlements and durations presented herein should be considered as approximate only. Settlement plates and piezometers will be required in the field to record the actual consolidation of the soils over time and evaluate when it is acceptable to move the surcharge fill.

If, based on the results of this settlement analysis, surcharging the site is determined to be practical, we would recommend that a test surcharge program be conducted. The test program would more accurately define the field performance and required durations of the surcharge. It would also help to identify construction issues related to the placement and transportation of the surcharge fill.

It should be understood that a surcharge program will not be effective in m1t1gating the seismic issues. While the pre-consolidation would reduce the compressibility of the fine-grained soils, we do not anticipate that the strength of the soils would increase significantly. Therefore, amplifications of ground motions in the deep fine-grained soil deposits will likely occur during seismic events. Additionally, a surcharge program will not to be effective in densifying the loose sand deposits underlying the site. These deposits would be expected to remain highly susceptible to liquefaction during both moderate and large earthquakes after the completion of the surcharge. Mitigation of both seismic and settlement issues would likely require supporting structures on pile foundations as well as surcharging the site. However, utilities and infrastructure not supported on piles would still be at risk of damage during an earthquake due to liquefaction. In summary, the site conditions are considered poor for the proposed development and even partial mitigation of these conditions will be costly and time consuming.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS REPORT AND WARRANTY

The analysis, conclu_sions, and recommendations contained herein are based on the assumption that the soil profiles and the ground water levels encountered in the borings are representative of overall site conditions. The above recommendations assume that we will have the opportunity to review final drawings and be present during construction to confirm assumed foundation conditions. No changes in the enclosed .recommendations should be made. without our approval. We will assume no responsibility or liability for any engineering judgment; inspection, or testing performed by others.

This report was prepared for the exclusive use of Richard P. Turi Architecture and Planning, the Port of Coos Bay and their design consultants for the Port of Coos Bay - Eastside Development project in Coos Bay, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for planning only, and is not for final design. Contractors using this information to estimate construction quantities or costs do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or ground water by hazardous or toxic materials. We assume that those services, if needed, have been completed by others.

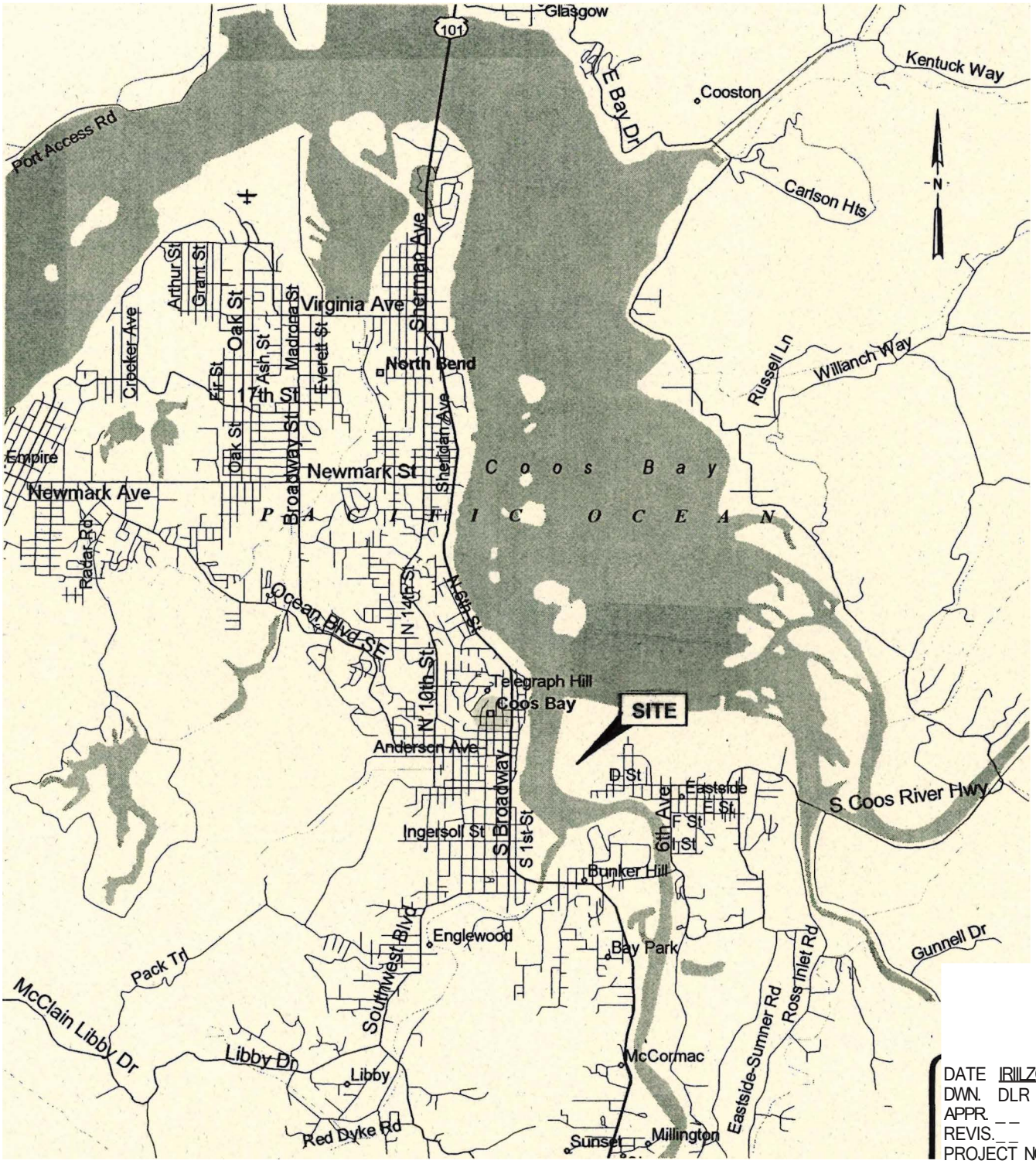
Our work was done in accordance with generally accepted soii and foundation engineering practices. No other warranty, expressed or implied, is made.

Appendix A.

*-Figures

Professional
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Foundation Engineering, Inc.



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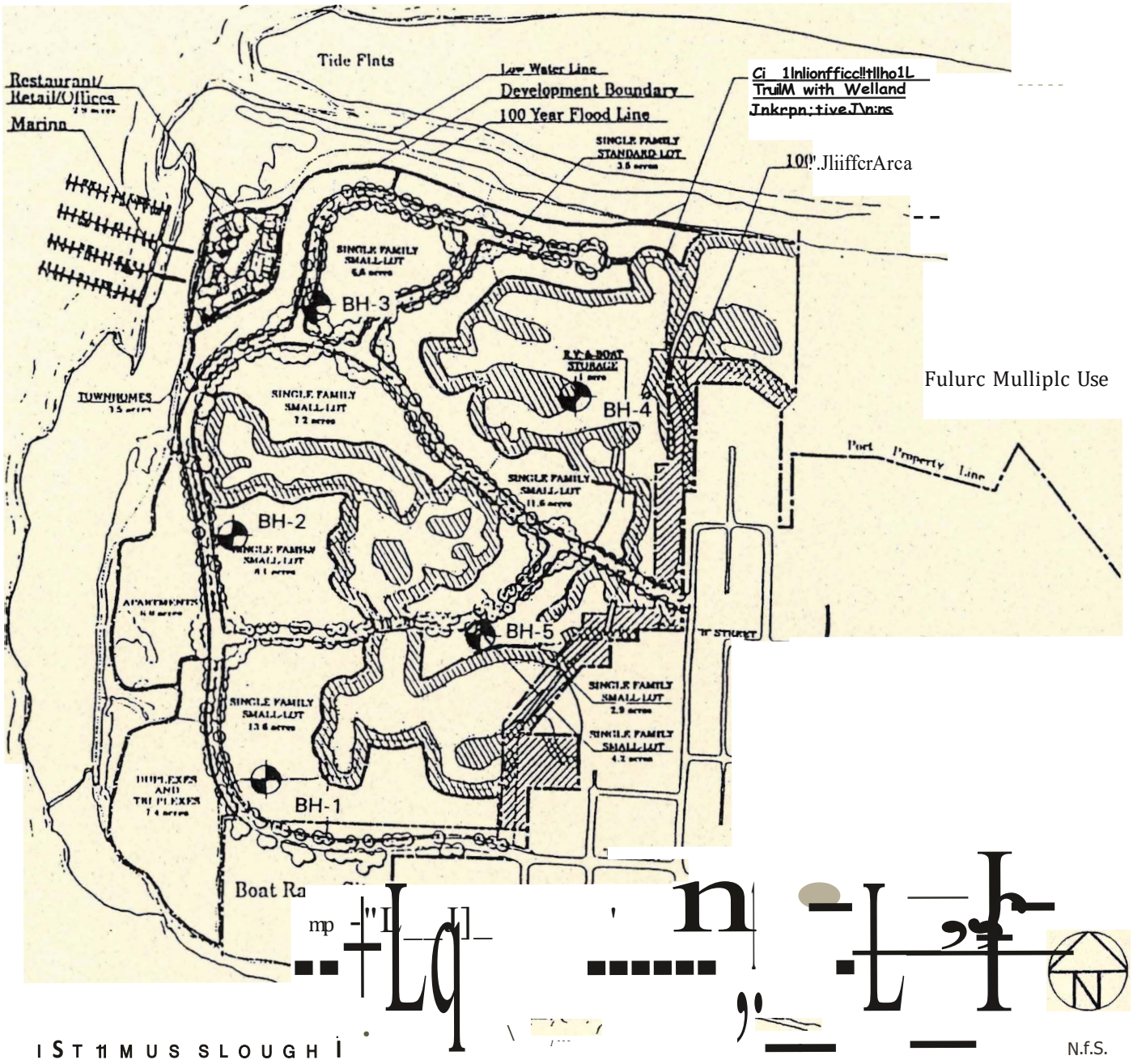
FOUNDATION ENGINEERING INC.
PROFESSIONAL GEOTECHNICAL SERVICES
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CORYAWS. OR 117333--104.f
BUS. (541) 757-7845 Fil (541) 757-?el50

VICINITY MAP

PORT OF COOS BAY EASTSIDE DEVELOPMENT
COOS BAY, OREGON

FIGrnE NO.

1



Ci 1Inlionfficc!ttllho1L TruilM with Welland Jnkrpn;tive.JTn:ns

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NOTES:

1 BASE MAP WAS PROVIDED BY RICHARD P TURI ARCHITECTURE AND PLANNING.
2. BOREHOLE LOCATIONS WERE ESTABLISHED BY PACING AND ARE APPROXIMt>.TE ONLY.

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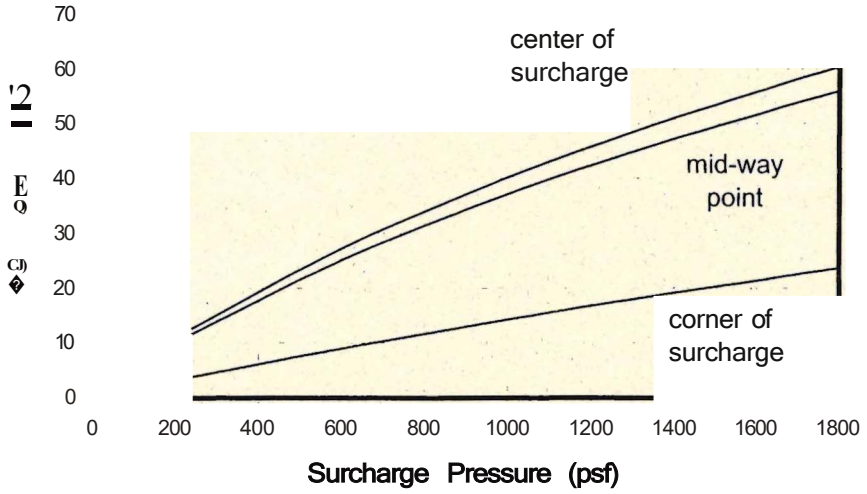
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SITE PLAN AND BORING LOCATIONS

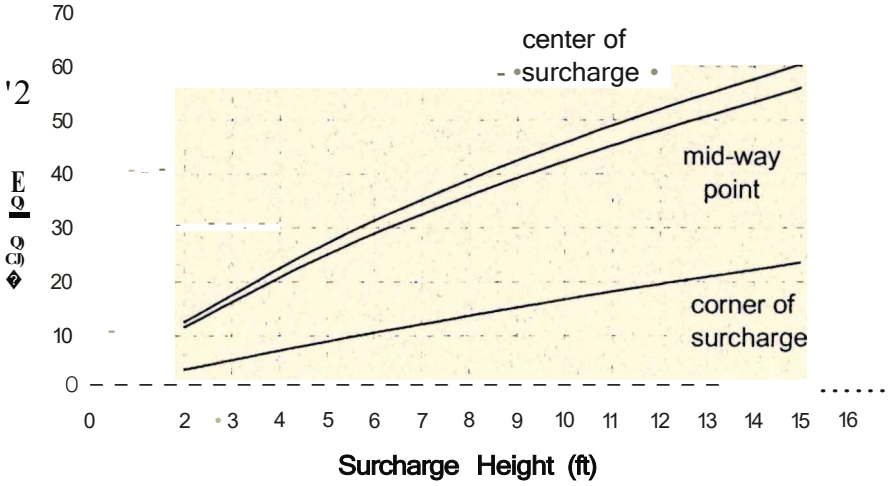
PORT Or COOS BAY EASTSIDE DEVELOrMENT
COOS BAY, Ot EGON

FIGURE NO.

2



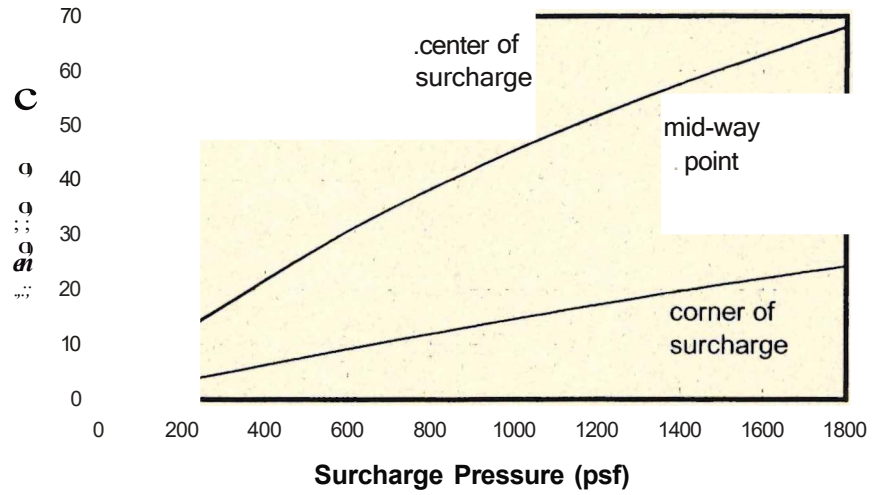
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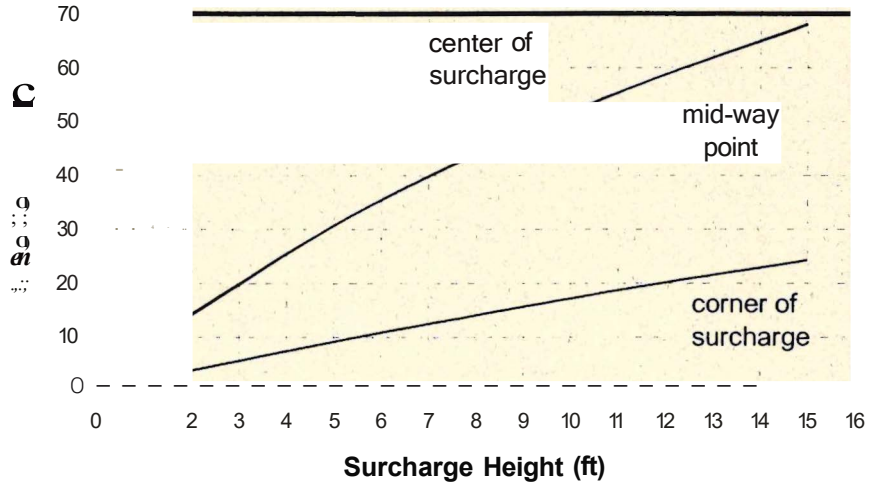
(b)

Notes:
1. Est. settlments assume a uniform surcharge will be in place throughout primary consolidation.
2. Surcharge height assumes a unit weight of 120 pcf for fill.

Figure 3. Estimated Settlement vs. Surcharge (a) Pressure and (b) Height for 100 foot by 100 foot Surcharge Area.



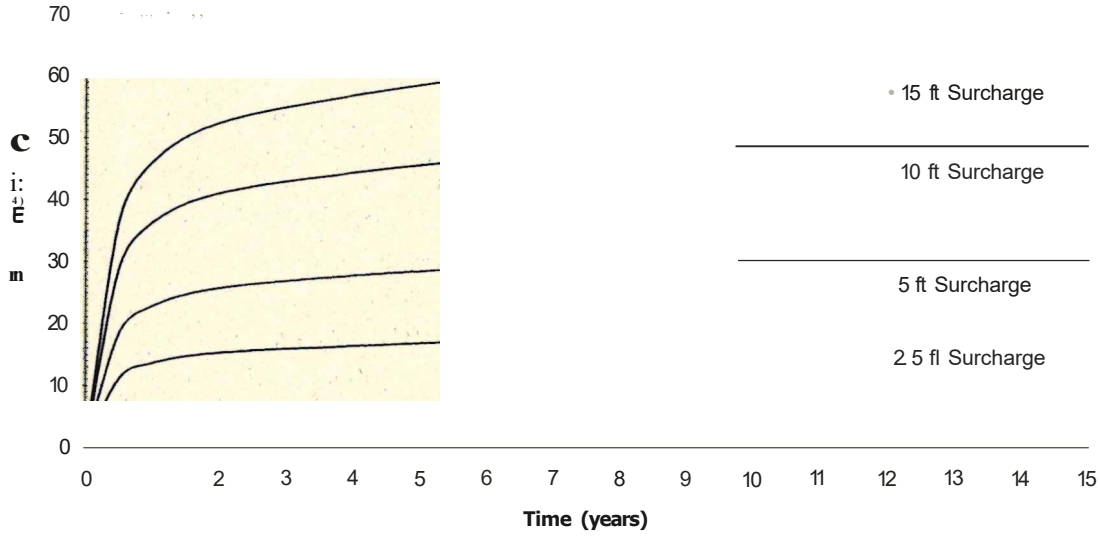
(a)



(b)

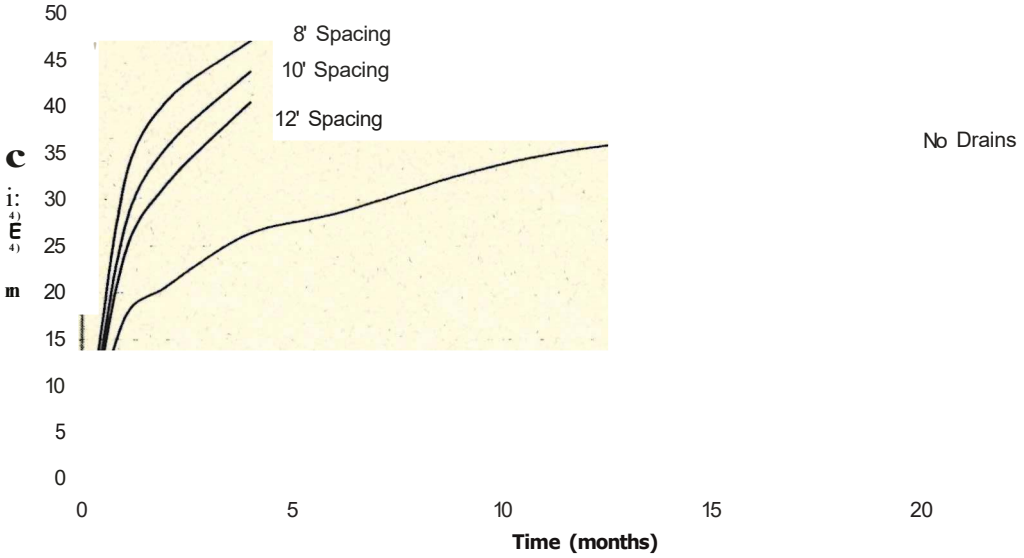
Notes:
1. Est. settlments assume a uniform surcharge will be in place throughout primary consolidation.
2. Surcharge height assumes a unit weight of 120 pcf for fill.

Figure 4. Estimated Settlement vs. Surcharge (a) Pressure and (b) Height for 1,000 foot by 1,000 foot Surcharge Area.



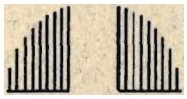
Notes:
1. Settlement is estimated for the center of a 1OO'x100' uniform surcharge.
2. Surcharge height assumes a unit weight of 120 pcf for fill.

Figure 5. Variation of Estimated Settlement with Time (No Wick Drains).



Notes:
1. Settlement is estimated for the center of a 100'x100' uniform surcharge.
2. Surcharge height assumes a unit weight of 120 pcf for fill.
3. Additional consolidation from drain installation assumes "ideal conditions" (i.e., no soil disturbance around wick drain and no drain resistance).

Figure 6. Variation of Estimated Settlement with Time for 10 foot Surcharge with and without Wick Drains.



Appendix B·

Boring Logs

Professional
Georechnical
Services

Foundation Engineering, Inc.

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepored for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also .contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the laboratory examinations and tests. Our recommendations are based on the contents of the fii;,al logs and the information contained therein and not on the field logs.

VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

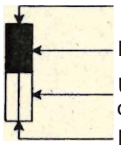
The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be **aware** that soil conditions at other locations or on other dates· may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines de•ignating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS

s+-3-4
J J t___Sample Number
L.'===Boring or Test Pit Number
Sample Type



S - Grab Samples
SS - Standard Penetration Test Sample (split-spoon)
SH - Thin-walled Shelby Tube Sample
C Core Sample
CS - Continuous Sample

A Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split-spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

• Water Content *(%):*

UNIFIED s·o1L CLASSIFICATION SYMBOLS

G - Gravel
S - Sand
M - Silt
C - Clay
Pt - Peat

W - Well Graded
P - Poorly Graded
L - Low Plasticity
H - High Plasticity
0 - Organic

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or pocket penetrometer devices.

TYPICAL SOIL/ROCK SYMBOLS

Sand
Clay
Basalt
Silt
Gravel
Siltstone

WATER TABLE

_Y_ Water Table Location
(1/31/00) Date of Measurement
Piezometer Tip Location (if used)

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SYMBOL KEY
BORING AND TEST PIT LOGS

Explanation of Common Terms Used 1n Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT	5ur (tsf)	Term	SPT	Term
Easily penetrated several inches by fist.	0 - 1	< 0.125	Very Soft	0 - 4	Very Loose
Easily penetrated several inches by thumb.	2 - 4	0.125-0.25	Soft	5 - 10	Loose
Con be genetrated several inches by thum - with moderate effort.	5 - 8	0.25 - 0.50	Medium Stiff (Firm)	11 - 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	9 - 15	0.50 - 1.0	Stiff	31 - 50	Dense
Readily indented by thumbnail.	16 - 30	1.0 - 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	31 - 60	> 2.0	Hard		

* Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldoble.
Moist	Groins appear darkened, but no visible **water.** Silt/cloy will clump. Sand will bulk. Soils ore often at or near plastic limit.
Wet	Visible **water** on larger grain surfaces. Sand and cohesionless silt exhibit dilotancy. Cohesive silt/clay can be readily remolded. Soil leaves wetness on the hand when squeezed. "Wet' indicates that the soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Nonplastic	0 - 3	Cannot be rc;,lled into a thread.
Low Plasticity	3 - 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 - 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and rerolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least 1 inch thick - describe variation.
Laminated	Alternating layers at less than inch thick - describe variation.
Fissured	Contains shears and partings along plones of weakness.
Slickensides	Partings appear glossy or striated.
Blocky	Breaks into lumps - crumbly.
Lensed	Contains pockets of different soils - describe variation.

Term	Soil Cementation Criteria·
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

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COMMON TERMS

SOIL ·DESCRIPTIONS

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value' Recovery	Moisture,% RQD.,%	Installations/ Water Table
1	Very loose, silty SAND; dark grey; wet, fine sand (Fill).		0.0				Borehole backfilled with bentonite chips.
7	Soft SILT; trace clay, brown, wet, medium plasticity-(Alluvium).		7.0	SS-1-1	0		
10				SS-1-2	2		
12	Contains scattered wood debris and sand lenses.						
15	Color grades to dark grey.			SH-1-3			
17				SS-1-4	2		
20				SS-1-5	5		
25				SS-1-6	3		
26	Soft SILT; dark grey-mottled-grey, wet, medium plasticity (Alluvium).		26.0				
30	Contains interbedded sand layers.			SS-1-7	3-1		

Project No.: 99100122

Surface Elevation: NIA

Date of Boring: September 29, 1999

Boring Log: BH-1

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Li&Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	A SPT, N-Value D Recovery	Moisture,% Eil RQD.,%	installations/ Water Table
36				SS-1-8	0 5	50 100	
37							
38							
39							
40				SS-1-9	3		
41							
42							
43							
44							
45	Encountered ±3-inch diameter wood fragment			SS-1-10	0		
46	(possible tree limb).						
47							
48							
49							
50	Soft SILT; S()me clay, dark grey, moist, medium		50.0	SS-1.-11	4		
51	plasticity (Alluvium).						
52							
53							
54							
55	Soft, siltyCLAY; trace sea shells, dark grey, moist;-		55.0	SS-1-12	4		
56	high plasticity (Alluvium).						
57							
58							
59							
60				SS-1-13	6		
61							
62							
63							
64							
65				SS-1-14	8		
66							
67							
68							
69					17		

Project No.: 99100122

Surface Elevation: *NIA*

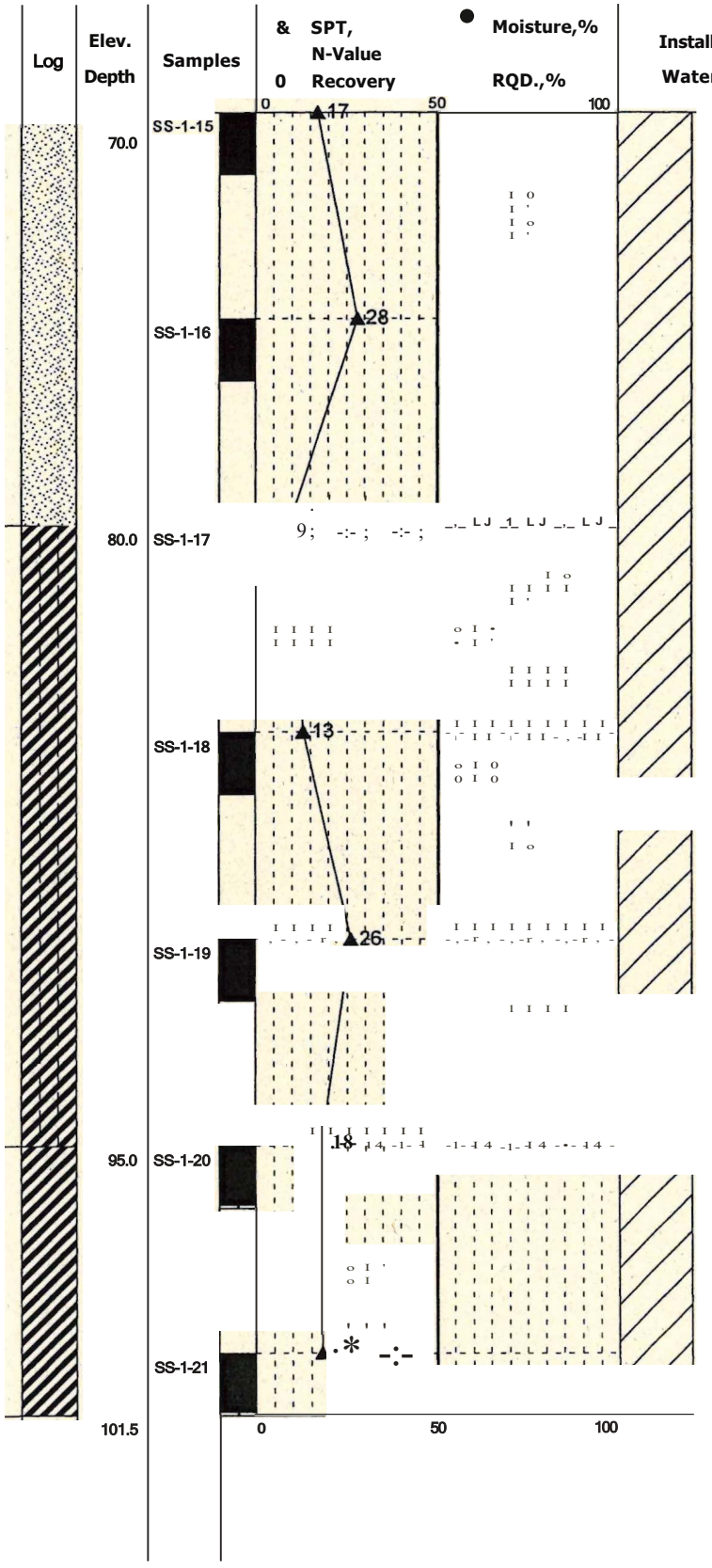
Date of Boring: September 29, 1999

Boring Log: BH-1

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Depth Feet	Soil and Rock Description and Comments	Elev. Depth
71	Medium dense ,SAND; interbedded silty clay layers, dark grey, fine to medium sand (Alluvium).	70.0
80	Stiff CLAY; some silt, dark grey, moist, high plasticity (Alluvium).	80.0
84	Contains scattered wood fragments and sand lenses.	
90	Becomes very stiff.	
95	Very stiff CLAY; dark grey, moist, high plasticity (Alluvium).	95.0
101	BOTTOM OF BORING.	101.5



Project No.: 99100122

Surface Elevation: N/A

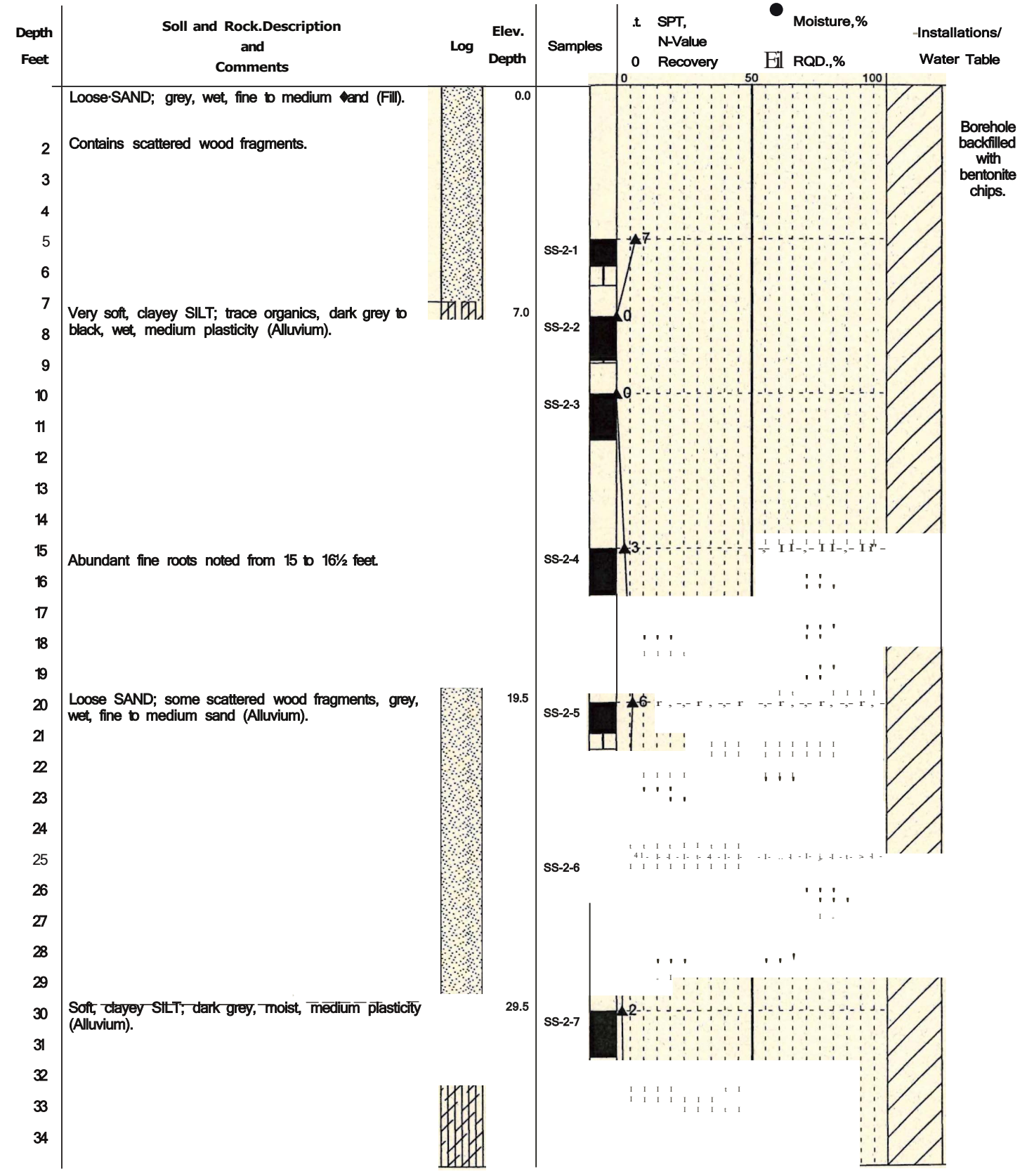
Date of Boring: September 29, 1999

Boring Log: BH-1

Port of Coos Bay Eastside Development

Coos Bay, Oregon

.. h Foundation Engineering, Inc.



Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 29, 1999

Boring Log: BH-2

Port of Coos Bay Eastside Development

Coos Bay, Oregon

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Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	••• SPT, N-Value / □ Recovery	● Moisture, % / ⌊;il RQD.,%	Installations/ Water Table
					0 3	50 100	
36	Trace fine sand and abundant fine roots noted from 35 to 36½ feet.			SS-2-8			
37							
38							
39	Becomes very soft.						
40							
41				SS-2-9			
42							
43							
44							
45	Becomes soft.			SH-2-10			
46							
47				SS-2-11			
48							
	BOTTOM OF BORING		48.5		0	50 100	

Project No.: 991 00122

Surface Elevation: N/A

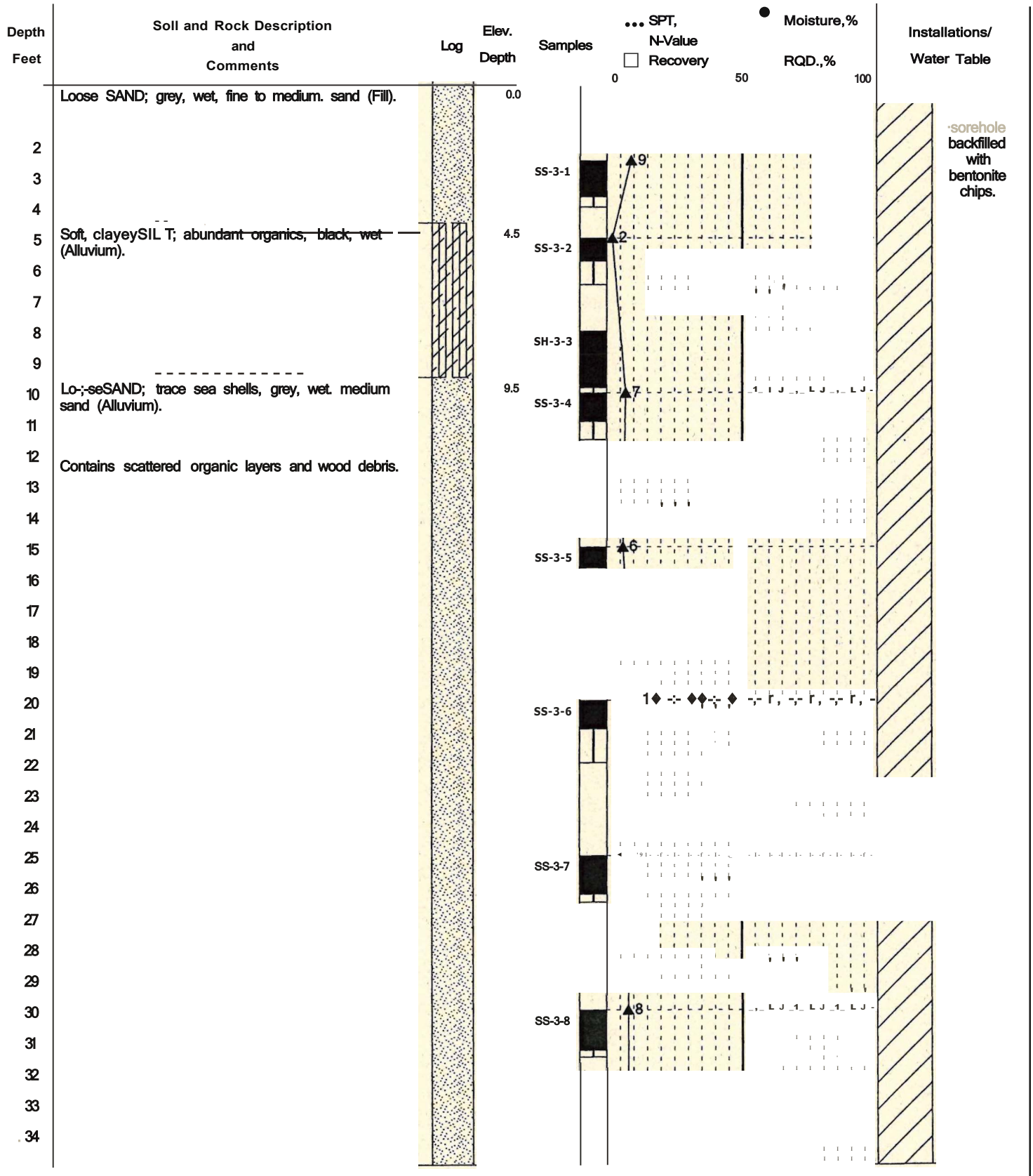
Date of Boring: September 29, 1999

Boring Log: BH-2

Port of Coos Bay Eastside Development

Coos Bay, Oregon

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Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Boring Log: BH-3

Port of Coos Bay Eastside Development

Coos Bay, Oregon

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Depth Feet	Soil and Rock Description and Comments.	Log	Elev. Depth	Samples	SPT, N-Value / Recovery	Moisture,% / RQD.,%	Installations/ Water Table
36	Grades to fine to medium SAND; trace silt.			SS-3-9			
37							
38	Medium stiff SILT; grey, moist, low to medium plasticity (Alluvium).		37.5				
39							
40				SS-3-10	5		
41							
42							
43							
44							
45				SS-3-11	6		
46							
47							
48	Medium stiff, clayey SILT; grey, moist to wet; medium plasticity (Alluvium).		48.0				
49							
50				SS-3-12	6		
51							
52	Medium stiff, clayey SILT; grey, wet, medium plasticity (Alluvium).						
53							
54							
55				SS-3-13	6		
56							
57							
58							
59							
60	Scattered wood fragments and sea shells noted.			SS-3-14	5		
61							
62							
63							
64							
65				SS-3-15	8		
66							
67							
68							
69							

Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

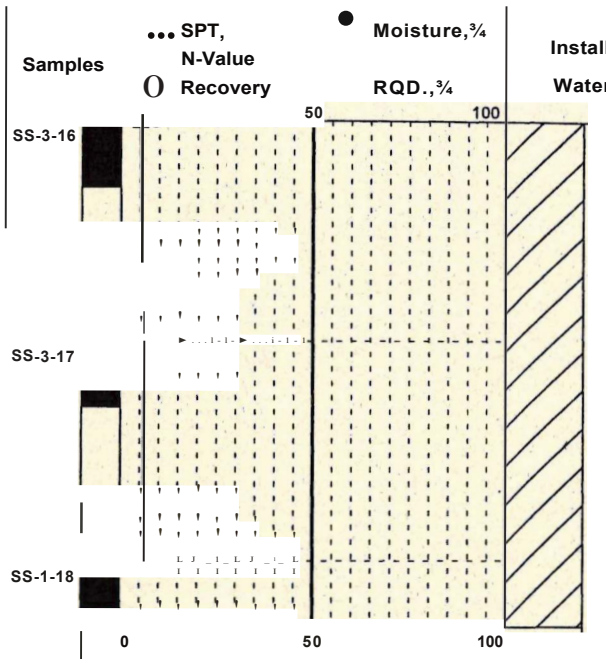
Boring Log: BH-3

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth
71			
72			
73			
74			
75			
76			
77	Medium stiff, clayey SILT; grey, wet, medium plasticity (Alluvium).		
78			
79			
80			
81			
	BOTTOM OF BORING		81.5



Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Boring Log: BH-3

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Sam pies
	Loose SAND; grey, wet, fine to medium sand (Fill).		0.0	
2				
3				
4				
5	Very soft, clayey SILT; scattered organics, dark grey to black, wet, medium plasticity (Alluvium).		4.0	SS-4-1
6				
7				
8				
9				
10	Becomes soft and contains scattered sand lenses.			SS-4-2
11				
12				
13				
14				
15				SS-4-3
16				
17				
18				
19				
20	Becomes very soft.			SS-4-4
21			21.0	
22	Very loose SAND; some silt, scattered wood fragments, grey, wet, medium sand (Alluvium).			
23				
24				
25				SS-4-5
26	Contains scattered lenses of soft, clayey silt			
27				
28				
29				
30				SS-4-6
31			31.0	
32	Very soft, clayey SILT; grey, wet, medium plasticity (Alluvium).			SH-4-7
33				
34				SS-4-8

SPT, N-Value / Recovery — Moisture,% / RQD., %

0 50 100

Installatfons/ Water Table

Borehole backfilled with bentonite chips.

Project No.:• 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Boring Log: BH-4.

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery	Moisture, % / RQD, %	Installations/ Water Table
	Contains scattered sand lenses and wood fragments.				0 50 100		
36							
37							
38							
39							
40					0		
41	Very loose.silty SAND; scattered wood fragments,- grey, wet, fine to medium sand (Alluvium).		40.2	SS-4-9.			
42							
43							
44							
45	Contains trace coarse sand below ±45 feet.			SS-4-10	31		
46							
	BOTTOM OF BORING.		46.5		0 50 100		

Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

Boring Log: BH-4

Port of Coos Bay Eastside Development

Coos Bay, Oregon

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Depth Feet	Soil and Rock Description and Comments	Elev. Depth
	Medium dense to dense SAND; scattered organics, dark grey, wet, medium sand (Fill).	0.0
7	Soft, clayey SILT; scattered organics, greytoblack-:- wet, medium plasticity (Alluvium).	7.0
15	Becomes very soft.	
20	Becomes. soft.	
26	Soft, clayey SILT; scattered organics, grey to black, wet, medium plasticity (Alluvium).	
30	Scattered sand lenses noted.	

Log

Samples

SPT, N-Value

Recovery

Moisture, -;

RQD.,%

0 50 100

Installations/ Water Table

Borehole backfilled with bentonite chips.

SS-5-1

SH-5-2

SS-5-3

SS-5-4

SS-5-5

SS-5-6

SS-5-7

Project No.: 99100122

Surface Elevation: N/A

Date of Boring: September 30, 1999

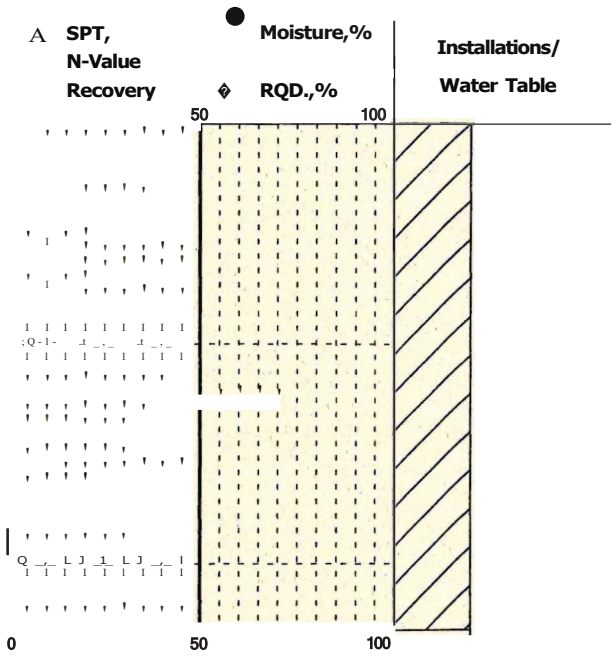
Boring Log: BH-5

Port of Coos Bay Eastside Development

Coos Bay, Oregon

.4. Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples
				SS-5-8
36				
37				
38				
39				
40				SS-5-9
41				
42				
43				
44				
45	Becomes very soft.			SS-5-10
46				
	BOTTOM OF BORING.		46.5	



Project No.: 99100122

Surface Elevation: N/A

Date of Boring: Septemoer 30, 1999

Boring Log: BH-5

Port of Coos Bay Eastside Development

Coos Bay, Oregon

Appendix C

Laboratory Test Results

Professional Geotechnical Services

Foundation Engineering, Inc.

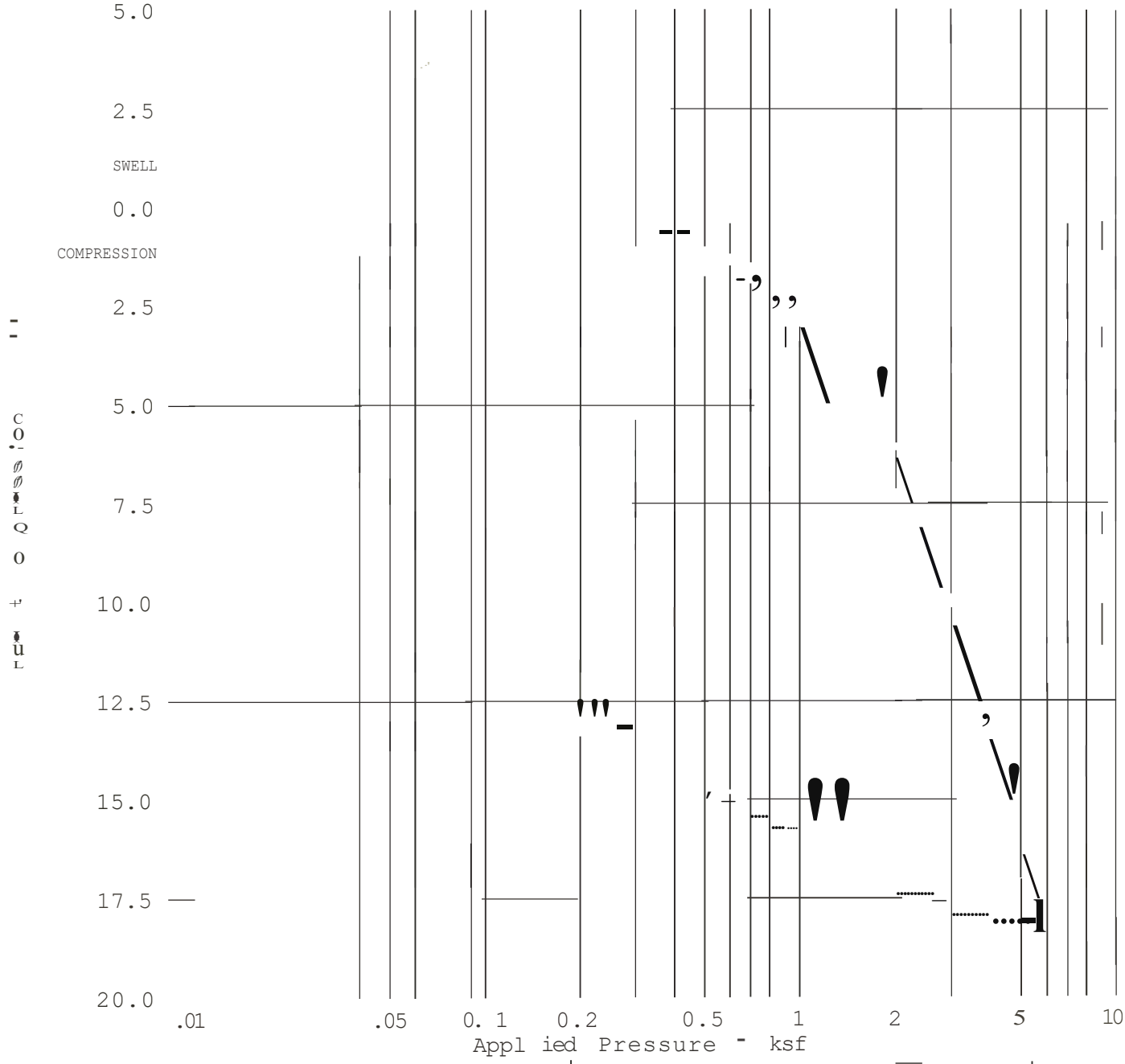
Table 1C. Natural Water Contents

Sample Number	Sample Depth (feet)	Natural Water Content (percent)
SS-1-2	10-11½	82.3
SS-1-4	17-18½	61.5
SS-1-5	20 - 21 ½	51.1
SS-1-6	25 - 26½	80.9
SS-1-7	30 - 31 ½	92.0
SS-1-9	40 - 41 ½	68.3
SS-1-11	50 - 51 ½	55.4
SS-2-3	10-11½	94.0
SS-2-4	15-16½	77.0
SS-2-5	20 - 21 ½	61.0
SS-2-7	30 - 31 ½	103.9
SS-3-2	5 - 6 ½	129.7
SS-3-5	15-16½	127.4
SS-3-7	25 - 26½	29.8
SS-3-9	35 - 36½	39.6
SS-3-10	40 - 41 ½	58.9
SS-3-12	50 - 51 ½	50.0
SS-3-14	60 - 61 ½	79.7
SS-4-1	5 - 6 ½	98.9
SS-4-3	15-16½	101.5
SS-4-5	25 - 26½	55.6
SS-4-8	33½ - 35	64.8
SS-4-9	40 - 41 ½	50.9
SS-5-3	10-11½	87.4

Table 1C. Natural Water Contents (cont.)

Sample Number	Sample Depth (feet)	Natural Water Content (percent)
SS-5-4	15 - 16½	63.4
SS-5-6	25 - 26½	93.9
SS-5-8	35 - 36½	66.5

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Precons. (ksf.)	Cc	eo
94.1 %	92.7 %	46.3	---	---	2.650		1.04	2.6101

TEST RESULTS

Compression Index = 1.04

MATERIAL DESCRIPTION

Dark grey SILT with some clay

Class: ---

Remarks:

Sample: SH-3-3 at 7.5-9.5 feet.

Project No.: 99100122
Project: Port of Coos Bay, East Side Development
Location: Coos Bay, Oregon

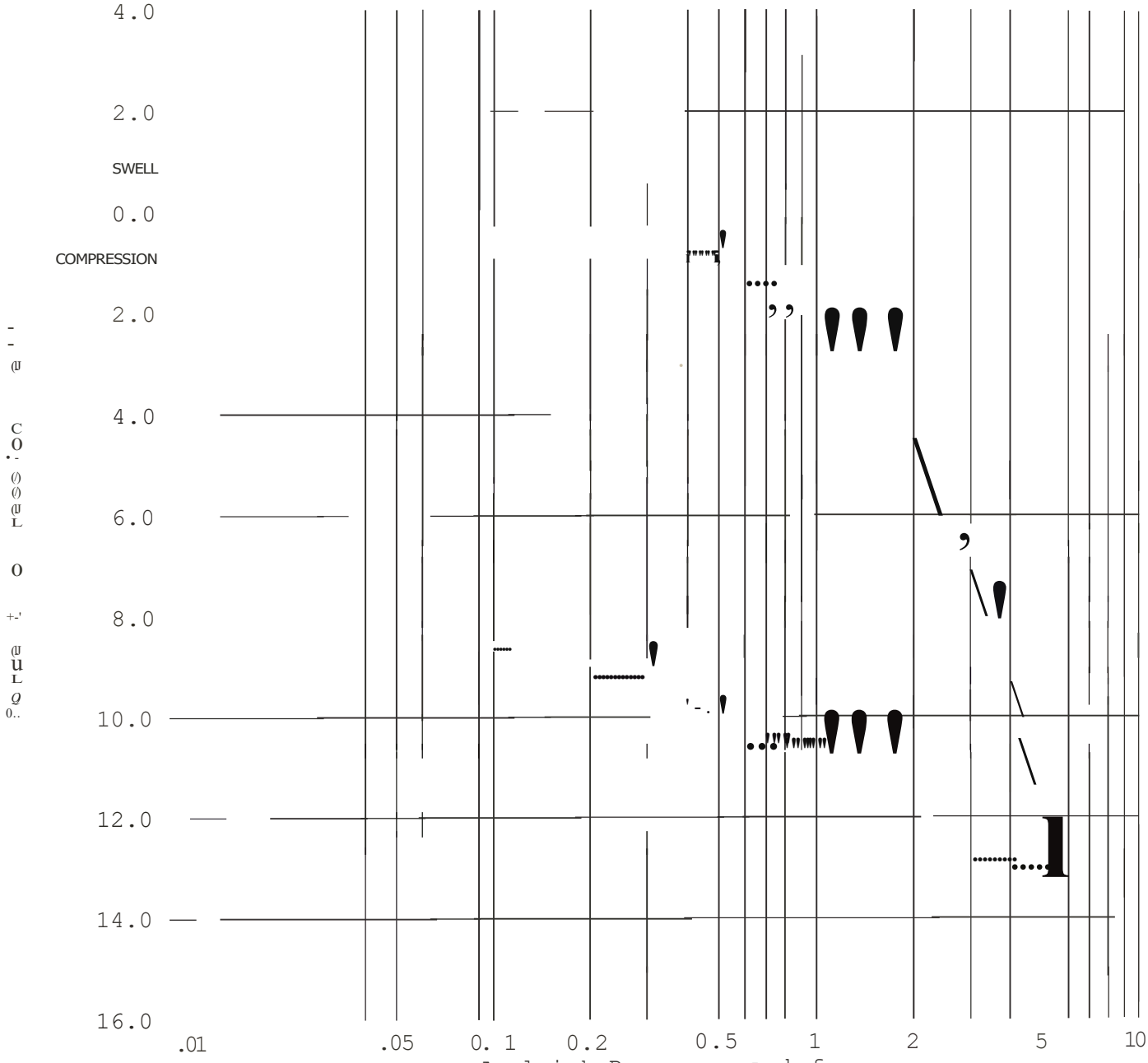
Date: 2/9/00

CONSOLIDATION TEST REPORT

Foundation Engineering, Inc.

Fig. No. 1C

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp .Gr.	Precons. (ksf)	Cc	eo
91 .8 %	82. 1 %	49.9	---	---	2.650		0.70	2.3711

TEST RESULTS

MATERIAL DESCRIPTION

Grey SILT, some clay

·compression Index 0.70

Project No.: 99100122
Project: Port of Coos Bay, East Side Development
Location: ·coos Boy, Oregon

Date: 2/7/00

Remarks:

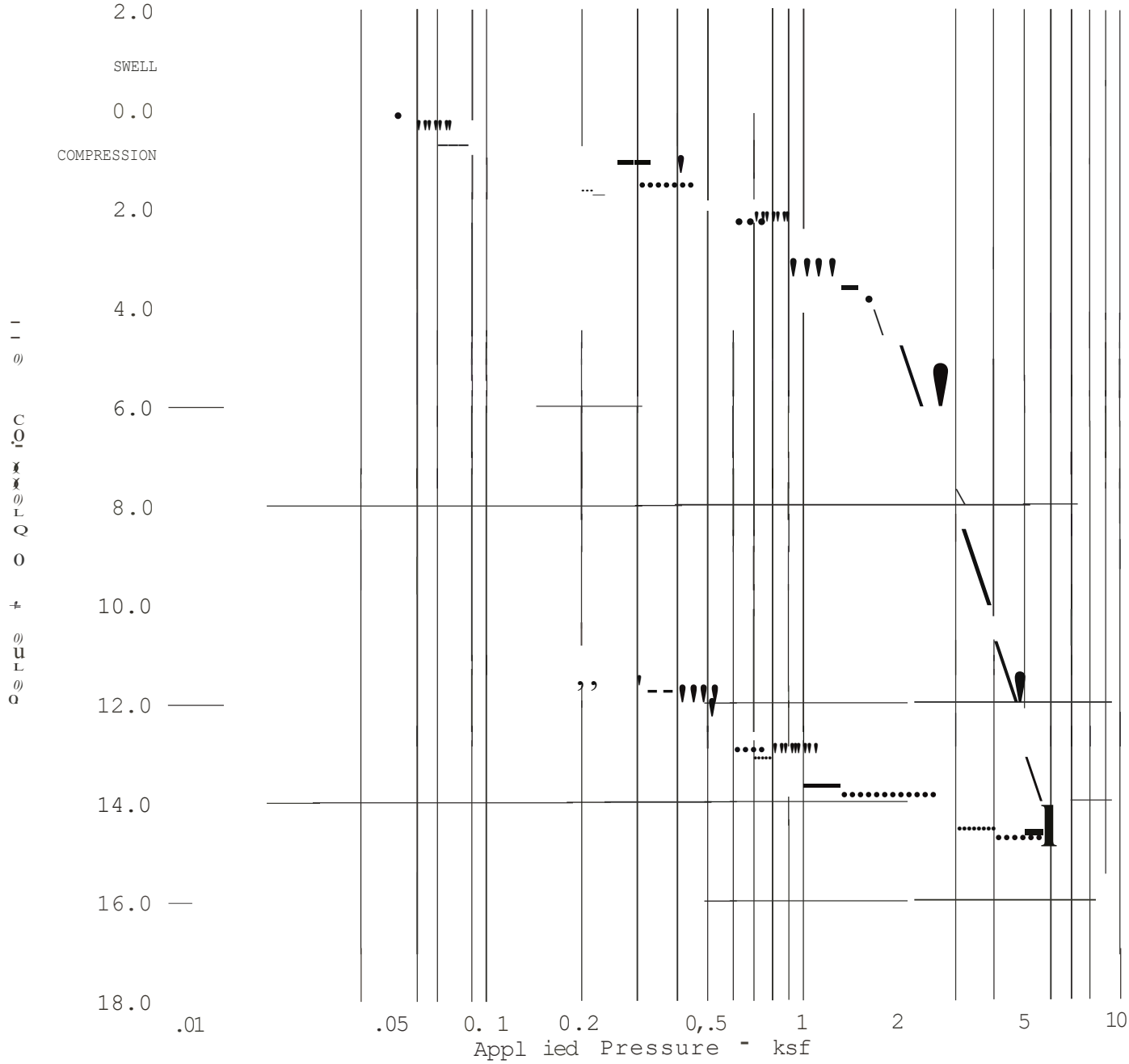
Sample: SH-1-3 at 15-17 feet.

CONSOLIDATION TEST REPORT

Foundation Engineering, Inc.

Fig. No. 2C

CONSOLIDATION TEST REPORT'



Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp. *Gr.*	Precons. (ksf)	Cc	ea
98.8 %	72.6 %	55.6	---	---	2.650		0.65	1.9468

TEST RESULTS

Compression Index = 0.65

MATERIAL DESCRIPTION

Grey clayey SILT

Project No.: 99100122
Project: Port of Coos Bay,, East Side Development
Loco t ion: Coos Bay, Oregon

Date: 2/10/00

CONSOLIDATION TEST REPORT

Foundation Eng inee, ing Inc.

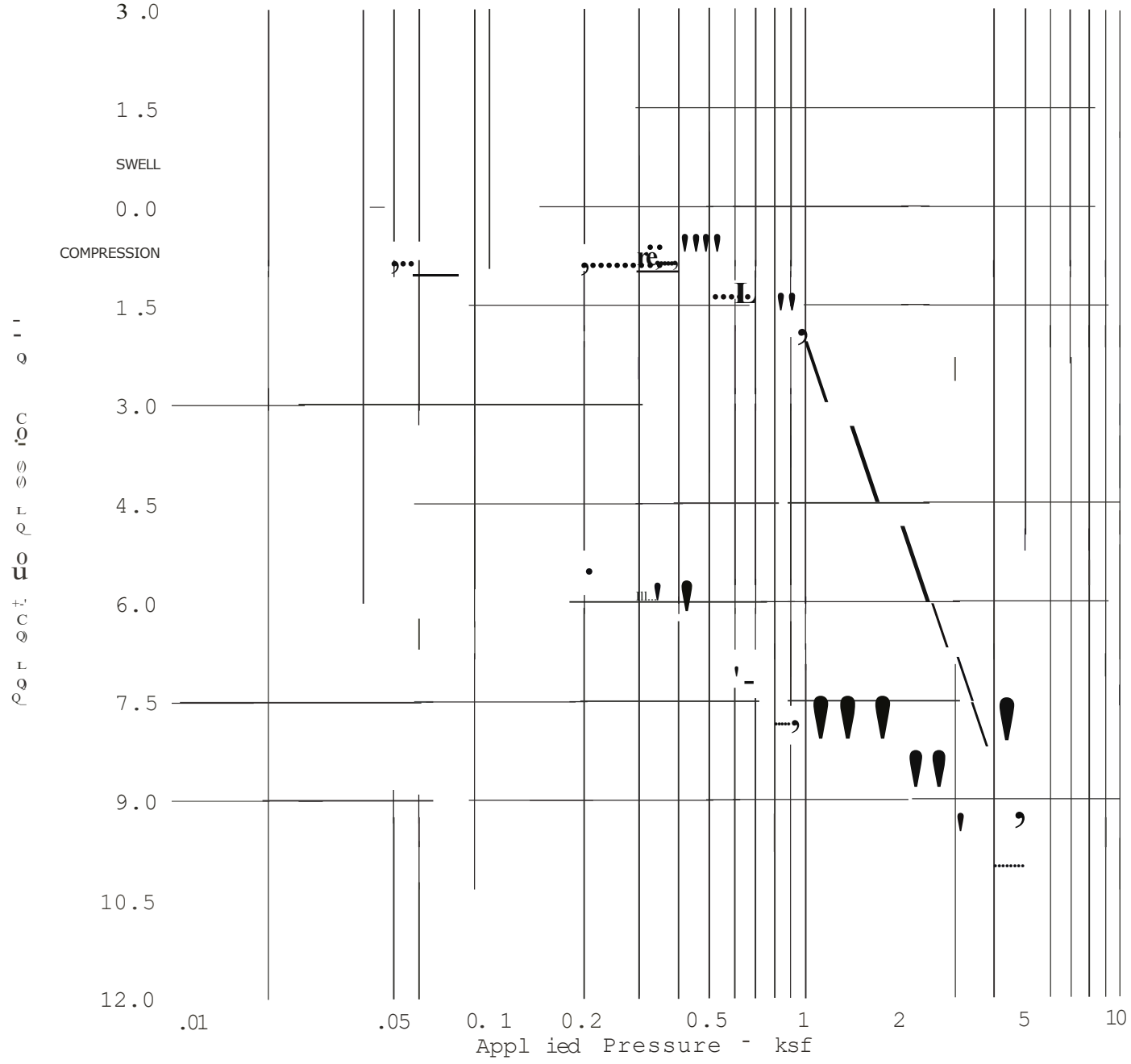
Class: ---

Re,:na rks_:

Sample: SH-4-7 at 32-34 feet.

Fig. No. 3C

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Initiol void ratio
96.8 %	72.5 %	55.5	---	---	2.650	1.9851

TEST RESULTS

MATERIAL DESCRIPTION

Grey SILT, some cloy

Project No.: 99100122
Project: Port of Coos Bay, East Side Development
Locotion: Coos Boy, Oregon

Dote: 2/8/00

CONSOLIDATION TEST REPORT

Foundation Engineering, Inc.

Remarks:

Sample: SH-2-10 at 45-47 feet.

Fig. No. 4C

Appendix I: Public Outreach Materials

In 2003, Stuntzner Engineering & Forestry, LLC (Stuntzner), was retained by Oregon International Port of Coos Bay to conduct a wetland delineation on Tax Lot 100 of Coos County Assessor's Map 25 13 26D. The delineation was submitted to the Oregon Department of State Lands, receiving concurrence under DSL File No. WD2003-0300 on August 7, 2003.

Wetland boundaries identified in WD2003-0300 were digitized then adjusted based on a review of recent aerial imagery obtained from Google Earth and one-foot interval contour data derived from LIDAR obtained from the Oregon Department of Geology and Mineral Industries (DOGAMI). Additional wetland areas were added based on National Wetland Inventory (NWI) mapping for estuarine wetlands within the defined project area. The potential wetlands identified on this figure have not been field verified and are considered approximate only. A full wetland delineation is required to determine the full extent of wetlands on-site.

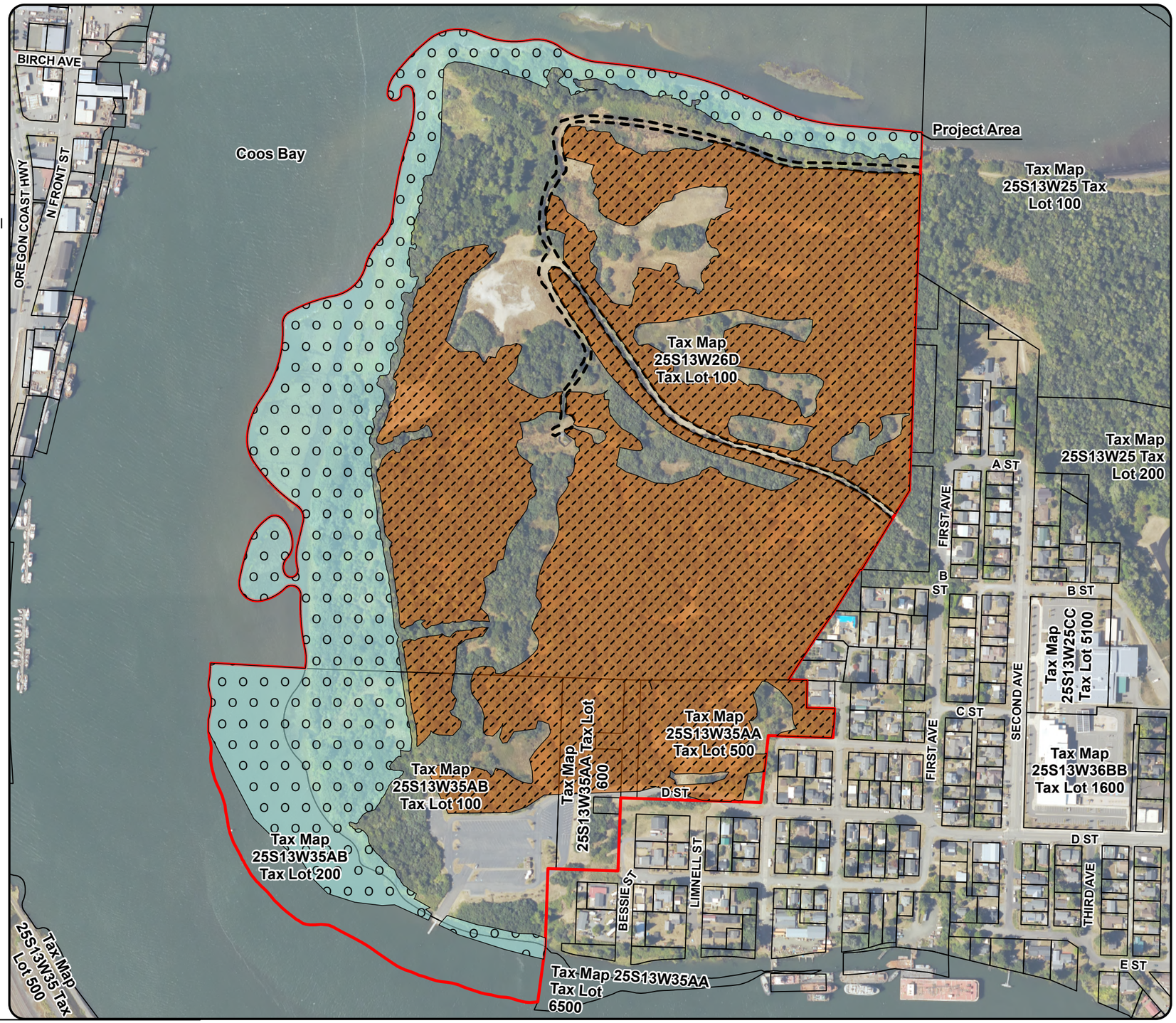
Anticipated Cowardin and Hydrogeomorphic (HGM) classifications have been assigned to the potential wetlands based on aerial review, LIDAR, and available tidal data.

Legend

- Project Area
- Potential E2EM, Estuarine Fringe Wetland
- Potential PEM/PSS, Flats Wetland
- Approximate On-site Road

This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Source: 2024 Aerial Photograph obtained from Oregon Statewide Imagery Program (OSIP). 1-foot interval contours derived from LiDAR obtained from DOGAMI (2009). Tax lot boundaries obtained from Coos county GIS database.



Print Date: 1/26/2026

Project: 12975

AKS Engineering & Forestry, LLC
12965 SW Herman RD, STE 100
Tualatin, OR 97062
P:503.563.6151 | aks-eng.com

Exhibit A
Wetland Feasibility Map

Job:12975

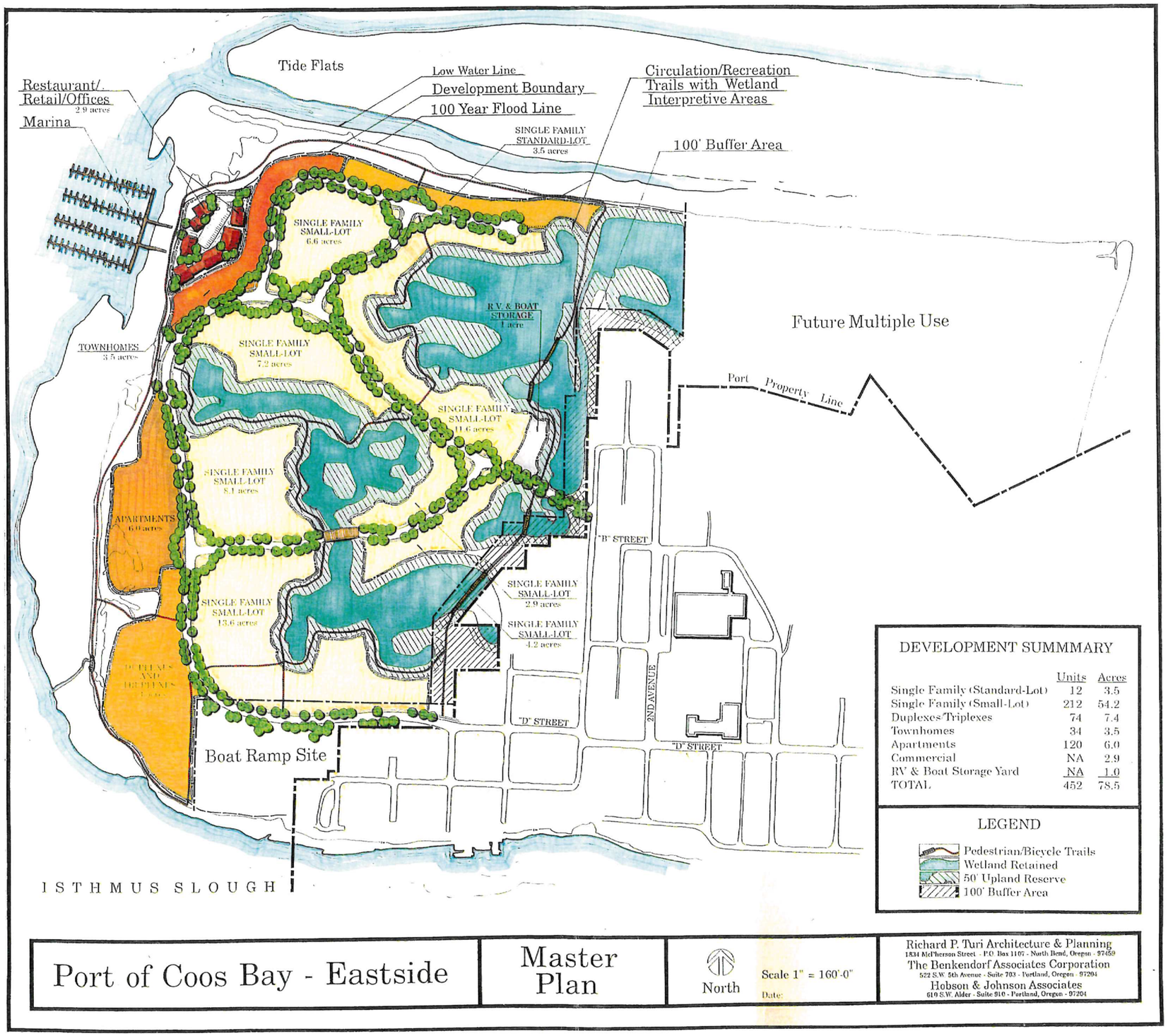
CoCoos Bay Planning Services Feasibility Study

N

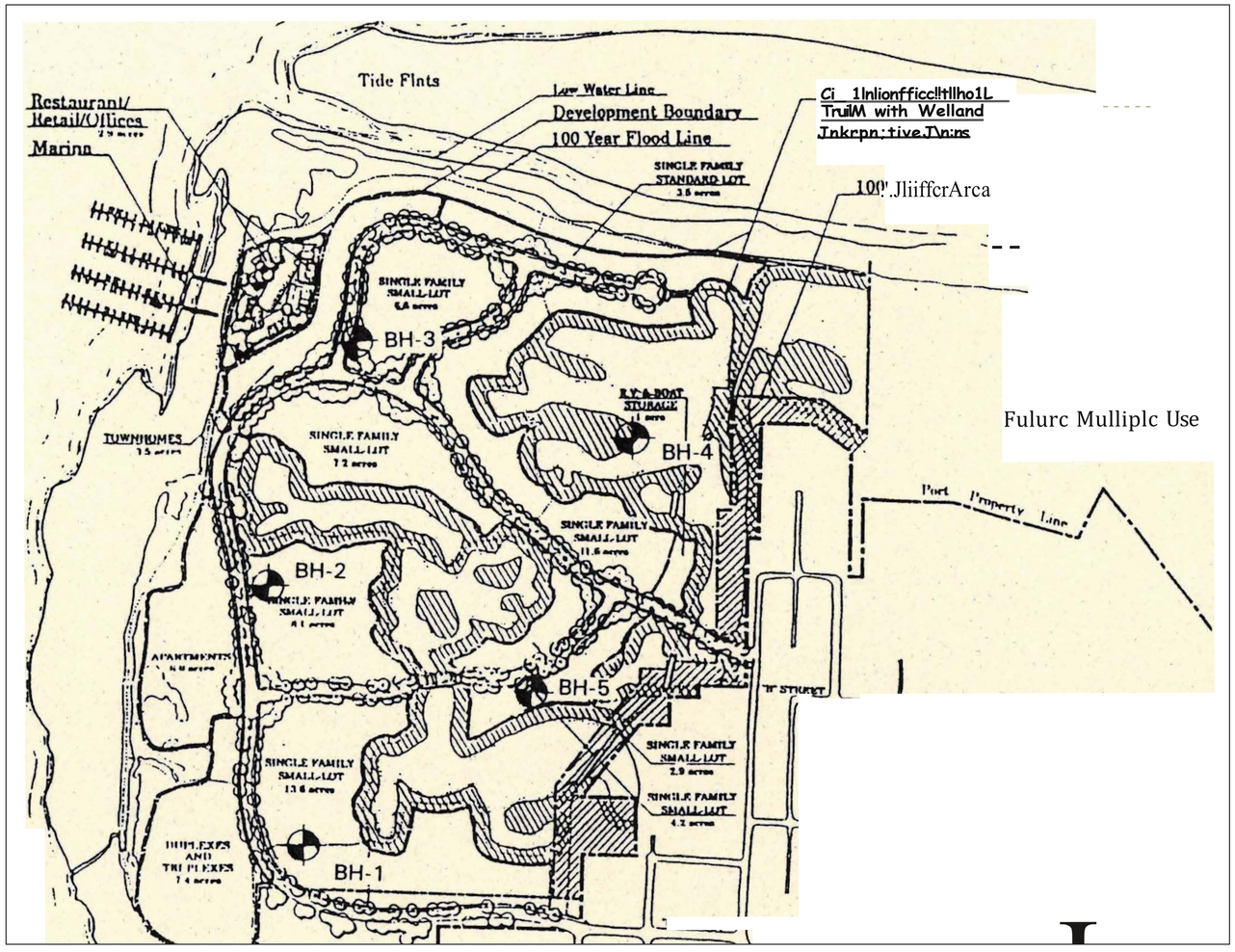
0 200 400 Feet

Printed on 11" x 17"

1996 Eastside Development Strategy



2000 Geotechnical Investigation



Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	& SPT, N-Value 0 Recovery	● Moisture,% RQD.,%	Installations/ Water Table
71	Medium dense SAND; interbedded silty clay layers, dark grey, fine to medium sand (Alluvium).		70.0	SS-1-15	17		
72							
73							
74							
75				SS-1-16	28		
76							
77							
78							
79							
80	Stiff CLAY; some silt, dark grey, moist, high plasticity (Alluvium).		80.0	SS-1-17	9		
81							
82							
83							
84	Contains scattered wood fragments and sand lenses.						
85				SS-1-18	13		
86							
87							
88							
89							
90	Becomes very stiff.			SS-1-19	26		
91							
92							
93							
94							
95	Very stiff CLAY; dark grey, moist, high plasticity (Alluvium).		95.0	SS-1-20	18		
96							
97							
98							
99							
100				SS-1-21	*		
101	BOTTOM OF BORING.		101.5				

0 50 100

Project No.: 99100122

Surface Elevation: N/A

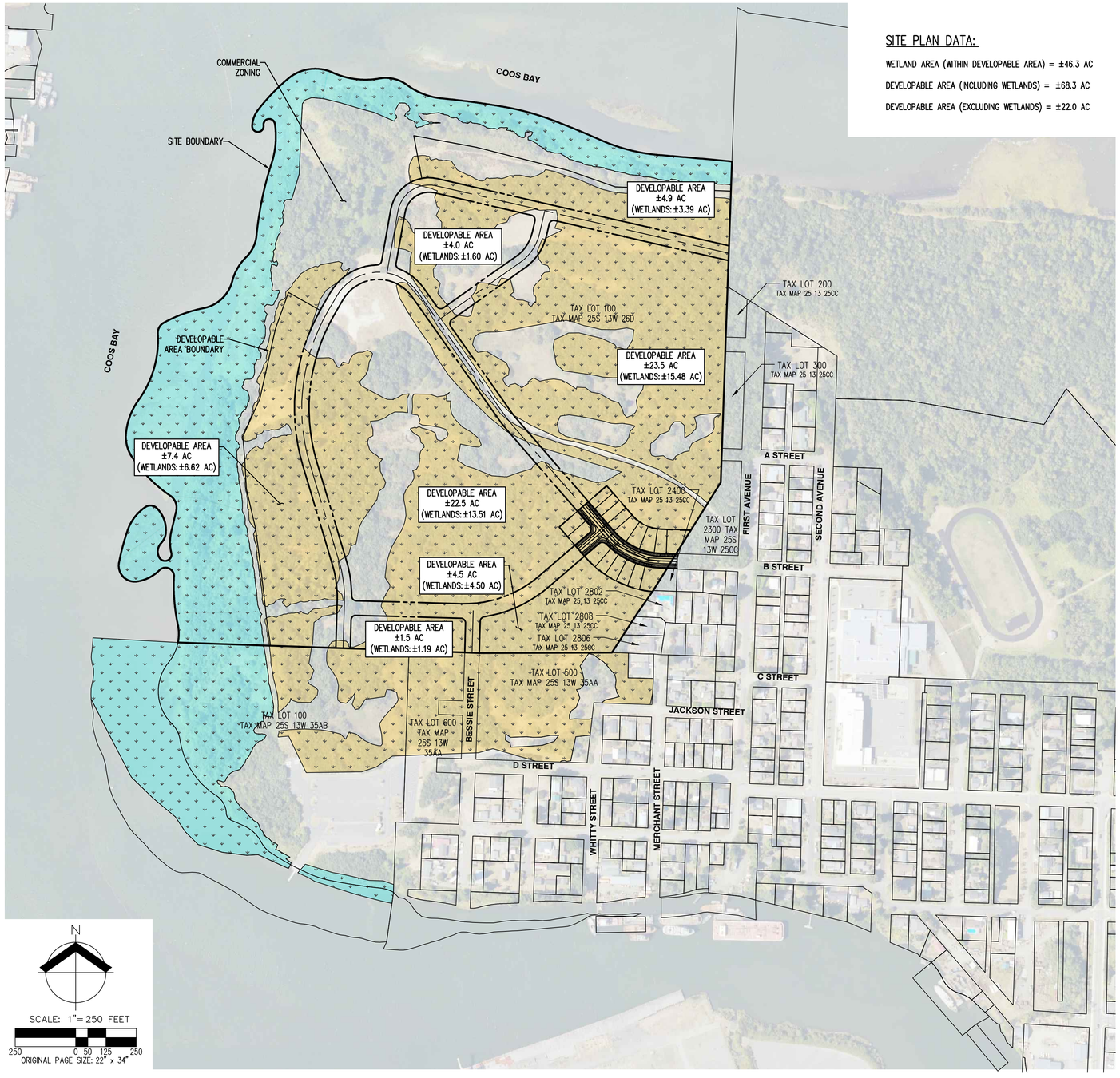
Date of Boring: September 29, 1999

.. h Foundation Engineering, Inc.

Boring Log: BH-1

Port of Coos Bay Eastside Development

Coos Bay, Oregon

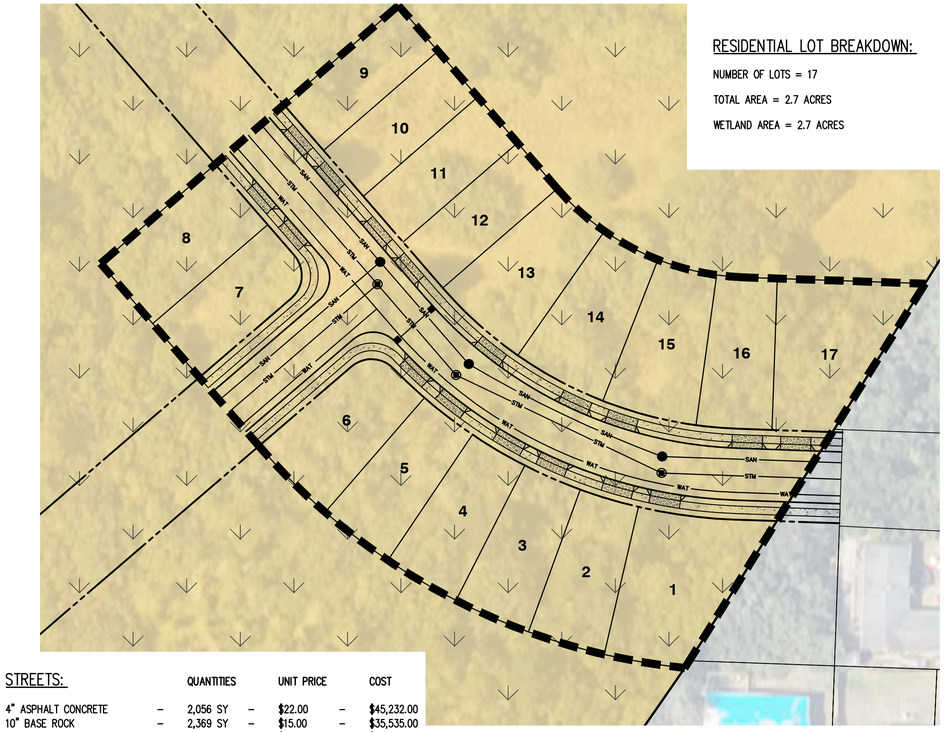


SITE PLAN DATA:

WETLAND AREA (WITHIN DEVELOPABLE AREA) = ±46.3 AC

DEVELOPABLE AREA (INCLUDING WETLANDS) = ±68.3 AC

DEVELOPABLE AREA (EXCLUDING WETLANDS) = ±22.0 AC



RESIDENTIAL LOT BREAKDOWN:

NUMBER OF LOTS = 17

TOTAL AREA = 2.7 ACRES

WETLAND AREA = 2.7 ACRES

STREETS:

		QUANTITIES		UNIT PRICE		COST
4" ASPHALT CONCRETE	–	2,056 SY	–	$22.00	–	$45,232.00
10" BASE ROCK	–	2,369 SY	–	$15.00	–	$35,535.00
STANDARD CURB AND GUTTER	–	1,127 LF	–	$28.00	–	$31,556.00
5' SIDEWALK	–	3,795 SF	–	$10.00	–	$37,950.00
DRIVEWAYS	–	3,100 SF	–	$18.00	–	$55,800.00
EXTRA FOR ADA RAMPS	–	6 EA	–	$2,245.00	–	$13,470.00
STREETLIGHTS	–	4 EA	–	$3,660.00	–	$14,640.00

STORM:

12" PVC STORM MAIN	–	607 LF	–	$65.00	–	$39,455.00
10" CATCH BASIN LEAD	–	27 LF	–	$44.00	–	$1,188.00
STORM PVC LATERAL	–	17 EA	–	$1,720.00	–	$29,250.00
CATCH BASIN	–	2 EA	–	$2,850.00	–	$5,700.00
48" STORM MANHOLE	–	3 EA	–	$5,670.00	–	$17,010.00
WATER QUALITY FACILITIES	–	2.7 AC	–	$14,400.00	–	$38,880.00

SANITARY:

8" PVC SANITARY MAIN	–	609 LF	–	$55.00	–	$33,495.00
SANITARY PVC LATERAL	–	17 EA	–	$1,935.00	–	$32,895.00
48" SANITARY MANHOLE	–	3 EA	–	$5,850.00	–	$17,550.00

WATER:

8" DI WATER MAIN	–	604 LF	–	$95.00	–	$57,380.00
8" GATE VALVE	–	3 EA	–	$2,490.00	–	$7,470.00
WATER SERVICE	–	17 EA	–	$1,075.00	–	$18,275.00
FIRE HYDRANTS	–	2 EA	–	$6,575.00	–	$13,150.00

MISCELLANEOUS:

MOBILIZATION & DEMOBILIZATION	–	LS	–	$173,818.00	–	$173,818.00
FRANCHISE UTILITIES	–	17 LOTS	–	$6,231.00	–	$105,927.00
WETLAND MITIGATION	–	2.7 AC	–	$132,800.00	–	$358,560.00
GROUND SURCHARGE	–	2.7 AC	–	$315,000.00	–	$850,500.00
DEEP SOIL MIXING BUTTRESSES	–	2.7 AC	–	$585,000.00	–	$1,579,500.00
EROSION CONTROL	–	LS	–	$36,000.00	–	$36,000.00
SUB TOTAL:						$3,650,186.00

SOFT COST:

ENGINEERING SERVICES (15%)*	–	LS	–	$183,000.00	–	$183,000.00
TOTAL:						$3,833,186.00

* 15% OF CONSTRUCTION COST DOES NOT INCLUDE GROUND SURCHARGE OR DEEP SOIL MIXING

LEGEND

SITE BOUNDARY

POTENTIAL PEM/PSS FLATS WETLAND

POTENTIAL E2EM, ESTUARINE FRINGE WETLAND

OUTSTANDING ITEMS NOT INCLUDED WITH COSTS:

- PUMP STATION IMPROVEMENTS
- ADDITIONAL CUT/FILL GRADING
- SIGNAGE AND STRIPING
- POTENTIAL OFFSITE IMPROVEMENTS THAT MAY BE REQUIRED PER TRAFFIC IMPACT ANALYSIS
- SOFT COSTS OTHER THAN ENGINEERING SERVICES
- JURISDICTIONAL FEES
- COMPACTION/SOIL TESTING FOR CONSTRUCTION

DATE: 03/09/2026 AKS JOB: 12975

AKS ENGINEERING & FORESTRY, LLC
3700 RIVER RD N, STE 1
KEIZER, OR 97303
503.400.6028
WWW.AKS-ENG.COM

ENGINEERING · SURVEYING · NATURAL RESOURCES
FORESTRY · PLANNING · LANDSCAPE ARCHITECTURE

SITE LAYOUT

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

CITY OF COOS BAY
COOS BAY, OR

How do we determine feasibility?

Cost to mitigate geotechnical issues
\+ Cost to mitigate wetland impacts
\+ Cost to design, permit, and construct on-site streets and other public infrastructure
\+ Cost to design, permit, and construct off-site improvements
\+ Cost to construct homes
\- Grants and other outside revenue support

Feasible *if* **Total cost to provide new homes and associated infrastructure** ≦ **$346,000 - $598,000 (house)**
$1,321 - $2,098/month (apartment)

Benefits do NOT outweigh cost.

Thanks for attending the open house. Please share your comments/feedback below:

We are not for this construction
It is not feasible because
1. dredging not stable
2. roads are inadequate
3. Bridge is insufficient - almost 100 yrs old and NOT PLANNED to be replaced nor rebuilt - It is at 6 on deck, superstructure, substructure. Not wise.

Name (optional): G. Farrel

Contact information (optional): _____

No police nor fire services plus we have 800 school children are affected negatively during negatively

Thanks for attending the open house. Please share your comments/feedback below:

THE FLOW OF TRAFFIC NEEDS TO BE CONSIDERED
THE BRIDGE WILL NOT CARRY THE EXTRA TRAFFIC.
I AM AGAINST THIS PROJECT.

Name (optional): GWYNETH STRINZ

Contact information (optional): (541) 217-0015

Thanks for attending the open house! Please share your comments, feedback

Housing is definitely needed in Coos Bay. The property in question would make for some nice neighborhoods. Concerns are many for infastructure before any housing should be considered. ~~The housing density suggested seems tight for lot sizes, and not similar to~~ ~~that~~ We are also concerned about the homes being bought up for airbnb's instead of being for actual families. Covenants would need to be created and enforced to prevent that. Also - a hybrid of recreational / housing useage should be considered to benefit all of our residents.

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

Has anyone considered a tsunami proof community Center?

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments, questions

Make a Park w/ Restaurants, really nice place for visitors.

Name (optional): Rich Baxter

Contact information (optional): 541-290-9500

Thanks for attending the open house. Please share your comments/feedback below:

- Hx of two towers on build site - will those be relocated
- ? Tsunami predicted in future - impact of tsunami on build location
- ? impact of future build on current water/sewer lines that were placed in the 1970's Will city cover costs of replacing those older lines if damage occurs from the influx?

Name (optional): Stacy + Josh Courtright

Contact information (optional): 541-290-9934

Thanks for attending the open house. Please share your comments/feedback below:

The Roads can not handle the traffic. Considering the traffic is not Eastside, Hwy 241, All the way up the river. All These residents use this ~~road~~ road to travel into town.

We do not have a fire Department.

The Bridge is not fit to sustain the traffic

All Ball field a park would be great for the Cass Community.

Name (optional): Stephanie McCormack & Jeff McCormack

Contact information (optional): (760) 636-6675

Thanks for attending the open house. Please share your comments/feedback below:

This needs to benefit US - the residents of Eastside!

No added taxes!

No houses!

We need our bridge repaired!

* Recreational uses, dog park, community Center.

Name (optional): LYNDA JOHNSON

Contact information (optional): inbandon@aol.com

Thanks for attending the open house. Please share your comments/feedback below:

Building new homes and/or apartments is not something Eastside needs. The infrastructure is already @ capacity. Please don't just look @ reports. Come park by the corner of 6th & D St from about 6:30-9:00 am — then come back starting at 2 pm-6 pm.

Please consider sports facilities and a trail system - something to add real value to Coos Bay.

Start looking for existing land like the Cascade Store land. Multi-person homes/apartments like NB is building. Thank you.

Name (optional): Betty McDaniel

Contact information (optional): Boopwithbetty@gmail.com

I AM OPPOSED TO DEVELOPING THE AREA FOR RESIDENTIAL DEVELOPMENT, BUT WOULD SUPPORT DEVELOPMENT FOR RECREATIONAL USE AND/OR ALTERNATIVE ENERGY DEVELOPMENT, i.e., INSTALLATION OF WIND TURBINES

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

Great ideas were presented for playing fields for multiple sport options. Leaning into the wetland majority, focusing efforts to walking or biking trails for community and tourism would be welcome. Currently you have to travel to Bandon for good biking trails. Many use the dyke trail to walk, a similar walking area like the South Slough uses/has would be fantastic for improving the area.

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

Opposed to the housing developement!
1. Current infrastructure inadequate now.
Cost of proposed houses are not affordable for people to purchase with curtent economic status of Coos County.
Our population is very slow growing.
We have 176 new units in North Bend coming available for rent.
Road egress to and from Eastside can not support increased traffic.

Name (optional): Shannon Hunt

Contact information (optional): 541-290-4934

Thanks for attending the open house. Please share your comments/feedback below:

Given the projected cost per lot, (which I believe to be a woefully low estimate) I don't think ~~residential~~ residential development to be attainable for many of our current or incoming residents. Personally I would like to see recreation or community center.

Name (optional): Taylor

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

I am in favor of any and all housing developments, We are desperate for increased housing units — of any price point - it all helps.

I do have reservations regarding flood plain properties; if that was addressed, I missed that - came in late.

People here resist change - that doesn't mean it's not needed!

Name (optional): Michelle Caldera

Contact information (optional): 541 290 8079

Thanks for attending the open house. Please share your comments/feedback below:

Recreation

- sports park
- Walking trails
- dog park
- frisbee golf course
- playground

} $ to maintain?

Name (optional): Nick & Joyce Jansen

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

This property is clearly unsuitable for housing. Recreational please, there is a strong need...
e.g. walking trails, sports fields, dog park
(Coos Bay is the only town/city in our area without a dog park).

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

I Live next TO the Fire Hall and the traffic for the School is to much add 500 homes TO That won't work

Name (optional): Jay Hill

Contact information (optional): 269-506 48

Thanks for attending the open house. Please share your comments/feedback below:

we say No to a Appartment, housing - only due to the the traffic - there is No way out of the area but 1 way. it takes me 40mis to get from 2nd Ave to #711 in the morning with the school traffic. NO fire or police in the area. - we would like to see maybe an indoor sports arena the weather here is nasty and it would be so nice to have indoor soccer year around, touch football, a swiming pool! I have a plan on my computer to support a 12 slide indoor water park. we need something inside - not just for basketball. indoor water slide park will bring in good $ and a go to for Coos. OR doesn't have 1. lets be the 1st!

Name (optional): Traci Kelley

Contact information (optional): Traci. Kelley 541-252-3026.

Thanks for attending the open house. Please share your comments/feedback below:

As we think of development which I am in favor of, please think of bike lanes along the roads to accomodate cyclists.

Name (optional): Cheryl Davies

Contact information (optional): eclough@charter.com

Thanks for attending the open house. Please share your comments/feedback below:

(1) Access/overall Area Jobs (Quality), Roads etc

(2) Limited use - Recreational etc

(1A) NO NEW TAXES ON the people That live here now, All ON The NEW ones 1ST.

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

Tsunami Zone !!!

Building on fill is insane!

Needs too much infastructure!

If you are building our town on tourism — build a park with Bike Trails, Walking Trail to connect to the marsh and Boat Ramp. Make a fishing Deck.

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

(1) I don't want homes, or more concerning, apartments built on this area.

(2) I'd like to see a community center, or park. Something that won't increase traffic any more than it already is.

(3) We have serious traffic issues and we feel the city & and school district is DEAF To this major problem. The city should not be ~~Busing~~ bussing 735 children to a peninsula The buses are only ½ full and having 600 vehicles coming into and out of Eastside is Horrible. We can't get out of our houses, Our air is poluted and we can't make appointments certain times because the roads are cluttered/blocked from 7:25-8:15 am and 2:15-3:00 pm. We don't have a fire department anymore so emergency situations

Name (optional): _____

Contact information (optional): _____

P.S. I know many of these comments aren't related to the property issue, but I hope they are included b/c we don't seem to be getting through to the local politicians the importance of this issue/problem.

Thanks for attending the open house. Please share your comments/feedback below:

Eastside is a nice place if one ignores all these parents bombing into our community 5 days/week.

(4) — I don't want a stoplight and I don't want a police substation either.

(5) if mosquito vector control is occuring (due to the wetlands) we should be notified w/ signs on the roads since many of us don't want to be around these sprays + treatments b/c of the increased risk of Parkinson's ~~Disease~~.

(6) we need another access point to Eastside which a ~~State~~ Federal politician Project/focus could help with. It's a safety issue right now.

Name (optional): Wynn Avocette

Contact information (optional): 503.335.9090

(7) Eastside would appreciate some focus for fixing this horrible traffic problem (from the schools) that we are dealing w/ daily.

Thanks for attending the open house. Please share your comments/feedback below:

I support development of Port Property in Eastside. As long as there is union members put to work and utilize apprenticeship programs. I think the information at the meeting for the feasibility study was good. I think some of the abdience was rude, when you are simply trying to improve a area of town. I support This.

Name (optional): Tallon Trentz

Contact information (optional): 971-230-4094

Tallon@IUOE701.com

Thanks for attending the open house. Please share your comments/feedback below:

I am a Commercal truck driver for a food Company and the resturant idea would have more impact to the neighorhood because of Refer truck like mine goint to the busnisses at 3 or 4am. Their are lots of other serices besides my food truck. laundry service, trash, bread trucks ect.

Pleas leave the area as is. OS eastside residents like our area as is.

Name (optional): Jason Kellam

Contact information (optional): (541) 252-6044

Thanks for attending the open house. Please share your comments/feedback below:

Rec. for all ages

Maybe a small pond for paddle boards

NO RV or Camping!

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

$300,000 x 400 = $120,000,000

PLUS

400 x 2 = 800 VEHICLES

ALL/MOST W/ LOANS & MTGS

TSUNAMI INUNDATION (?) A LOT IN $ TO CLEAN UP & ADD TO FINANCIAL BURDEN OF

Name (optional): _____

Contact information (optional): _____

Thanks for attending the open house. Please share your comments/feedback below:

~~MTB~~ Mountian Bike trails or pump track would be the Highest and Best use.

Also, The people with in 10 years of death Shouldnt Be Making 30 year planning Decisions

Name (optional): Mike S

Contact information (optional): 541-401-1129



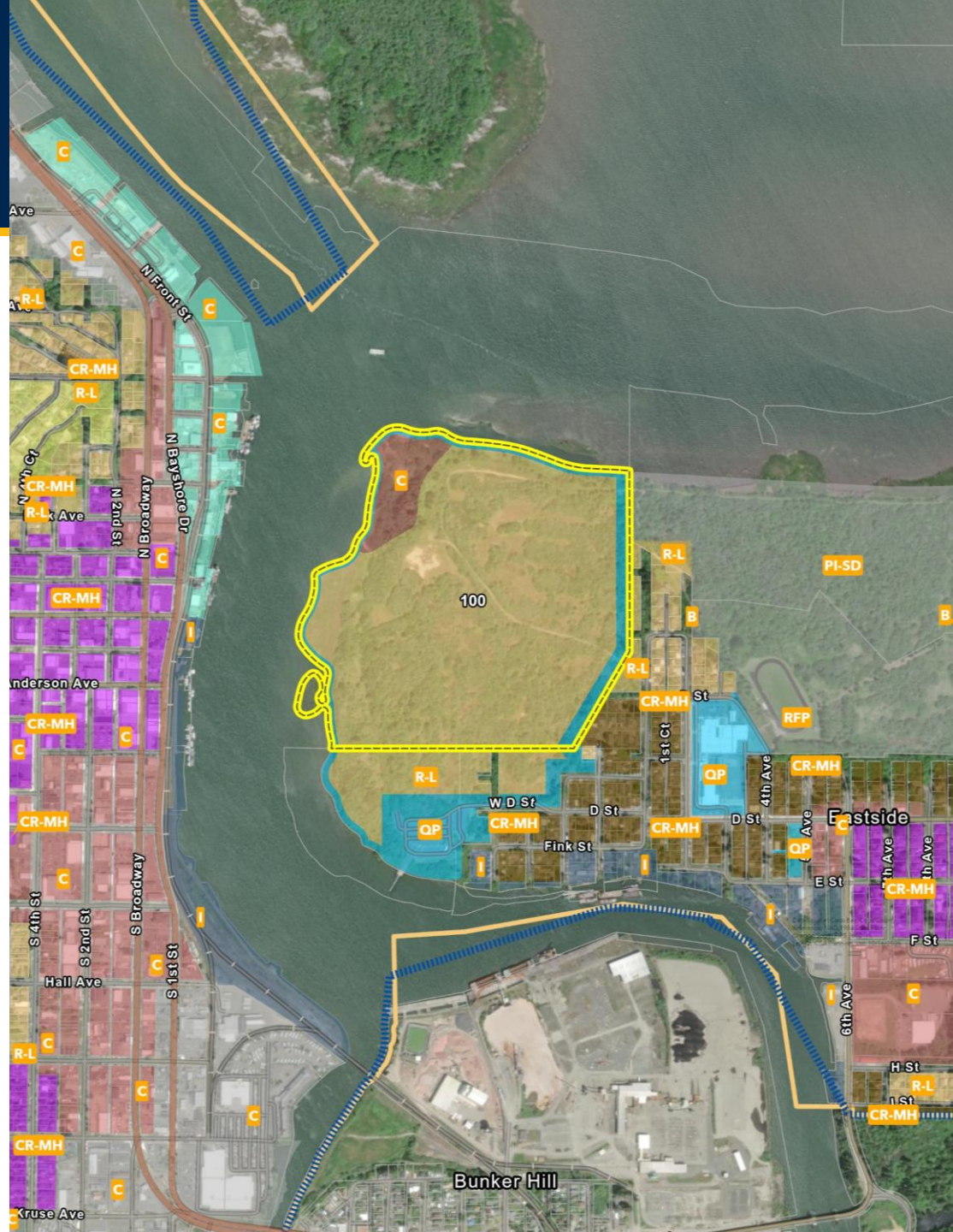
City/International Port of Coos Bay

Eastside Housing & Infrastructure Feasibility Study

AKS

Overview

- Introductions
- Why We're Here
- What We Heard from You
- Feasibility Findings
- What Else Would You Like to See?
- Next Steps



Project Team

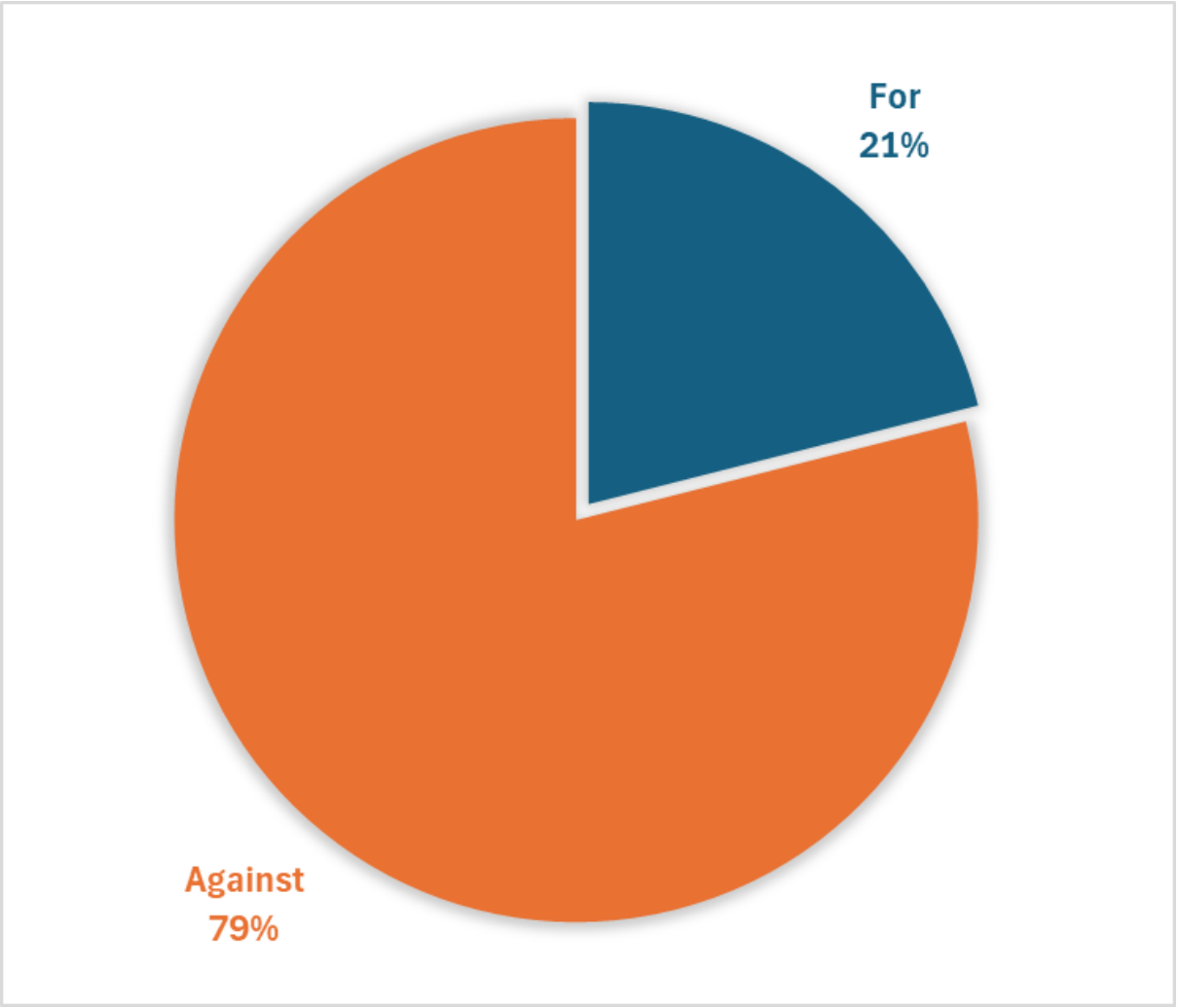
- City of Coos Bay
- International Port of Coos Bay
- Consultant Team
  - AKS Engineering
  - Johnson Economics
  - Foundation Engineering
  - MSC Engineers

Project Objective

- Is residential development of the site feasible? Would the site be attractive to a private developer?
- Feasible ***if*** Site Development Costs **<** Price of New Homes
- Currently, no development project planned

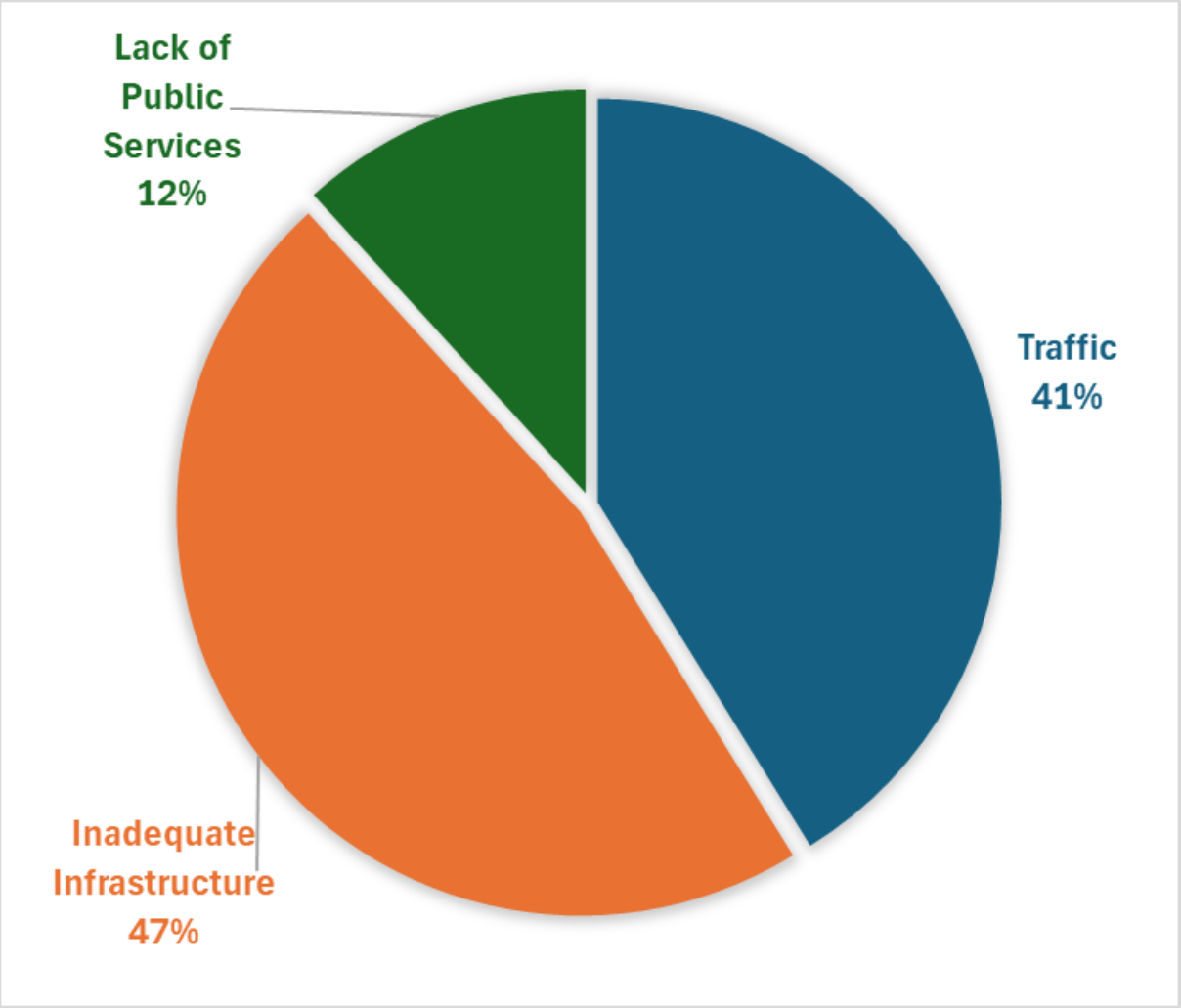
What We Heard from You

- **Open House #1** – March 11, 2026
- ±70 attendees
- Many expressed opposition to residential development
- 23 attendees returned written comments
  - ±79% of respondents are opposed to residential development
  - ±21% of respondents are in favor of residential development

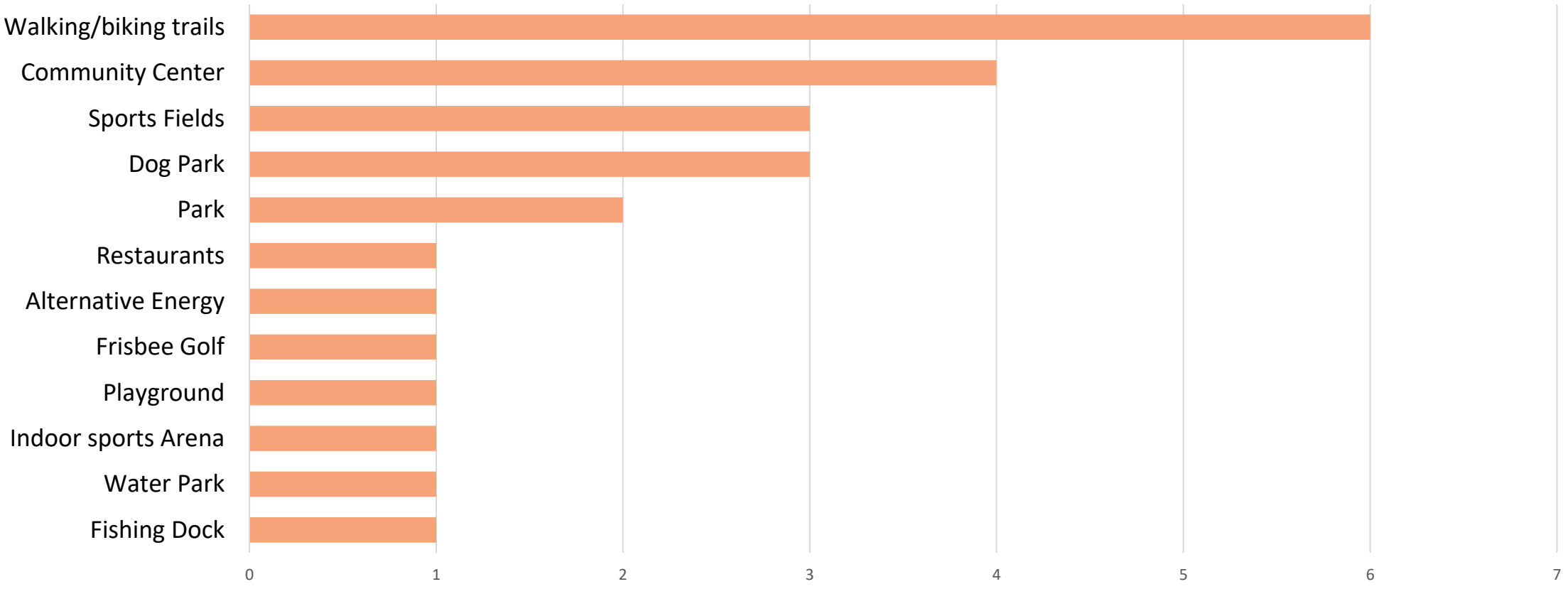


What We Heard from You

- **Open House #1** – March 11, 2026
- ±79% of respondents are opposed to residential development
- Reasons for opposition:
  - Inadequate infrastructure (Isthmus Slough Bridge, Area Roads, Public Utilities)
  - Traffic Congestion
  - Lack of Public Services (Police and Fire protection)



What you said – Other Ideas for the Site

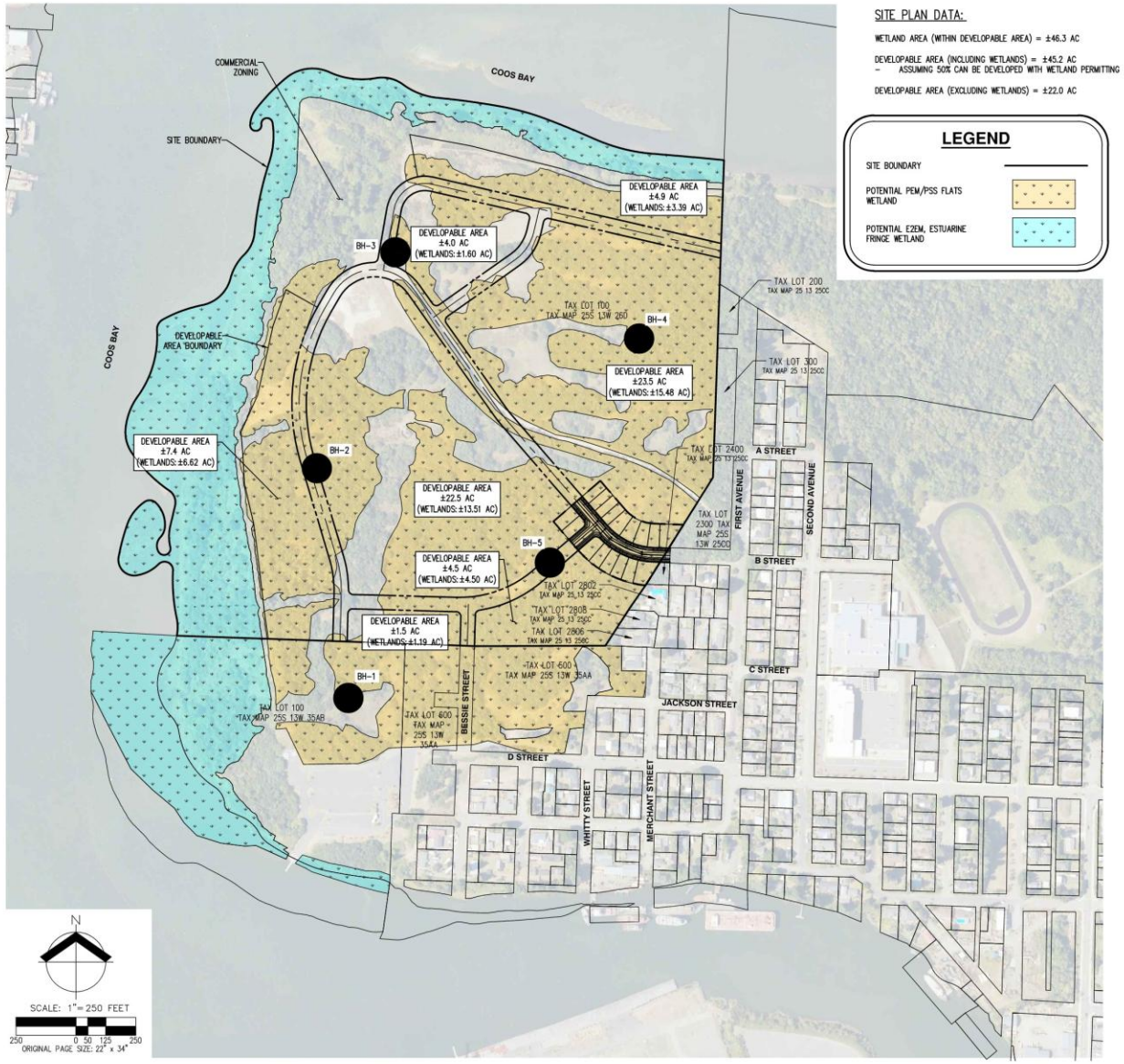


Feasibility Findings

Feasible *if* **Total cost to provide new homes and associated infrastructure** ≦ **$346,000 - $598,000 (house)**
$1,321 - $2,098/month (apartment)

Total cost to provide new homes and associated infrastructure =

Cost to mitigate geotechnical issues
\+ Cost to mitigate wetland impacts
\+ Cost to design, permit, and construct on-site streets and other public infrastructure
\+ Cost to design, permit, and construct off-site improvements
\+ Cost to construct homes
\- Grants and other outside revenue support



SITE PLAN DATA:

WETLAND AREA (WITHIN DEVELOPABLE AREA) = ±46.3 AC

DEVELOPABLE AREA (INCLUDING WETLANDS) = ±45.2 AC
– ASSUMING 50% CAN BE DEVELOPED WITH WETLAND PERMITTING

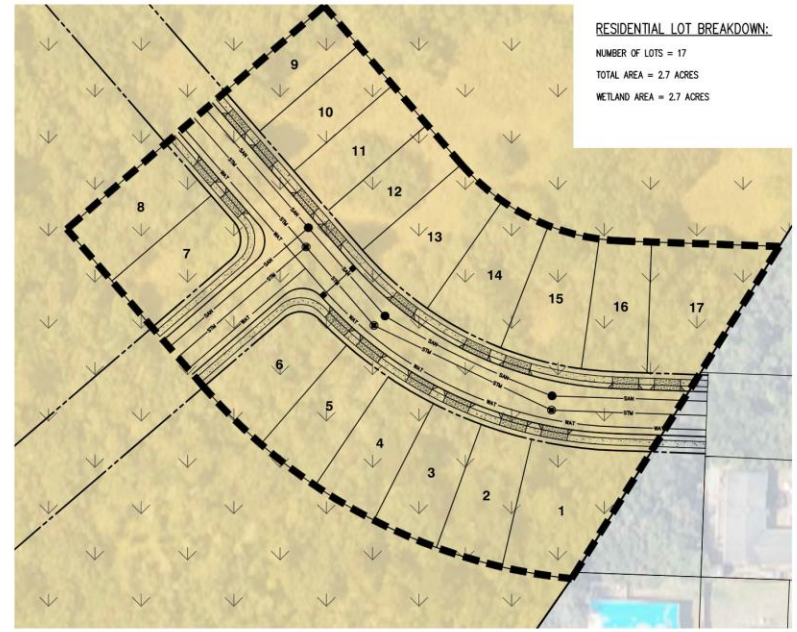
DEVELOPABLE AREA (EXCLUDING WETLANDS) = ±22.0 AC

LEGEND

SITE BOUNDARY

POTENTIAL PEM/PSS FLATS WETLAND

POTENTIAL E2EM, ESTUARINE FRINGE WETLAND



RESIDENTIAL LOT BREAKDOWN:

NUMBER OF LOTS = 17

TOTAL AREA = 2.7 ACRES

WETLAND AREA = 2.7 ACRES

STREETS:

		QUANTITIES		UNIT PRICE		COST
4" ASPHALT CONCRETE	–	2,056 SY	–	$22	–	$45,232
10" BASE ROCK	–	2,369 SY	–	$15	–	$35,535
STANDARD CURB AND GUTTER	–	1,127 LF	–	$28	–	$31,556
5' SIDEWALK	–	3,795 SF	–	$10	–	$37,950
DRIVEWAYS	–	3,100 SF	–	$18	–	$55,800
EXTRA FOR ADA RAMPS	–	6 EA	–	$2,245	–	$13,470
STREETLIGHTS	–	4 EA	–	$3,660	–	$14,640

STORM:

12" PVC STORM MAIN	–	607 LF	–	$65	–	$39,455
10" CATCH BASIN LEAD	–	27 LF	–	$44	–	$1,188
STORM PVC LATERAL	–	17 EA	–	$1,720	–	$29,250
CATCH BASIN	–	2 EA	–	$2,850	–	$5,700
48" STORM MANHOLE	–	3 EA	–	$5,670	–	$17,010
WATER QUALITY FACILITIES	–	2.7 AC	–	$14,400	–	$38,880

SANITARY:

8" PVC SANITARY MAIN	–	609 LF	–	$55	–	$33,495
SANITARY PVC LATERAL	–	17 EA	–	$1,935	–	$32,895
48" SANITARY MANHOLE	–	3 EA	–	$5,850	–	$17,550

WATER:

8" DI WATER MAIN	–	604 LF	–	$95	–	$57,380
8" GATE VALVE	–	3 EA	–	$2,490	–	$7,470
WATER SERVICE	–	17 EA	–	$1,075	–	$18,275
FIRE HYDRANTS	–	2 EA	–	$6,575	–	$13,150

MISCELLANEOUS:

MOBILIZATION & DEMOBILIZATION	–	LS	–	$200,000	–	$200,000
FRANCHISE UTILITIES	–	17 LOTS	–	$10,000	–	$170,000
WETLAND MITIGATION	–	2.7 AC	–	$220,000	–	$600,000
GROUND SURCHARGE	–	2.7 AC	–	$315,000	–	$850,500
DEEP SOIL MIXING BUTTRESSES	–	2.7 AC	–	$886,000	–	$2,392,200
EROSION CONTROL	–	LS	–	$50,000	–	$50,000
PUMP STATION IMPROVEMENTS*	–	LS	–	$77,700	–	$77,700

TRAFFIC (OFFSITE):

PROPORTIONATE SHARE OF INTERSECTION IMPROVEMENTS**				$90,000
600' OF ROADWAY AND SIDEWALK IMPROVEMENTS**				$3,000
SUB TOTAL:				$4,980,000

SOFT COST:

ENGINEERING SERVICES (20%)***	–	LS	–	$348,000	–	$348,000

SUMMARY:

TOTAL:	$5,328,000
COST PER LOT:	$313,410

*IT IS ASSUMED $1.3 MILLION IS THE PROPORTIONAL SHARE REPRESENTED TOTAL FOR THE PROJECT.
**IT IS ASSUMED $1.5 MILLION IS THE PROPORTIONAL SHARE REPRESENTED TOTAL FOR THE PROJECT.
***20% OF CONSTRUCTION COST DOES NOT INCLUDE GROUND SURCHARGE OR DEEP SOIL MIXING

NOTE: SUMMARY INCLUDED ASSUMES 6 LOTS PER ACRE, WHICH APPROXIMATES TO A TOTAL OF 270 RESIDENTIAL DWELLINGS FOR THE SITE.

OUTSTANDING ITEMS NOT INCLUDED WITH COSTS:

- ADDITIONAL CUT/FILL GRADING
- SIGNAGE AND STRIPING
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- JURISDICTIONAL FEES
- COMPACTION/SOIL TESTING FOR CONSTRUCTION
- HOME CONSTRUCTION
- LAND PURCHASE
- SDC FEES

DATE: 03/25/2026 AKS JOB: 12975

AKS ENGINEERING & FORESTRY, LLC
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KEIZER, OR 97303
503.400.6028
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ENGINEERING · SURVEYING · NATURAL RESOURCES
FORESTRY · PLANNING · LANDSCAPE ARCHITECTURE

SITE LAYOUT

EASTSIDE HOUSING & INFRASTRUCTURE FEASIBILITY STUDY

CITY OF COOS BAY
COOS BAY, OR

Feasibility Findings – Lot Development Costs

AKS

STREETS:		QUANTITIES		UNIT PRICE		COST
4" ASPHALT CONCRETE	–	2,056 SY	–	$22	–	$45,232
10" BASE ROCK	–	2,369 SY	–	$15	–	$35,535
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Feasibility Findings – Lot and Home Cost

- **Lot Costs: $343,410**
  - Lot development costs
  - Off-site improvements
  - Lot developer profit
  - Cost of land (not currently included)
- **Total New Home Costs: $444,650**

  Assumes 1,500 sf single-family home
  - Construction costs
  - Builder overhead and profit
  - System development charges
  - Building permit and plan review fees
  - Utility connections/home
  - Landscaping
  - Buyer closing costs

Total All-in Cost to First-time Buyer: **$788,060**

Feasibility Findings

- Residential Development Likely **Not Feasible**
  - Estimated home + lot development costs total $788,060
  - Exceeds $598,000 price point supported by market
  - Home build pro-forma assumes 1,500 sf home
  - Land costs (profit for Port at sale of property) not included

Feasible *if* **Total cost to provide new homes and associated infrastructure** ≦ **$346,000 - $598,000 (house)**
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What Else Could Work Here?



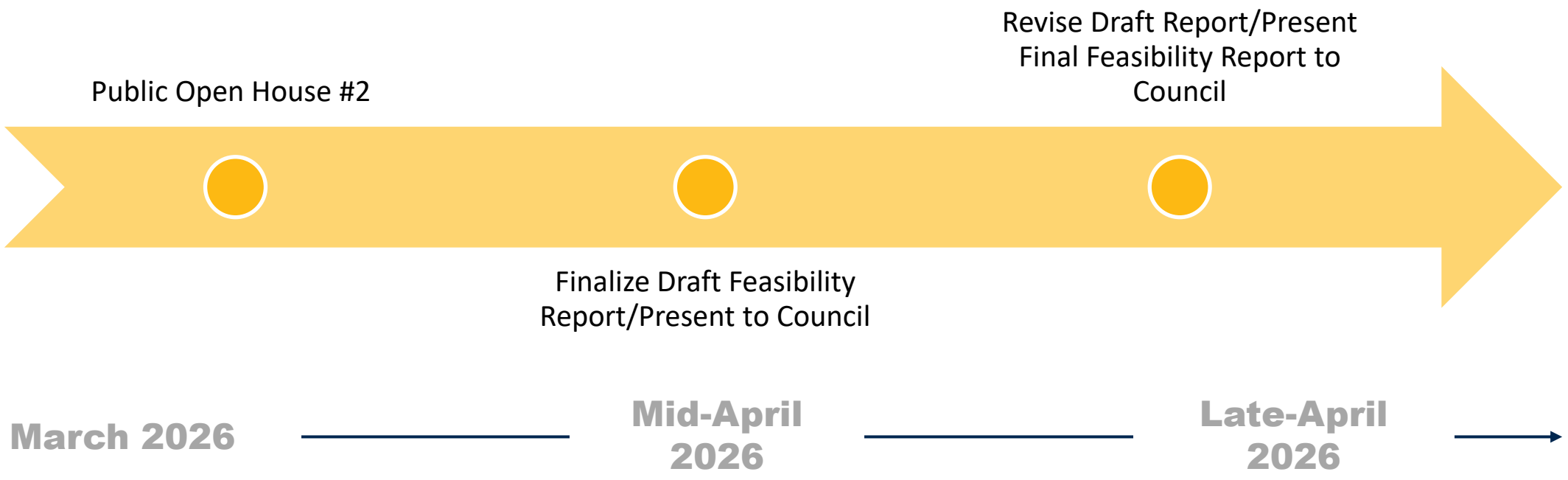
Questions and Feedback



Zach Pelz, AICP
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(503) 400-6028

Jennifer Wirsing, PE
jwirsing@coosbayor.gov
(541) 269-1181

Next Steps


Public Open House #2
Finalize Draft Feasibility Report/Present to Council
Revise Draft Report/Present Final Feasibility Report to Council
March 2026
Mid-April 2026
Late-April 2026

Questions and Feedback



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Site Constraints

- **Geotechnical Conditions:** Early per-acre cost vs. market feasibility determines viability
- **Sanitary Sewer Infrastructure:** Wastewater pump station likely insufficient; expansion uncertain
- **Transportation Infrastructure:** Limited site ingress/egress; likely substantial network improvements needed to support large increase in traffic