



APPENDIX I:
STORMWATER ASSESSMENT

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PORT OF LONGVIEW MASTER PLAN PHASE I FEASIBILITY STUDY Stormwater Assessment



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1.0 INTRODUCTION

In 2010 the Port of Longview (Port) purchased the 275-acre property at Barlow Point for future Port industrial development. The Port acquired an additional 7.5 acres of tidelands in 2012 bringing the site total to 282.5 acres. The property is located downstream of the current developed Port at approximately river mile 64 (RM 64), which is on the west side of the City of Longview, Washington (City). In order to better understand the full potential of the Barlow Point site, the Port determined that a comprehensive master planning process was necessary. The first step of the due diligence study to assess the feasibility to develop the site into a marine terminal.

A market analysis and conceptual site planning exercise were performed in late 2014 through early 2015 to identify possible types of use and site layouts. Specific industry types were identified from the market analysis to be the basis to analyze potential site layout and use at Barlow Point. Two options arose from that evaluation, which focus on production and/or export of dry or liquid bulk commodities. Both options identified would have a site occupied by three bulk commodity tenants. The dry bulk option (Option 1) consists of potash, urea and wood pellets. The liquid bulk option (Option 2) consists of crude oil, methanol and biodiesel. A third option (Option 3) was also considered where a single commodity/tenant occupies the entire site. The focus of the this report will be on Option 1 and 2 due to the complexity of a site with multiple tenants and the similar site layout between the three options. See the Conceptual Plans in Appendix A and the Conceptual Planning and Market Analysis is Appendix B of the main report.

Site stormwater was investigated as part of the due diligence study including the following items: describing the existing site, performing a Level 1 Downstream Analysis, quantifying/estimating the size of the development, identifying permitting requirements and thresholds, understanding preliminary flow control and water quality requirements, and reviewing Low Impact Development options. These items will be investigated and reported to a due level of effort. Following these items, a conceptual stormwater approach will be described with the intent to allow for highest and best use of the property. Included in this section will be various development issues and options.

2.0 EXISTING CONDITIONS

2.1 EXISTING LAND USE AND SURFACE COVER

The Barlow Point property consists of approximately 282.5 acres located approximately 4 miles down-river (West) of the Lewis and Clark Bridge. The site is zoned heavy industrial (HI) and is contained within the Longview City limits (see Attachment A and Attachment B). The site is considered Greenfield which typically refers to a piece of undeveloped agricultural land that is being considered for development.

The site is bounded to the north by State Route (SR) 432 and Mt. Solo Landfill. SR 432 is adjacent to the property between approximately State Route Milepost 2.17 to 2.78. The majority of the northern site

boundary is Mt. Solo Landfill, a capped landfill, and is separated from the landfill by a large private ditch (Private Drainage Facility or PDF). The property line generally runs along the center of the ditch which acts as a shared stormwater discharge location. The shared ditch meanders forming oxbows which defines the atypical northern property boundary.

The southern boundary of the site is adjacent to the Columbia River at approximately River Mile 62. The site, which is at elevation $10' \pm$ NAVD88, is separated from the river by a large levee with a top elevation at $30' \pm$ NAVD88. The levee is part of the broader Longview-Kelso flood protection system which is overseen by United States Army Corps of Engineers (USACE) and locally through the Consolidated Diking District #1 (CDID#1). The portion of the levee on the property is approximately 6,170 linear feet long and is sited within a 375 foot wide easement granted to the CDID#1 (see the Land Use, Zoning, Comprehensive Plan and Easements Report located in Appendix C of the main report). The landward design slope of the levee is 6 to 1 and the water-side design slope is 3 to 1 but is typically shallower. The majority of the levee side slopes and area within the easement are covered in grasses except for where the gravel road connects up onto the levee. The downstream two-thirds of the water-side shoreline is occupied by a dense stand of trees located between the toe of the levee and the edge of water. A gravel road runs along the top of the levee for the length of the site and continues down the landward side of the levee on both the east and west property line. The road continues around the perimeter of the site creating a looped maintenance roadway. The site is gate controlled at each end of the property.

The east boundary of the site is defined by Ditch #14, one of many large ditches owned by CDID#1. The CDID #1 Reynolds Pump Station is located next to the south-east corner of the site at the toe of the levee. The pump station discharges to the Columbia River at a maximum rate of 80,000 gallons per minute through large diameter pipes that penetrates through the levee. A 900 foot wide high power transmission easement granted to Bonneville Power Administration (BPA) also runs over the eastern portion of the site. Three of the four transmission towers within the 900 foot easement are located in the south-east corner of the site. The adjacent property to the east beyond the Ditch #14 is zoned and utilized for heavy industrial purposes.

The site is bounded to west by undeveloped farm land also zoned for heavy industrial. Aside from SR432, the site can be accessed from Barlow Point Road where the paved portion of the road at the base of the levee terminates approximately 460 feet west of the site. A gravel road continues from this point where it transitions to the top of the levee and continues on to the site.

The existing site, which is at elevation $10' \pm$ NAVD88, is composed of undeveloped farm land with isolated pockets of trees near the center of the site. A portion of the site is currently contracted out by the Port to be farmed. Approximately 1/10th of the site contains preliminary and unverified Category III or Category IV wetlands. Both the PDF and portions of the CDID#1 ditch network are classified as fish bearing Type F streams as defined by WAC 222-16-030 (see the Riverfront Environmental and Other Regulatory Considerations Report located in Appendix D of the main report).

The site is classified by the Federal Emergency Management Agency (FEMA) as Zone X which indicates that the area is protected from the one percent annual chance (100-year) flood by a levee. The top of the

levee is at approximately +30' NAVD88 and the 100-year and 500-year flood stage elevations are +19.6' NAVD88 and +22.0' NAVD88 which means the levee in the vicinity of Barlow Point provides protection up to the 500-year flood event.

2.2 EXISTING DRAINAGE PATTERNS

The existing site is broken into two distinct drainage basins separated by the levee (see Attachment B). The area from the center line of the levee road to the south drains down the water-side face of the levee at approximately 6:1 side and discharges directly to the Columbia River. The area from the center line of the levee road to the north drains down the land-side face of the levee at approximately 4:1 side slope into the main body of the site.

The main site north of the levee is comprised of several sub-basins and is generally flat with slopes varying from 0% to 2%. The sub-basins are drained via several shallow agricultural ditches. Flow is conveyed to the large ditch to the north (Private Drainage Facility or PDF) and CDID#1 Ditch #14 to the east and discharged through series of 24" to 36" ADS culverts under the gravel maintenance road. The PDF and Ditch #14 combine in the north-east corner of the site and connect to the CDID#1 Ditch #10 which runs adjacent to SR 432 conveying flow to the north and west.

There is a gated access point to Mt. Solo landfill at the north-west corner of the site. The PDF connects to the drainage ditch that runs along the base of Mt. Solo landfill through an approximately 18 to 24 inch diameter culvert which appears to be plugged with debris. CDID#1 also indicated that a trio of 48 inch diameter culverts located at the site entrance to SR 432 are undersized, hindering the flow of Ditch #10. During the field visit, only one culvert was observed and it appeared to be damaged and partially plugged (see Attachment L).

The site stormwater is ultimately discharged to the Columbia River through sheet flow from the riverside face of levee or through one of two pump stations. When activated, the Reynolds Pump Station located at the south-east corner of the site discharges Ditch #14 directly to the Columbia River at a rate of 80,000 gallons per minute maximum capacity. According to CDID#1, the Reynolds Pump Station is manually operated and only activated as a precautionary measure when a large storm event is predicted while water levels in the ditch network are high. During normal operations when the Reynolds Pump Station is idle, Ditch #14 flows to the west and north to the main CDID#1 pump station located approximately 3 miles downstream where the pump station discharges at a rate of 336,000 gallons per minute total maximum capacity to the Columbia River via Coal Creek.

2.2.1 OFF-SITE DRAINAGE

The existing site receives off-site stormwater flows from a single location. In the northwest corner of the site, the property line jogs prior to heading east creating an approximate 0.88 acre area of the levee that drains north on to the property. The land-side face of the levee is planted with grasses that is regularly maintained and slopes at approximately 6 to 1 down to the interior of the site.

2.3 GROUNDWATER

Groundwater was observed by ongoing piezometer readings performed by Ecological Land Service, Inc. starting in 2010 and by a field investigation performed by Hart Crowser in May of 2015 (see the Riverfront Environmental and Other Regulatory Considerations Report located in Appendix D and Preliminary Geotechnical Assessment located in Appendix F of the main report). Ground water was observed to be 3 feet below grade in the unverified wetlands areas during the rainy season and 5 to 6 feet below grade during the dry season. Groundwater elevation was observed in the test pit locations outside of the unverified wetlands at 2 to 4 feet below grade. In general, groundwater was observed ranging from 2 to 6 feet below ground surface and has been observed to fluctuate in response to seasonal rainfall patterns.

2.4 SITE SOILS AND GEOLOGY

The near-surface soils at the site are mapped by the U.S. Department of Agriculture in the Soil Survey of Cowlitz County, Washington as found on the Web Soil Survey (USDA 2006) website. The report generated by the Soil Survey indicates several soil subtypes are mapped at the site including; Arents (Dike fill), 0 to 5 percent slopes; Caples silty clay loam, 0 to 3 percent slopes; Pilchuck loamy fine sand, 0 to 8 percent slopes; Riverwash (Outwash deposits on the riverside of the dikes); Schneider-Rock outcrop complex, 15 to 65 percent slopes; and Snohomish silty clay loam, 0 to 1 percent. The Schneider-Rock outcrop complex represents a small outcrop of bedrock near Mt. Solo Road and won't be discussed further.

The site is effectively split into two areas displaying similar soil types; 1) the inland portion of the site, covering nearly 75% of the land area, comprised of the Caples and Snohomish soil units, and 2) the levee portion of the site comprised of the Arents, Pilchuck, and Riverwash soil units. In general, for site planning purposes, the soils found at the site should be classified mainly as silt and sand with areas of organic silt possibly present in the Snohomish soil unit.

Soils in the inland portion of the site are typical alluvial deposits that form near bodies of water such as the Columbia River. Drainage characteristics of the soils range from moderately well drained in the Caples soil unit to poorly drained in the Snohomish. Permeability of the soil ranges from moderately low to moderately high between 0.06 and 0.60 inches/hour. These soils types are prime farmland provided they are drained and not exposed to excessive flooding.

Soils in the levee portion of the site range from typical alluvial deposits in the Riverwash and Pilchuck soil units, to manmade fills for the flood control dike in the Arents soil unit. Drainage characteristics of the soils range from somewhat poorly drained in the Riverwash soil unit, moderately well drained in the Arents soil unit, to somewhat excessively drained in the Pilchuck soil unit. Permeability of the soil ranges from moderately high to very high, between 0.6 and 20 inches/hour in the Pilchuck and Arents soil unit. Permeability estimates for Riverwash is not mapped at the site. Pilchuck is considered prime farmland provided the soils are irrigated (see the Preliminary Geotechnical Assessment located in Appendix F of the main report).

2.5 LEVEL 1 DOWNSTREAM ANALYSIS

A Level 1 downstream analysis was performed as a first step in investigating the stormwater at Barlow Point. A Level 1 downstream analysis is a qualitative analysis meant to identify off-site water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by the development of Barlow Point. The analysis was performed per Section 2.6.2 of the Department of Ecology (Ecology) Stormwater Management Manual for Western Washington (SWMMWW 2014). Included in this report are photo logs, critical area maps and other pertinent information which help to better define the existing site. For the purposes of this study, the Level 1 downstream analysis is intended to be a stand-alone report and, where necessary, pertinent information identified in that report have been brought forward into this report (see Attachment L).

The Level 1 downstream analysis did not reveal any critical issues that would preclude the development of Barlow Point. During the investigation, three drainage features were identified that should be considered during development of site. First, according to a CDID#1 representative, three 48 inch diameter culverts located at the existing site entrance are under sized. Second, CDID#1 has expressed willingness to partner with the Port to utilize, in some fashion, the Reynolds Pump Station to discharge stormwater. Third, a regional detention pond is located downstream from the site. Use of the Reynolds Pump Station and the regional detention pond will be discussed in more detail below.

3.0 DEVELOPMENT CONCEPTS

The dry and liquid bulk options, each with three tenants, were development during the conceptual planning phase. In general, the development is proposed to include a site entrance from SR432, an access road around the perimeter of the site, rail infrastructure, cargo piers and trestles, a levee road for access and maintenance, supporting utilities, possible ditch realignments and various stormwater features (see the Conceptual Plans in Appendix A and the Conceptual Planning and Market Analysis in Appendix B of the main report). These items are envisioned as “backbone infrastructure” to be constructed by the Port prior to any tenant improvements within their lease areas. Both the dry and liquid bulk options are proposed to have a similar layout with the rail heavy tenant located inside the rail loop on the west side of the site and the major process tenant occupying the majority of the east side of the site. Remaining space not needed by the process tenant could be occupied by a smaller third tenant. These two options were the basis for analyzing the stormwater requirements herein.

Stormwater specific improvements will likely include various combinations of detention ponds, outfalls to the Columbia River, lift stations, water quality treatment, Low Impact Development (LID) features, and typical gravity collection and conveyance systems. Further detail on these items will be described below.

3.1 LAND USE ASSUMPTIONS

The next step in investigating the site stormwater was to estimate the size of the development. Land

utilized as marine terminals, and industrial areas in general, tend to become fully developed or built-out over time to maximize usable space. Barlow Point is zoned Manufacturing District/Heavy Industrial (HI) as defined by the Longview Municipal Code (LMC) 19.58. According to HI zoning requirements, site development will be restricted to 85% maximum impervious area of lot or, conversely, must remain 15% pervious area of lot (see the Land Use, Zoning, Comprehensive Plan and Easements Report located in Appendix C of the main report). For the 282.5 acre site, this equates to approximately 240.1 acres maximum impervious surface and approximately 42.4 acres of required pervious surface. The majority of the water side and land side faces of the levee will remain undeveloped/vegetated (pervious) per USACE requirements and account for nearly the entire 15% pervious area required by zoning. This allows the main, usable portion of the site to be developed as needed knowing that the levee satisfies the majority of the pervious requirement. This provides a conservative starting point for assessing development areas and stormwater requirements.

Port areas were estimate based on the conceptual plan layout for the dry and liquid bulk options and included the “backbone infrastructure” areas described above. This equates to approximately 43 acres of developed area for the dry bulk option and 48 acres of developed area for the liquid bulk option. The rail corridor for the liquid bulk option is larger to accommodate the additional rail demand which accounts for the difference in area. See Attachment K for summary potential Port build-out.

A range of potential tenant build-out, estimated as impervious surface, was developed based on examples provided in the conceptual planning report by Cargo Velocity (see the Conceptual Planning and Market Analysis Report located in Appendix B of the main report). Potential build-out was estimated as a range between 75% and 100%. The most notable difference in potential build-out range was the potash industry. Examples of both fully/mostly impervious and partially impervious facilities are available for potash. The Canpotex facility in Vancouver, BC is mostly impervious while the BHP facility in Portland, OR is mostly pervious. Therefore, the range of impervious development for potash was assumed to be 50% to 100%. A range of required area for each tenant was provided in the Conceptual Planning and Market Analysis Report. For ease of comparison, identical areas were chosen for each tenant for the dry and liquid bulk options: 70 acres for potash and crude oil, 60 acres for urea and methanol, and 15 acres for wood pellets and biodiesel. See Attachment J for a summary of potential tenant build-out areas.

4.0 DEVELOPMENT REQUIREMENTS FOR STORMWATER

The next step in investigating the site stormwater was to compare the conceptual plans and land use assumptions against the existing site conditions to identify the permitting/development requirements. Based on the location of Barlow Point and the potential types of developments identified, Table 1 below identifies the applicable public agencies and their design manuals that will outline requirements for development.

Table 1 – Public Agencies

Permitting Agency	Description ¹
City of Longview, Washington (City)	Stormwater Manual 2012
Department of Ecology (DOE)	Stormwater Management Manual for Western Washington 2014 (SWMMWW 2014)
Cowlitz County (County)	Cowlitz County Stormwater Drainage Manual 2011 (SWDM)
Department of Ecology (DOE)	Industrial Stormwater General Permit (ISGP)
Department of Ecology (DOE)	National Pollution Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit
Washington Department of Transportation (WSDOT)	Hydraulics Manual 2010 M 23-03; Highway Runoff Manual 2014 (HRM) M 31-16.04
Consolidated Diking District (CDID#1)	Stormwater Management Program March 2012
United States Army Corps of Engineers (USACE)	Design and Construction of Levees EM 1110-2-1913
Washington Department of Fish and Wildlife (WDFW)	Standard Hydraulic Project Approval (RCW 77.55)
National Marine Fisheries Service (NMFS)	-

¹The most recent versions of permitting agency manuals were used in this study. Manuals and requirements may be updated.

4.1 CITY OF LONGVIEW

The Barlow Point property is located within the City of Longview limits and Port and tenant developments will be subject to the requirements the City’s Stormwater Manual dated 2012. The City manual adopts the requirements of the DOE SWMMWW with a few notable additions which will be described below. The City manual satisfies the requirements of the Department of Ecology’s Western Washington Phase II Municipal Stormwater National Pollutant Discharge Elimination System (NPDES) Permit.

To determine how to apply the applicable requirements of the City manual, the number of Threshold Discharge Areas (TDAs) must first be determined. A TDA is defined by the SWMMWW 2014 as “an on-site area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream.” If multiple natural discharge locations combine farther than one-quarter mile downstream the areas are defined as separate TDAs. The purpose of defining TDA’s is to clarify how the thresholds of the manual are applied to a site with multiple discharge points. Barlow Point contains two TDA’s consisting of the waterside face of the levee discharging to the Columbia (waterside TDA), and the CDID#1 ditch network discharging to the Columbia River (during normal operations) further than one-quarter mile downstream of the site (landside TDA). The thresholds identified in the manual will need to be applied separately to each TDA.

Due to USACE requirements for levees (see below), development on the waterside face of the levee will be minimal (pier abutments, conveyor foundations, etc.) and will likely not trigger the requirements for stormwater treatment and detention for waterside TDA. If development of the waterside TDA does trigger

additional requirements, compensatory treatment will likely need to be provided in the upland TDA. Any additional stormwater treatment and detention requirements from the development of the waterside TDA will be minimal when compared to the development of the landside TDA.

4.1.1 MINIMUM REQUIREMENTS

Determining the minimum requirements for a project is outlined in the City of Longview Stormwater Manual local and state requirements flow chart (see Attachment D). The flow chart provides an easy to follow method to compare the various minimum requirement triggers to a proposed development. Based on the size and type of site use, the development at Barlow Point will be subject to Minimum Requirements #1 thru #9 of the SWMMWW 2014 (see Table 2).

Table 2 – Minimum Requirements from SWMMWW 2014

Min. Req. #	Description ¹
1	Preparation of Stormwater Site Plans
2	Construction Stormwater Pollution Prevention (SWPPP)
3	Source Control of Pollution
4	Preserve Natural Drainage Systems and Outfalls
5	On-Site Stormwater Management (Low Impact Development; LID)
6	Runoff Treatment (Stormwater Quality)
7	Flow Control (Stormwater Quantity)
8	Wetlands Protection
9	Operations and Maintenance Manual

¹Items struck through will need to be addressed as part of any site development but are not included in the scope of this due diligence study)

4.1.1.1 SOURCE CONTROL OF POLLUTION

It is assumed that the Port and perspective tenants will implement operational and structural BMPs to the maximum extent practicable for any development at Barlow Point. Operational source control BMPs, like street sweeping and covered fueling areas, are considered a cost effective method of preventing contaminants from entering the stormwater. Municipal and, more importantly, industrial treatment methods have a better opportunity to work as intended when operational and structural BMPs are implemented. These BMPs for the backbone infrastructure will be investigated further as specific site uses and features are agreed upon. It is assumed that tenants will be responsible for their own source control BMPs.

4.1.1.2 PRESERVE NATURAL DRAINAGE SYSTEMS AND OUTFALLS

According to the SWMMWW 2014, natural drainage patterns and outfalls should be preserved to the maximum extent practicable. There are currently no on-site outfalls to the Columbia River and the site is drained through a large PDF and a series of large man-made ditches that are part of the CDID#1 ditch

network. The Columbia River is also available as an alternate discharge location either through the Reynolds Lift Station existing outfall or through new outfalls.

4.1.1.3 ON-SITE STORMWATER MANAGEMENT (LOW IMPACT DEVELOPMENT)

Low Impact Development (LID) is a development approach to control stormwater at its source across a site to mimic the natural drainage patterns of a pre-developed site conditions. The City of Longview places high priority on LID features and has additional requirements in parallel with the SWMMWW 2014 requirements. LID requirements are outlined in Section 5 of the City of Longview Stormwater Manual 2012 and Volume I Section 2.5.5 of the SWMMWW 2014 (see Attachment E) where requirements depend on the flow control exempt status of the potential discharge location (see Section 4.1.1.5). Development at Barlow Point will be subject to one of two requirements depending on where stormwater is discharged.

As shown in the flow chart and on Table 2.5.1 in the SWMMWW, areas not in an Urban Growth Area and discharging to the CDID#1 ditch network are required to meet the LID Performance Standard. This means developments must match the post-developed discharge rate to 8% and 50% of the pre-developed 2-year 24-hour peak discharge flow rate. This may be accomplished through any BMP(s) in the SWMMWW 2014 or the LID Technical Guidance Manual for Puget Sound (except Rain Gardens).

Areas discharging directly to the Columbia River through new outfalls do not need to meet the LID Performance Standard because the Columbia River is designated as a flow control exempt water body. Some presumptive LID BMPs are still required to be implemented to the maximum extent practicable. These include downspout full infiltration, downspout dispersion systems, perforated stub-out connections, and post-construction soil quality depth.

4.1.1.4 STORMWATER QUALITY TREATMENT REQUIREMENTS

Due to the size and nature of the potential new development, both the Port and tenant areas will contain greater than 5,000 square feet of new Pollution Generating Hard Surface (PGHS) and/or greater than $\frac{3}{4}$ acres Pollution Generating Pervious Surface (PGPS) each of which trigger the requirement for stormwater treatment (see Attachment D).

The following six step process to determine municipal treatment is outlined in the SWMMWW 2014 (see Attachment G). Areas where industrial activities take place that fall under the ISGP will be subject to additional (see Section 4.2 below).

DETERMINE THE RECEIVING WATER AND POLLUTANTS - There are two possible discharge locations for stormwater leaving Barlow Point: the CDID#1 ditch network and directly to the Columbia River. The Columbia River is listed as a Basic Treatment Receiving Water in Appendix I-C of the SWMMWW 2014. Therefore, discharge directly to the Columbia River from non-industrial areas will require basic treatment.

The CDID#1 ditch network ultimately discharges to the Columbia River and stormwater discharge will likely also require basic treatment.

DETERMINE IF OIL CONTROL FACILITIES ARE REQUIRED - Oil control facilities will likely be required in

areas within both Port and tenant controlled areas. Oil control is typically applied to high use and industrial areas like fueling stations, maintenance areas, and rail yards. Potential Port controlled infrastructure that may require oil control could include rail fueling areas and any other potential industrial activity performed by the Port at Barlow Point. Potential tenant controlled infrastructure that may require oil control could include parking lots around administrative buildings and any external maintenance areas. Site uses identified in the liquid bulk option will require additional consideration and design features in terms of oil. Specifically, the potential crude oil export tenant that is part of the liquid bulk option will require extensive oil control and containment beyond the scope of the SWMMWW 2014. It is assumed that tenant controlled areas will be designed and constructed to meet the level of standard practice for those industrial facilities.

DETERMINE IF INFILTRATION FOR POLLUTANT REMOVAL IS PRACTICAL - An initial geotechnical exploration was performed in early 2015 that consisted of Cone Penetration Tests and test pits (see Appendix F of main report). Initial results indicated poor draining soils and a high groundwater table. In general, these conditions are similar throughout the greater Longview-Kelso area. These conditions suggest infiltration is likely not a practical solution at this site.

DETERMINE IF PHOSPHOROUS CONTROL IS REQUIRED - Due to the potential discharge locations and land uses, phosphorous control will likely not be required. Barlow Point will not discharge to a lake or other water bodies identified as sensitive to phosphorous. Non-industrial land uses like access roads, roofs, and parking lots are not typically a source of phosphorous.

DETERMINE IF ENHANCES TREATMENT IS REQUIRED - Enhanced treatment is used for the reduction of dissolved metals in stormwater discharge. Specific to Barlow Point, enhanced treatment is required for industrial sites that discharge directly to fresh water or conveyance systems that discharge to fresh waters designated for or have existing aquatic life. Portions of the private ditches and the CDID#1 ditch network are classified as Type F streams (WAC 222-16-030). By definition, discharge to these waters would require enhanced treatment.

However, based on prior work in the area and conversations with permit agencies, the State and City are familiar with the CDID#1 ditch network as being unique among mapped waterways as fish bearing because they are sluggish, low quality, weed choked, and their purpose is to convey stormwater and protect Longview from flooding. Additional coordination with the State and City is required to determine actual treatment levels for discharge to the ditch network.

The other potential discharge location for stormwater at Barlow Point is the Columbia River. The Columbia River is designated as a Basic Treatment Receiving Water according to the SWMMWW 2014. Stormwater discharge to this location is only required to be treated to the Basic Treatment level. This would likely only apply to areas that do not have industrial activities taking place (not covered by ISGP). Areas with industrial activities and covered by the ISGP that discharge to the Columbia will essentially need to provide enhanced treatment (see Section 4.2 below).

SELECT A TREATMENT FACILITY - Basic treatment is used to address removal of total suspended solids (TSS). Stormwater discharges from areas not covered by the ISGP and where industrial activities will not

take place will likely require basic treatment. Specific land uses are identified within areas covered by the ISGP or where industrial activities take place that only require basic treatment. These areas include landscaping and private parking areas for employees. Examples of basic water quality treatment methods include filter strips, media filter drains, swales and ponds. See Attachment H for a list stormwater quality treatment options including advantages, disadvantages, and a general recommendation of their applicability for use at Barlow Point.

4.1.1.5 STORMWATER QUANTITY (FLOW CONTROL) REQUIREMENTS

According to Volume I Appendix I-E of the SWMMWW 2014, both the Columbia River and the CDID#1 ditch network are considered flow control exempt. However, the City of Longview Stormwater Manual requires any development that creates greater than 5,000 square feet of new or replaced impervious surface to provide on-site flow control to discharge to the CDID#1 ditch network even if the project is located within the flow control exempt CDID#1 boundary. See Table 3 for the City flow control requirements.

Table 3 – City of Longview Flow Control Requirements

City of Longview Stormwater Manual 2012
50% of pre-developed 2-yr, 24-hr
Pre-developed 2-yr, 24-hr ¹
Pre-developed 25-yr, 24-hr
Pre-developed 100-yr, 24-hr

¹City of Longview Alternate Flow Control Requirements
(see LID Section 4.1.1.3 above)

According to the City Stormwater Manual, if LID is implemented to the maximum extent practicable, alternate flow control requirements may be allowed. Storm designs utilizing the alternate flow control requirements are allowed to match the full peak of the full 2-year, 24-hour design storm instead of 50% of the 2-year, 24-hour storm which reduced required detention volume.

4.1.1.6 WETLANDS PROTECTION

The existing site contains approximately 28.5 acres of preliminary and unverified wetlands. These wetlands will likely be disturbed during the development of Barlow Point and will likely require off-site mitigation. At such time development is proposed, there would be complete wetland delineation and a request for jurisdictional determination from USACE (see the Riverfront Environmental and Other Regulatory Consideration Report located in Appendix D of the main).

According to the United States Fish and Wildlife National Wetlands Inventory, the large private ditch that is shared with Mt. Solo Landfill is classified as a freshwater emergent wetland. Also, approximately 2,300 feet downstream of the site, CDID#1 Ditch #10 is classified as a riverine wetland. However, by definition from the City LMC 17.10.050 and LMC 17.10.070 (10), maintained drainage ditches are not considered a regulated wetland under the Critical Areas Ordinance. Therefore, the discharge to the large private ditch, Ditch #14 and Ditch #10 should not be subject to Minimum Requirement #8 from the SWMMWW 2014.

Additional coordination with the City and Ecology are required to determine requirements.

4.2 INDUSTRIAL GENERAL STORMWATER PERMIT

Under current Industrial Stormwater General Permit (ISGP) regulations, certain industry types included in the Dry and Liquid Bulk options will likely need to comply with the ISGP. The permit identifies facilities requiring coverage through Standard Industrial Classifications (SIC). DOE may also require a facility to obtain coverage if the facility: is a significant contributor of pollutants to waters of the state; may reasonably be expected to cause a violation of any water quality standard; or conducts industrial activity (e.g., maintenance and repair of vehicles on-site), or has a SIC with stormwater characteristics similar to industrial activity or SIC code listed in the permit (see permit Section S1.B). Certain areas have been excluded from requiring coverage including industrial facilities that discharge to sanitary sewer, industrial facilities that discharge exclusively to groundwater, or office building/administrative parking lots where stormwater does not comingle with industrial areas (see permit Section S1.C).

Compliance with the ISGP is demonstrative, as opposed to presumptive for municipal stormwater. Stormwater discharging to surface water bodies must be sampled at discrete locations and meet the benchmarks defined in the permit (see permit Section S4.B). According to the current ISGP document, new facilities requiring coverage constructed after the effective date of the ISGP permit shall submit an application to DOE showing compliance with ISGP requirements and State Environmental Policy Act (SEPA) requirements. Failure to meet benchmarks may trigger a series of Corrective Actions which include implementing and constructing new or additional operational, structural, and treatment BMPs. See Table 4 below for general discharge thresholds.

Table 4 – Industrial Stormwater General Permit Benchmarks

Parameter	Units	Benchmark Value
Turbidity	NTU	25
pH	Standard Units	Between 5.0 and 9.0
Oil Sheen	Yes/No	No Visible Oil Sheen
Copper, Total	µg/L	Western WA: 14
Zinc, Total	µg/L	117

¹See permit section S5.A Table 3: Benchmarks and Sampling Requirements Applicable to All Facilities for full table.

Areas with rail transportation have been identified in the ISGP as needing to comply with the permit’s discharge requirements. The Port may also be required to apply for coverage under the ISGP for certain areas of the rail corridor. The Port will need to negotiate with perspective tenants on how industrial stormwater is handled and treated for the rail corridor because pollution will be generated by the rail activity of the tenant.

4.3 NATIONAL POLLUTANT DISCHARGE ELIMINATION PHASE II

Barlow Point is located within the City which is currently covered under a National Pollutant Discharge Elimination (NPDES) Phase II Municipal Stormwater permit. Development of the “backbone infrastructure” may be considered a municipal separate storm sewer system (MS4). The Port, as a public entity and designated as a special purpose district, may be required to apply for coverage as a co-permittee or secondary permittee. Additional coordination is required with the State and the City to determine what level of stormwater improvements would trigger the requirement to become a co-permittee or secondary permittee.

4.4 COWLITZ COUNTY

The City of Longview is located within Cowlitz County and the property boundary to the north-east and east for Barlow Point abuts the City limits. The connection point to extend rail from the Reynolds Lead onto the site is located outside the property boundary within the limits of Cowlitz County. Development of the rail extension through the adjacent Burlington Northern Santa Fe (BNSF) parcel and potentially through a portion of the neighboring Northwest Alloys Inc. will be subject to the Cowlitz County Stormwater Drainage Manual (see the Land Use, Zoning, Comprehensive Plan and Easements Report located in Appendix C of the main report). Additional coordination will be required with the City and County to determine level of review between the two agencies.

4.5 WASHINGTON DEPARTMENT OF TRANSPORTATION

Widening of SR 432 is anticipated to be needed to provide a new site entrance to Barlow Point (see Appendix G of main report). The potential work located within the WSDOT right-of-way will be subject to WSDOT requirements including the stormwater requirements outlined in the HRM 2014 and the Hydraulics Manual 2010.

4.6 CONSOLIDATED DIKING DISTRICT #1

The CDID#1 is a Secondary Permittee under the NPDES Phase II municipal stormwater permit. As part of moving into Phase II of the Municipal Stormwater Permit, CDID#1 has developed a Stormwater Management Plan (SWMP) dated March 2012. The CDID#1 SWMP is ultimately a compliance document for CDID#1 to meet its own permit obligations for its MS4 as Secondary Permittee to the City of Longview and does not contain additional requirements for development at Barlow Point.

Regardless, the site is essentially surrounded by CDID#1 interests including Ditch #14, the Reynolds Lift Station, Ditch #10, and the levee. Close coordination with CDID#1 will be necessary for development of a site stormwater management approach at Barlow Point.

4.7 UNITED STATES ARMY CORPS OF ENGINEERS

The entire southern boundary of Barlow Point contains approximately 6,170 linear feet of levee structure which is part of the greater levee network protecting the City of Longview. The levee system throughout

the City is overseen by the CDID#1 and ultimately USACE.

Development at Barlow Point is anticipated to have infrastructure that interacts with the levee. This infrastructure may include new outfall pipes through or over the levee, product conveyor foundations and piles, pier abutments, access road, turnouts, ramps and levee enlargements. Specific requirements are outlined in the USACE design manual EM 1110-2-1913 Design and Construction of Levees (see the Section 7.0 References below). USACE prefers that new pipes cross over a levee rather than penetrate the levee embankment and generally, the only new pipelines allowed to penetrate the embankment of a levee are gravity drainage lines. Any new outfalls to the Columbia River will likely need to be pumped systems similar to the Reynolds Pump Station where the discharge lines travel through or over the levee.

The levee is considered a USACE civil works project and any project that proposes to alter a levee will be subject to Section 408 review by the USACE (see the Riverfront Environmental and Other Considerations Report in Appendix D of the main report). Due to levee failures from Hurricane Katrina in 2005, the USACE has been much stricter in reviewing and permitting the types of projects that are allowed to alter levees. This may make it difficult to get new lift station discharge lines that penetrate the levee permitted. Regardless of the permitting environment, there are sound engineering methods for constructing pump station discharge pipes over or through a levee. Additional and ongoing coordination with USACE will be required for the development of Barlow Point.

As part of this study, USACE was contacted through the CDID#1 representative for initial coordination and vetting of potential site development concepts. Concept exhibits were generated highlighting the design elements described above, most important of which is potential stormwater discharge pipes through the levee or over the levee (see Attachment C). USACE did not respond or provide input on the concept exhibits provided, likely due to the preliminary nature of the due diligence study.

4.8 WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

The site contains private drainage facility (PDF or private ditch) in the north-west portion of the site that may need to be realigned as part of the development concepts. Projects that use, divert, obstruct, or change the natural flow or bed of any state waters (e.g., culvert work or realignment) will be subject to Hydraulic Project Approval (HPA) by the Washington State Department of Fish and Wildlife (WDFW) as defined by RWC 77.55 and WAC 220-110.

4.9 NATIONAL MARINE FISHERIES SERVICES

There may be additional stormwater discharge thresholds put in place by other agencies, like the National Marine Fisheries Service (NMFS), that could be stricter than ISGP thresholds. These stricter thresholds may only apply to stormwater discharged directly to the Columbia River through new outfalls (see the Riverfront Environmental and Other Considerations Report located in Appendix D of main report). Additional coordination with NMFS and the State are required to determine discharge thresholds.

5.0 DEVELOPMENT ISSUES AND APPROACH TO MEET STORMWATER REQUIREMENTS

Various site issues related to stormwater were identified through review of existing site conditions and the planning process. Based on the review of the permitting and development requirements in Section 4, development at Barlow Point will be subject to a number of local, state, federal, municipal, and industrial stormwater requirements. The following section will address specific site development and how they may affect site development, outline available options and will also provide a general recommendation for handling stormwater at Barlow Point based on the LID, stormwater quality (treatment) and stormwater quantity (flow control) requirements identified in Section 4.

5.1 AREAL FILL ON-SITE

The on-site soils and elevation of the main developable area will impact design of stormwater systems. The average elevation of the area behind the levee is approximately elevation 10' NAVD88 with groundwater at approximately at elevation 8' NAVD88 during the wet season (see Section 2). Importing fill material across the site (areal fill) to raise the site elevation could provide benefit for a number of stormwater issues including more constructible detention ponds, more opportunity for gravity conveyance, and less energy required for pumping over the levee. However, aerial fill at a site as large as Barlow would require significant quantities of material and additional time for development to allow pre-settling. Potential areas to fill would not include the water side face of the levee. CDID#1 has stated that fill can be placed on top and on the land side face of the levee. This leaves approximately 252 acres of backland that could be brought up to the desired elevation. Filling an area of this size would require large quantities of material and would require an additional expense by either the Port or the Tenant. See Table 5 for approximate fill quantities.

Table 5 – Potential Areal Fill Volumes

Site Elevation (NAVD88)	Fill Depth ¹ (FT)	Volume ^{2,3} (CY)
11	2	820,000
12	3	1,220,000
13	4	1,630,000
14	5	2,040,000
15	6	2,440,000
16	7	2,850,000

¹Fill depth assumes 1 foot of clearing and grubbing would be required prior to fill. This depth may change with additional geotechnical investigation.

²Volumes are rounded up to the nearest ten thousand.

³Volumes do not include potential settlement due to geotechnical conditions.

Due to the geotechnical conditions (i.e., highly compressible site soils), areal filling will likely induce some level of ground settlement. To achieve site elevations reported above, additional fill depth would be

required. For example, for approximately every 1 foot of fill placed on the site, the existing ground will likely settle by approximately 1/4 foot (see the Preliminary Geotechnical Assessment located in Appendix F of main report). The cost of areal fill on the site will need to be balanced with the potential benefits it would provide but will not preclude development at Barlow Point.

5.2 DISCHARGE LOCATIONS, OUTFALLS, AND CONVEYANCE

5.2.1 COLUMBIA RIVER

Stormwater at Barlow Point could be discharged to the CDID#1 ditch network or directly to the Columbia River. The benefit of discharging to the Columbia River is that it is flow control exempt (see Section 4.1.1.5) which reduces the amount of detention volume required on-site. There are no existing outfalls on-site so discharge to the Columbia River will require the construction of new outfalls either through or over the top of the levee. Based on the USACE levee design requirements in Section 4.7 and input from CDID#1, it is anticipated that new outfalls will likely need to be routed over the top of the levee. Routing new outfalls over the levee will require pump stations. Access along the levee maintenance road will need to be maintained if new outfalls are routed over the levee (see Attachment C). According to CDID#1, placing fill on the top and land side slope of the levee is acceptable. Adequate cover will need to be provided over any outfall pipe. To check feasibility of a new outfall, rough order of magnitude conveyance flows were generated based on high use land use assumptions (see Section 3.1) for the largest combined Port and Tenant area. The outfall design check is based on the following assumptions.

- Conveyance flows were based on 85 acres of fully developed land. The 85 acres included portions of levee access road, lower access road, rail corridor, and all of Tenant 1 area and represents a large portion of the site south of the main access road that could potentially be directed to a new outfall location. Flow generated using WWHM2012 using 15-minute time steps. Existing conditions were modeled as pasture per the City manual. Peak 25-year and 100-year conveyance flows are 100 and 130 cubic feet per second (CFS) respectively which are conservative.
- Ideally, velocities in discharge pipes should be kept below 10 feet per second (FPS). Velocities greater than 10 FPS can reduce the service life of piping and valves.
- Velocity at the outfall should ideally be kept below 10 FPS. According to Volume V of the SWMMWW2014, outfalls with discharge velocities less than 10 FPS do not require gabion basket protection engineered energy dissipater structures.

Based on the above conservative assumptions, approximately four 24 inch diameter discharge pipes could discharge the 100 year peak with velocities less than 10 FPS for an 85 acre area over the levee. The four pipes could then be recombined into a single 48 inch diameter pipe for a single outfall with velocities less than 10 FPS. Smaller 24 inch diameter discharge lines could be used to cross the levee to reduce the amount of fill placed on the levee.

An alternative to discharging over the levee is discharge through the levee. A single, larger diameter pipe could be installed via a cut and cover method. The invert of the pipe could be located above the 500 year Columbia River flood elevation and still have room to provide approximately 3 feet of cover (see Figure 1).

The permitted top of levee elevation is approximately elevation 29.5 feet NAVD 88 so the pipe would be with the levee prism. Further coordination with USACE would be necessary to determine requirements.

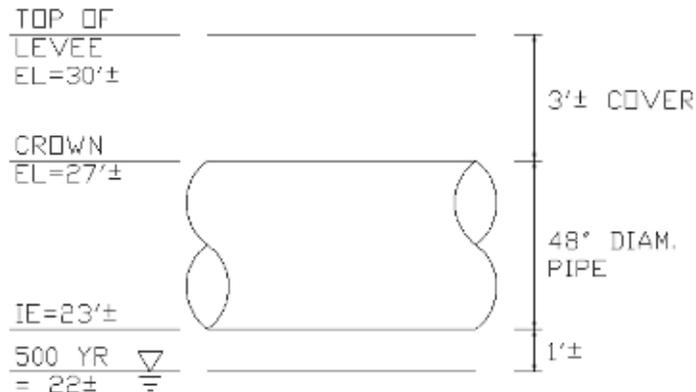


Figure 1 - Alternative Outfall Discharge through Levee

5.2.2 CDID#1 REYNOLDS PUMP STATION

As a third alternative, stormwater could be discharged to the Columbia River through the adjacent CDID#1 Reynolds Pump Station. Utilizing the existing infrastructure would reduce the number of new outfalls that would be needed and limit the impact to the levee and Columbia River. CDID#1 expressed willingness to consider partnering with the Port to utilize the Reynolds Pump Station. The pump station is currently activated intermittently by CDID#1 and the Port may be able to utilize its capacity in some fashion. The pump station is sized to discharge 80,000 gallons per minute (178 CFS) making it large enough to handle stormwater discharge from a sizable area. Additional coordination the Ecology, the City, and CDID#1 is required to determine if the Port can utilize the Reynolds Pump Station.

5.2.3 CDID#1 DITCH NETWORK

To utilize the Reynolds Pump Station, stormwater would need to be discharged to Ditch #14. Infrastructure to discharge stormwater to the CDID#1 ditch network is much simpler and outfall protection would need to be provided per CDID#1 standard details. As part of partnering with CDID#1 to utilize the Reynolds Pump Station, the Port and CDID#1 could agree to shared maintenance or improvements of Ditch #14 to increase its functionality. This would be mutually beneficial as it would improve drainage around Barlow Point and allow access to the Reynolds Pump station while reducing the maintenance burden on CDID#1.

5.2.4 ON-SITE CONVEYANCE

Ideally, all stormwater would be conveyed through gravity systems and could be provided through a series of ditches and gravity sewer pipes. Gravity conveyance systems are typically less expensive to operate than pump systems over the long term. However, the site is expansive with the north-west corner of the site being hydraulically remote from the potential new outfalls and ditches. The ability to effectively utilize gravity sewer pipes would be based the amount of fill brought to the site and the expected finished

elevation (see Section 5.1). Pump stations may be necessary to convey stormwater from the remote locations to their treatment and discharge points.

5.3 ON-SITE STORMWATER MANAGEMENT (LOW IMPACT DEVELOPMENT)

LID requirements are based on the chosen discharge location for stormwater (see Section 5.2). LID features may consist of a flow control performance standards or implementation of presumptive stormwater features. Areas discharging to the CDID#1 ditch network must meet the LID performance standard and areas discharging to the Columbia River only need to implement presumptive stormwater features (see Section 4.1.1.3).

For areas of Port backbone infrastructure that discharges to the CDID#1 ditch network, the LID features should be implemented to the maximum extent practicable to reduce the required detention volumes (see Section 5.5). This may be accomplished through bioretention areas/swales located in ancillary areas adjacent to the private drainage ditch or Ditch #14. Other BMPs, like permeable pavements may be used in low traffic, non-industrial areas but may be difficult to implement due to the high groundwater.

For areas of Port backbone infrastructure that discharge to the Columbia River, the presumptive LID feature most suited for the site is Post-construction Soil Quality Depth. This involves reusing existing duff layer soils or amending disturbed areas with "topsoil" in areas not converted to impervious surface to bolster stormwater functionality of the soil. See Attachment F for LID BMP options.

Lastly, for development of the tenant areas, the tenants will be responsible for meeting the City LID requirements for their individual developments. Tenants may implement green roofs, rainwater harvesting, permeable pavements or other LID BMPs to meet the LID requirements. Additional water rights review would be needed to implement rainwater harvesting.

The City of Longview recognizes that the poorly draining soils and high groundwater table, which is typical of the Longview-Kelso area and Barlow Point, makes LID practices less effective than in other areas in Western Washington. LID requirements will need to be closely coordinated with the City but they do not preclude the development of Barlow Point.

5.4 STORMWATER QUALITY TREATMENT

This section will focus on municipal and industrial stormwater quality treatment options available for Port controlled backbone infrastructure including the access road, support areas like the substation, and the rail corridor. For development of the tenant areas at Barlow Point, it is assumed that tenants will be responsible for their stormwater quality compliance, both municipal and industry, within their lease areas.

TREATMENT TYPES

In general, stormwater treatment technologies can be organized into two major categories, passive (gravity driven) and active (power/pump driven) or a combination of the two. Passive treatment systems include bioretention/filtration, drain inlet inserts, hydrodynamic separation, oil/water separators and media filtration. Active treatment systems include chemical filtration/treatment, electrocoagulation, ion

exchange, reverse osmosis and pressurized filtration.

The treatment types that can be used to address the Port backbone infrastructure vary and are also categorized more generally by Ecology. These categories/requirements include oil treatment, pre-treatment, basic treatment, enhanced treatment, phosphorus control, and construction treatment. For the purposes of this study, construction treatment will not be addressed further except for technologies like chitosan enhanced sand filtration (CESF) and electrocoagulation which have been utilized more frequently as permanent treatment to meet ISGP discharge requirements.

For the typical Ecology categories, there are generally both non-proprietary and proprietary technologies that can be used to address municipal stormwater treatment requirements. The proprietary technologies described in the SWMMWW 2014 are listed as Emerging Technologies, and are controlled under the Ecology TAPE (Technical Assessment Protocol) program. These technologies are categorized as General Use Level Designation (GULD), Conditional Use Level Designation (CULD), and Pilot Use Level Designation (PULD) and, in the order listed, generally represent a level of confidence in the technology from highest to lowest.

For industrial areas controlled by ISGP requirements, Emerging Technologies (proprietary) or construction technologies (proprietary) are typically necessary to meet discharge benchmarks. Non-proprietary stormwater treatment methods listed in the SWMMWW 2014 are generally not individually able to meet benchmarks or are not feasible due to reasons like excessive size requirements or other site constraints.

For the support areas like the substation stormwater treatment will likely include pretreatment, oil control and enhanced treatment for discharge to the PDF and Ditch #14. For an isolated stormwater area like the substation, these treatment types could be provided in a treatment train where stormwater passes from one treatment type to the next before discharge.

For this study, the feasibility/applicability of stormwater treatment methods for both the typical Ecology categories and Emerging Technologies were assessed (see Attachment H). This included a brief description of the technology, advantages and disadvantages, Ecology treatment rating, Ecology TAPE rating, general ability to meet ISGP requirements, and general cost trends installation and maintenance. A select group of Emerging Technologies were chosen to represent a broad range of treatment types and were assessed based on past project experience and discussions with treatment vendors. The assessment of Emerging Technologies also includes a determination if the technology is applicable for the site and further goes to make recommendations on technology types based on Port input.

5.4.1 STORMWATER QUALITY TREATMENT APPROACH

The recommended general approach to the stormwater treatment for Barlow Point should be to separate industrial and municipal flows to the maximum extent practicable. This would provide the best opportunity for compliance with the ISGP by reducing the amount of stormwater treated, and thus reduce the size of the more expensive treatment technologies capable of meeting discharge thresholds. Separating industrial and municipals stormwater should start by separating stormwater between tenant and Port controlled areas. This could occur in the upstream conveyance system with the Port and Tenants

discharging to a shared lift station and outfall controlled by the Port (see Section 5.2). Tenants would have separate conveyance and treatment systems within their lease limit to treat stormwater to their individual requirements and would sample prior to discharging to the Port lift station or other “Point of Compliance” (see Attachment I for stormwater schematic). This would benefit both the Port and Tenants by eliminating ambiguity over who is responsible for treating what stormwater.

For Port municipal areas, centralized treatment of stormwater is not likely practical given the linear nature of the Port backbone infrastructure with the exception of the support areas. Centralized treatment also required additional power and pumping infrastructure to convey stormwater from hydraulically remote locations to the treatment areas. In general, low permeability soils and high groundwater preclude a number of infiltration based treatment methods. Shallow infiltration/filter methods like filter strips or biofiltration swales with underdrains may be applicable adjacent to roads or other ancillary areas. The applicability/constructability of some the larger municipal treatment methods, like wet ponds, will be subject to how much fill is placed on the site for development although the premium on space for industrial/terminal sites typically limits the available space for large treatment ponds.

For Port industrial areas, selecting a treatment system to meet ISGP discharge threshold requirements must meet all known, available, and reasonable methods of treatment, prevention and control (AKART). Treatment systems will need to be selected based on the expected range/concentration of constituents (see Table 4). Treatment technologies range from gravity based media filtration up to more expensive technologies like chitosan enhanced sand filtration and electrocoagulation with the latter two being more flexible and likely to meet benchmarks but significantly more expensive (see Attachment H).

For the Port backbone areas, stormwater treatment will be an integral part of the development of Barlow Point. Development will require meeting the presumptive stormwater treatment requirements of the SWMMWW 2014 but additional design and coordination with the Port is required to choose a treatment technology to meet the demonstrative requirements of the ISGP. Neither municipal nor industrial treatment requirements will preclude development of Barlow Point.

5.5 STORMWATER QUANTITY (FLOW CONTROL)

Flow control is required per Minimum Requirement #7 of the SWMMWW 2014 and is typically achieved through detention ponds or combined detention/wetpool facilities. For the simplest construction, the bottom of these facilities should typically be place above ground water or would need to be concrete lined. The bottom of detention ponds should typically be placed at least 1’ above ground water and have 1’ minimum sediment storage. After sediment storage, detention storage would be provided with an additional 1’ to 1.5’ of freeboard on top of that (see Figure 2).

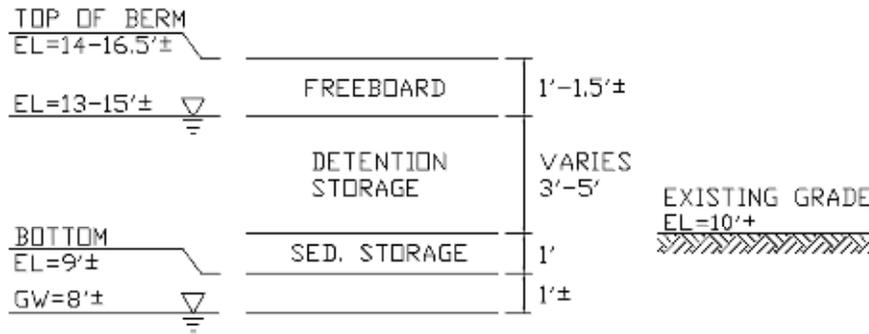


Figure 2 - Detention Pond Schematic

Depending on how much fill is placed on the site, the detention pond berm may be above grade and pumping would be required to convey stormwater to the pond.

As a general rule in the Pacific Northwest, approximately 1/2 acre-ft of detention volume is required per acre of developed area. Stormwater from the water side face of the levee will not be captured leaving approximately 252 acres that could be developed. Approximate detention volume required for 252 acres is 126 acre-feet which is conservative. For a theoretical detention pond size with detention storage depths ranging from three to five feet, 126 acre-ft of storage would require an approximately 43 to 26 acre detention pond. A preliminary sizing of a detention pond was also performed using the hydraulic modeling program WWHM2012. The detention volume required was approximately 112 acre-feet at a depth of 4 feet which would require approximately 28 acres. This analysis will assume the more conservative amount of 126 acre-ft. Providing detention areas of this size is not the highest and best use for a site development.

There are options for reducing the amount of detention on-site. Likely, the most effective method to reduce the quantity of on-site detention is a combination of methods including meeting the City LID performance requirement and to discharge directly to the Columbia due to its flow control exempt status. If the 145 acres of tenant area identified in Section 3.1 are discharged to the Columbia, the required detention volume decreases from 126 acre-ft to approximately 54 acre-ft. This would require a detention pond area of approximately 11 to 18 acres (5 and 3 feet storage depth respectively).

A regional detention pond controlled by CDID#1 is located approximately 3,500 feet downstream of Barlow Point. A portion of the on-site detention requirements may be waived by the City if the Port utilizes the regional detention pond. As of May of 2015, there are 260,000 cubic feet of storage remaining in the pond available for purchase at \$2.28 per cubic foot on a first-come, first-served basis. The available storage equates to approximately 6 acre-ft. Utilizing the regional detention pond will reduce the amount of on-site detention from 54 acre-ft to 48 acre-ft but would not satisfy all detention needs.

A potential location on-site for large detention ponds is the landside triangle formed by the BPA easement on the east side of the site. This area provides approximately 5.5 to 6 acres of available space that will likely not be able to be developed for industrial use per BPA requirements but may be used for water storage. Detention ponds ranging in storage depth from 3' to 5' would be able to impound 18 to 30 acre-ft of the remaining 48 acre-ft within the BPA triangle. This means an additional 18 to 30 acre-ft of

storage would need to be provided elsewhere on-site. There are approximately 10 to 15 acres of ancillary area north of the access road that could be utilized for detention.

Choice of detention pond outlet structure can also affect detention volume. Typical detention outlet structures consist of a vertical tee with multiple downturned elbows with control orifices and an emergency overflow. These structures, though effective, typically under approximate the pre-developed outflow hydrograph which leads to additional, unnecessary storage volume. There are outlet structure technologies, like buoyant flow control devices (BFD), that claim to reduce the overall detention volume required by up to 50% by more closely matching the pre-developed outflow hydrograph (i.e., more efficient use of land). Additional design is necessary to determine if this method is appropriate for Barlow Point.

Lastly, individual detention facilities should be limited in size to impound less than 10 acre-ft of water in volume if possible. Stormwater detention facilities that can impound 10 acre-ft or more with the water level measured at the embankment crest are subject to the state's dam safety requirements, even if water storage is intermittent and infrequent (WAC 173-175-020(1)). This would increase the cost to construct and maintain a detention facility but would not preclude development of Barlow Point.

Based on a conservative method to estimate required detention volumes, there is enough additional space on-site to meet detention requirements but will not likely be met in as single location due to site layout and pond size constraints. It is recommended that a combination of methods be utilized to handle and discharge water including direct discharge to the Columbia, utilizing the regional detention ponds, and meeting the City LID requirements. After directing discharge to flow control exempt waters and using offsite detention, efficient detention technologies should be utilized to further reduce required detention volumes. Based on this review, there are multiple potential discharge locations for stormwater and multiple opportunities to address detention on-site. Flow control requirements will not precluded development of Barlow Point.

6.0 CONCLUSION

Stormwater requirements were evaluated for the potential development of Barlow Point. This included investigation of the existing site, identifying initial permitting and stakeholder requirements, and a high-level analysis of critical stormwater components based on the conceptual site layouts and requirements.

The stormwater requirements for the City, Cowlitz County, WSDOT and the ISGP will be applicable to various parts of the potential development. The City and County stormwater requirements are based on Ecology's SWMMWW 2014. Site development will also need to comply with CDID#1 requirement to discharge to the ditch network.

Due to the size and nature of the improvements, the potential development will likely be subject to all nine Minimum Requirements of the SWMMWW. This includes the requirements for Low Impact Development, stormwater quality (treatment) and flow control (detention).

Areas where industrial activities take place like the rail corridor and tenant lease holds will likely be subject to ISGP requirements. These requirements, unlike the municipal permit requirements, are demonstrative and require sampling proof that discharge limits are being met. Typical municipal stormwater treatment methods are generally not adequate to meet the requirements of the ISGP.

Development at Barlow Point will be subject to flow control requirements. Meeting the flow control requirements for the development of a Greenfield site will likely require large volumes of detention (e.g., large ponds). To reduce the size of the detention required on site, new outfalls could be installed to discharge stormwater to the Columbia River (which is flow control exempt) and the Port could purchase detention storage in the Regional Detention Pond located downstream of the site. In addition, there is an opportunity to partner with CDID#1 to utilize the Reynolds lift station as a potential outfall to the Columbia River.

Lastly, Barlow Point is located within the City which is covered under a Phase II municipal stormwater permit. The Port, as a public entity and designated as a special purpose district, may be required to apply for coverage as a co-permitee or secondary permittee since the backbone infrastructure for storm will be owned and operated by the Port .

While the stormwater considerations needed for the development of Barlow Point will be significant, there are enough alternatives to accommodate development.

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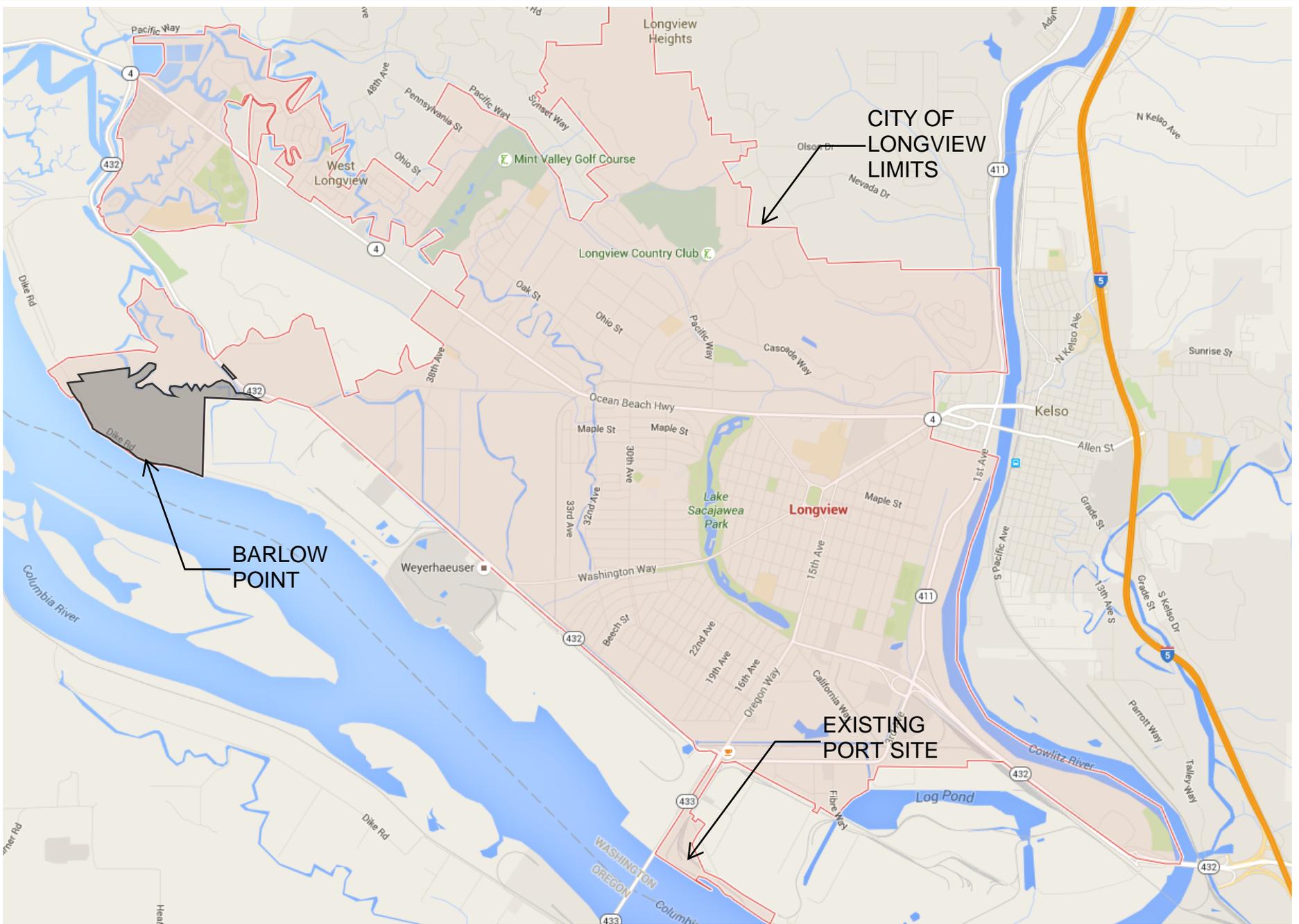
Pringle, Russell F., Evans, Robert L. *Soil Survey of Cowlitz County, Washington*. United States Department of Agriculture, Natural Resources Conservation Service, Washington State Department of Natural Resources, and Washington State University Agricultural Research Center, 1988. PDF. Retrieved August 12, 2015, from http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/washington/cowlitzWA2006/Cowlitz.pdf.

Washington State Department of Ecology. *2013-2018 Western Washington Phase II Municipal Stormwater Permit*. 2014. PDF. Retrieved August 12, 2015, from <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/phaseIIww/wwphiipermit.html>.

Washington State Department of Ecology. *Industrial Stormwater General Permit*. 2014. PDF. Retrieved August 19, 2015, from <http://www.ecy.wa.gov/programs/wq/stormwater/industrial/ISGPFinal2015.pdf>

ATTACHMENT A:
LOCATION MAP

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NOT TO SCALE

 PORT OF LONGVIEW

kpff
Consulting
Engineers

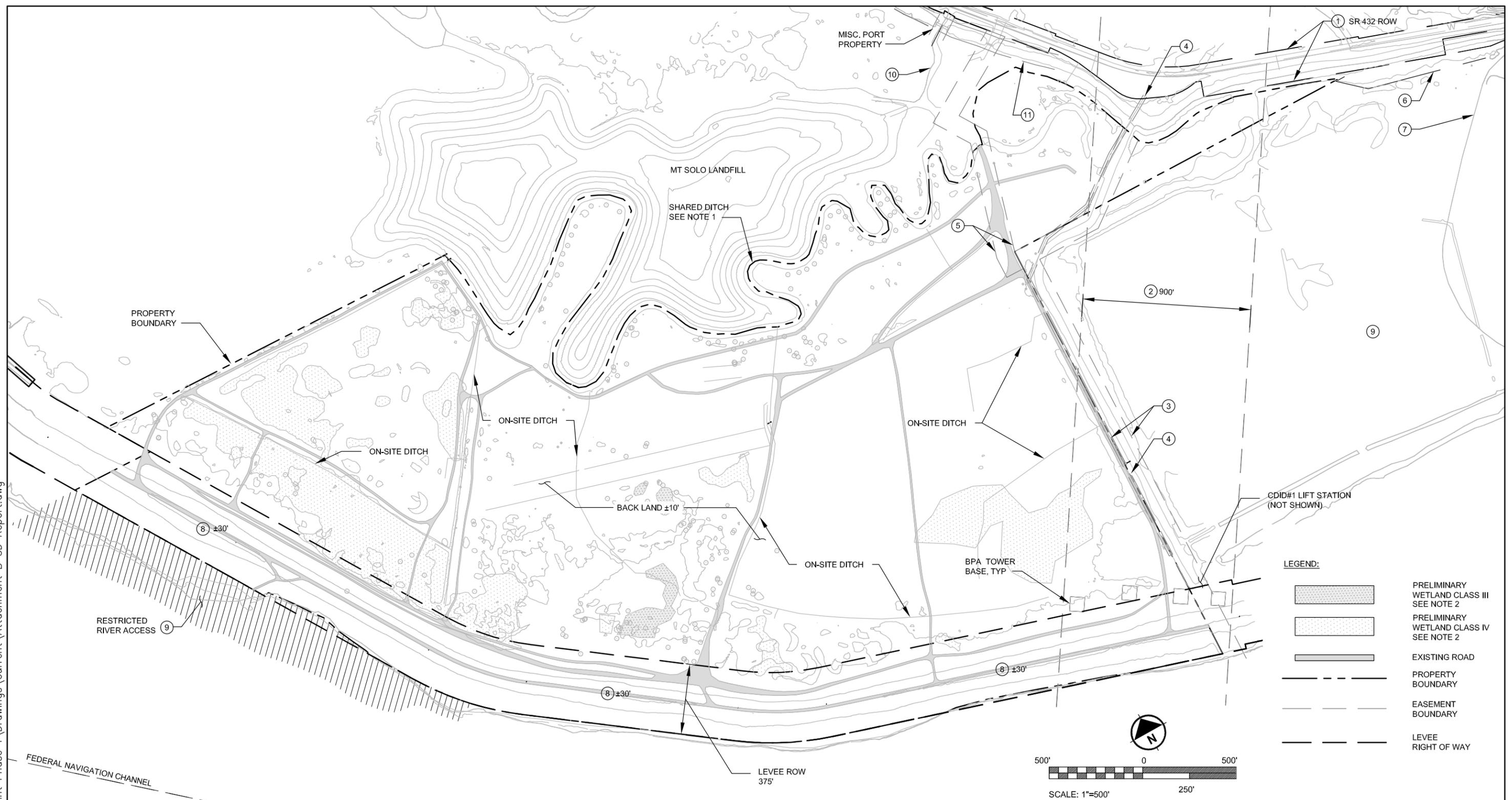
BARLOW POINT
PORT OF LONGVIEW
ATTACHMENT A
LOCATION MAP

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ATTACHMENT B:
EXISTING SITE PLAN AND AREAS

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Plotted: Mar 09, 2016 - 2:01pm ebeckwith Layout1
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- ① SR432 (NHS, ROW VARIES 70'-185')
- ② BPA EASEMENT (900')
- ③ CDID#1 DITCH EASEMENT (100')
- ④ CDID#1 ELECTRICAL EASEMENT (20')
- ⑤ ACCESS EASEMENT (100')
- ⑥ BNSF PARCEL PER GIS (APPROX.)
- ⑦ BNSF RAIL SPUR (APPROX.)
- ⑧ CDID#1 LEVEE
- ⑨ NORTHWEST ALLOYS PROPERTY
- ⑩ INGRESS/EGRESS EASEMENT
- ⑪ DITCH EASEMENT

NOTES:

1. PROPERTY BOUNDARY RUNS ALONG CENTER OF SHARED DITCH.
2. WETLAND BOUNDARIES SHOWN ARE PRELIMINARY AND UNVERIFIED.

DRAFT



**PORT OF LONGVIEW - BARLOW POINT
 SITE CONCEPT
 EXISTING CONDITIONS**

DATE: 2015-08-07	SCALE: AS SHOWN
DRAWN BY: ESB	1 OF 1

ATTACHMENT B

kpff		Project: Barlow Point Due Diligence Study	Date: 6/16/2015
1601 5th Avenue, Suite 1300		Location: Barlow Point, City of Longview, WA	Sheet #
Seattle, Washington 98101		Client: Port of Longview	Job # 114180
		By: E. Beckwith	
	Area (SF)	Area (AC)	Notes
Property Boundary	12,305,700	282.5	
Existing Conditions of Site			
Preliminary Wetlands Total	1,241,460	28.5	
Acquired Tidelands Total	326,700	7.5	
Gravel Roads Total	558,420	12.8	
PDF Ditch Total	312,239	7.2	
Pasture Total	9,866,881	226.5	
Pasture Steep Subtotal	1,626,610	37.3	Levee Slopes
Pasture Flat Subtotal	8,240,271	189.2	
Subtotal	12,305,700	282.5	
Off-Site Flow	38,492	0.9	
Total	12,344,192	283.4	
Area Draining Into Site			
Preliminary Wetlands Total	1,241,460	28.5	
Gravel Roads Total	558,420	12.8	
Levee Road Subtotal	49,646	1.1	
Gravel Road Draining to Site Total	508,774	11.7	
PDF Ditch Total	312,239	7.2	
Pasture Total	9,866,881	226.5	
Pasture Subtotal	1,009,482	23.2	Waterside slope of levee
Pasture Subtotal	8,857,399	203.3	
Pasture Steep	617,128	14.2	Landside slope of levee
Pasture Flat	8,240,271	189.2	
Subtotal	10,919,872	250.7	
Off-Site Flow	38,492	0.9	
Total	10,958,364	251.6	Round up to 252 acres.
Notes:			
1) Acres are rounded up to the nearest tenth.			

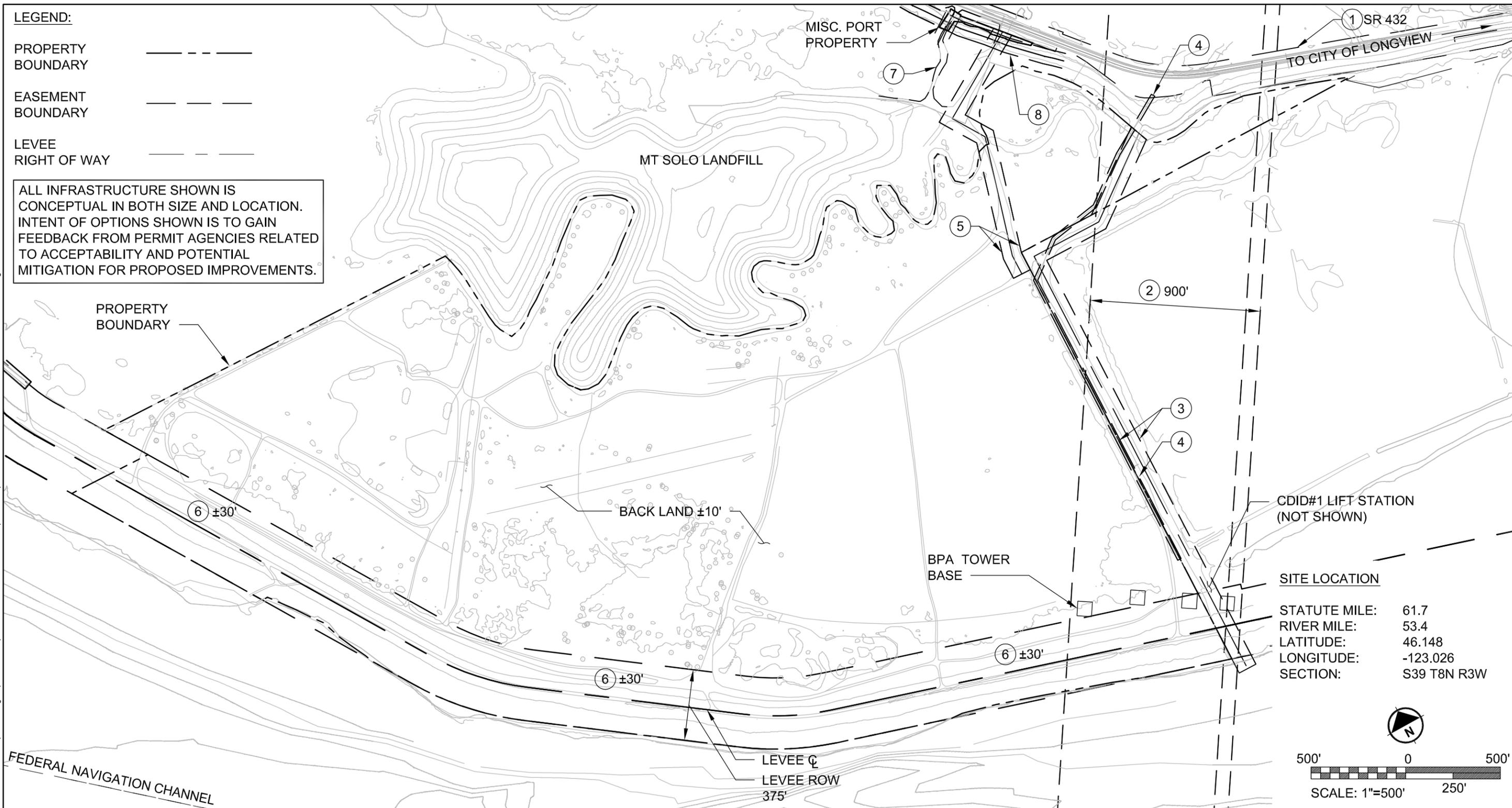
ATTACHMENT C:
USACE COORDINATION EXHIBITS

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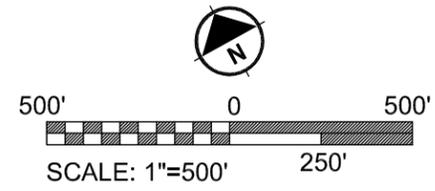
- LEGEND:**
- PROPERTY BOUNDARY
 - EASEMENT BOUNDARY
 - LEVEE RIGHT OF WAY

ALL INFRASTRUCTURE SHOWN IS CONCEPTUAL IN BOTH SIZE AND LOCATION. INTENT OF OPTIONS SHOWN IS TO GAIN FEEDBACK FROM PERMIT AGENCIES RELATED TO ACCEPTABILITY AND POTENTIAL MITIGATION FOR PROPOSED IMPROVEMENTS.



SITE LOCATION

STATUTE MILE: 61.7
 RIVER MILE: 53.4
 LATITUDE: 46.148
 LONGITUDE: -123.026
 SECTION: S39 T8N R3W



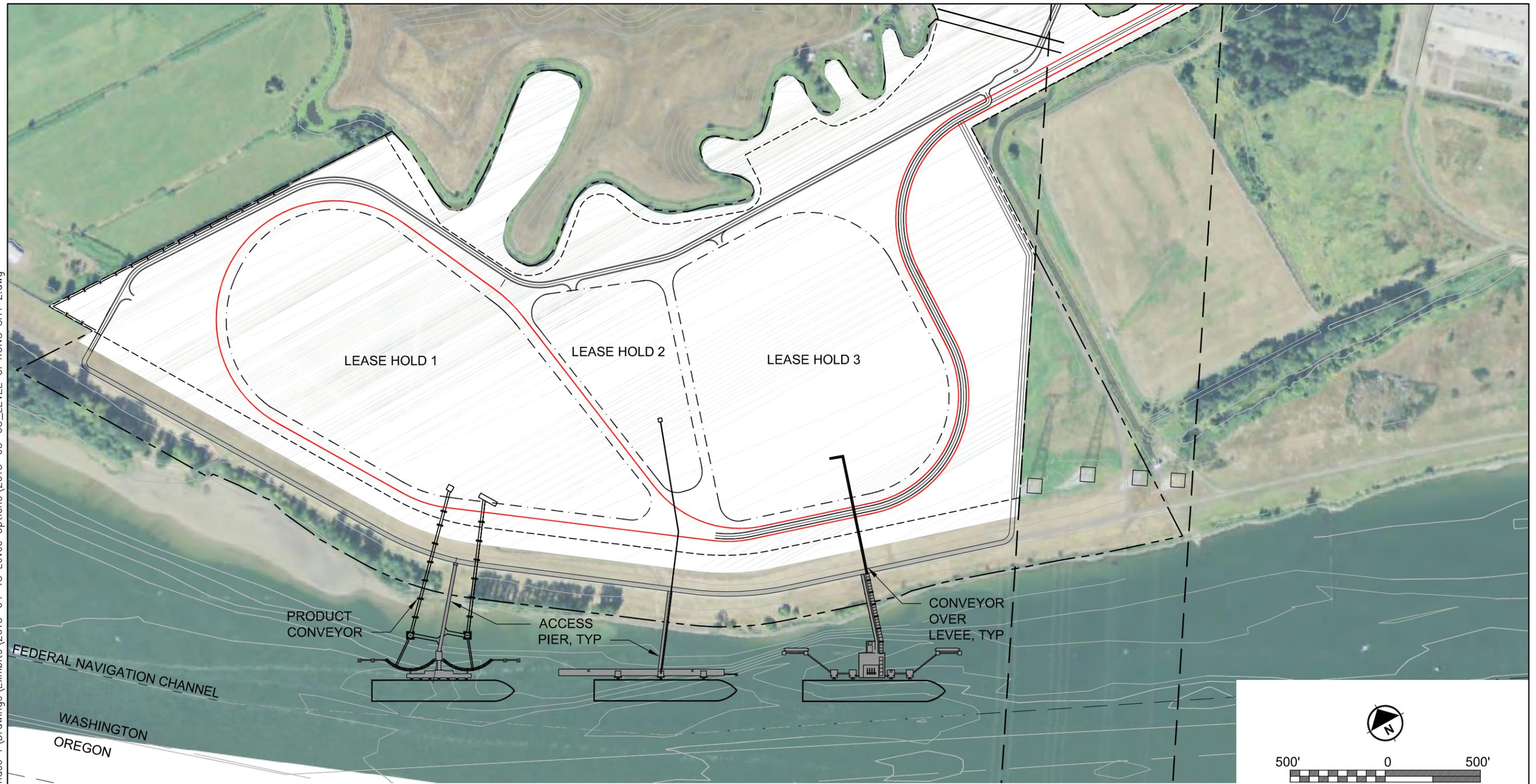
- ① SR432 (NHS, ROW VARIES 70'-185')
- ② BPA EASEMENT (900')
- ③ CDID#1 DITCH EASEMENT (100')
- ④ CDID#1 ELECTRICAL EASEMENT (20')
- ⑤ ACCESS EASEMENT (100')
- ⑥ CDID#1 LEVEE
- ⑦ INGRESS/EGRESS EASEMENT
- ⑧ DITCH EASEMENT

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BARLOW POINT EXISTING CONDITIONS	
DATE: 2015-05-05	SCALE: AS SHOWN
DRAWN BY: ESB	SHT 1 OF 5

Plotted: Aug 24, 2015 - 5:31pm jchapman Layout: SHT2
 M:\2014\114180 Barlow Point Phase 1\Drawings\Exhibits\2015-04-15 Levee Options\2015-05-05_LEVEE_OPTIONS_SHT_2.dwg



NOTES:

1. VARIOUS TYPES OF PIERS ARE SHOWN. ACTUAL PIER TYPE AND CONFIGURATION WILL BE DETERMINED BY FUTURE TENANT.
2. PIER HEAD LINE AND ORIENTATION ARE APPROXIMATE.

ALL INFRASTRUCTURE SHOWN IS CONCEPTUAL IN BOTH SIZE AND LOCATION. INTENT OF OPTIONS SHOWN IS TO GAIN FEEDBACK FROM PERMIT AGENCIES RELATED TO ACCEPTABILITY AND POTENTIAL MITIGATION FOR PROPOSED IMPROVEMENTS.

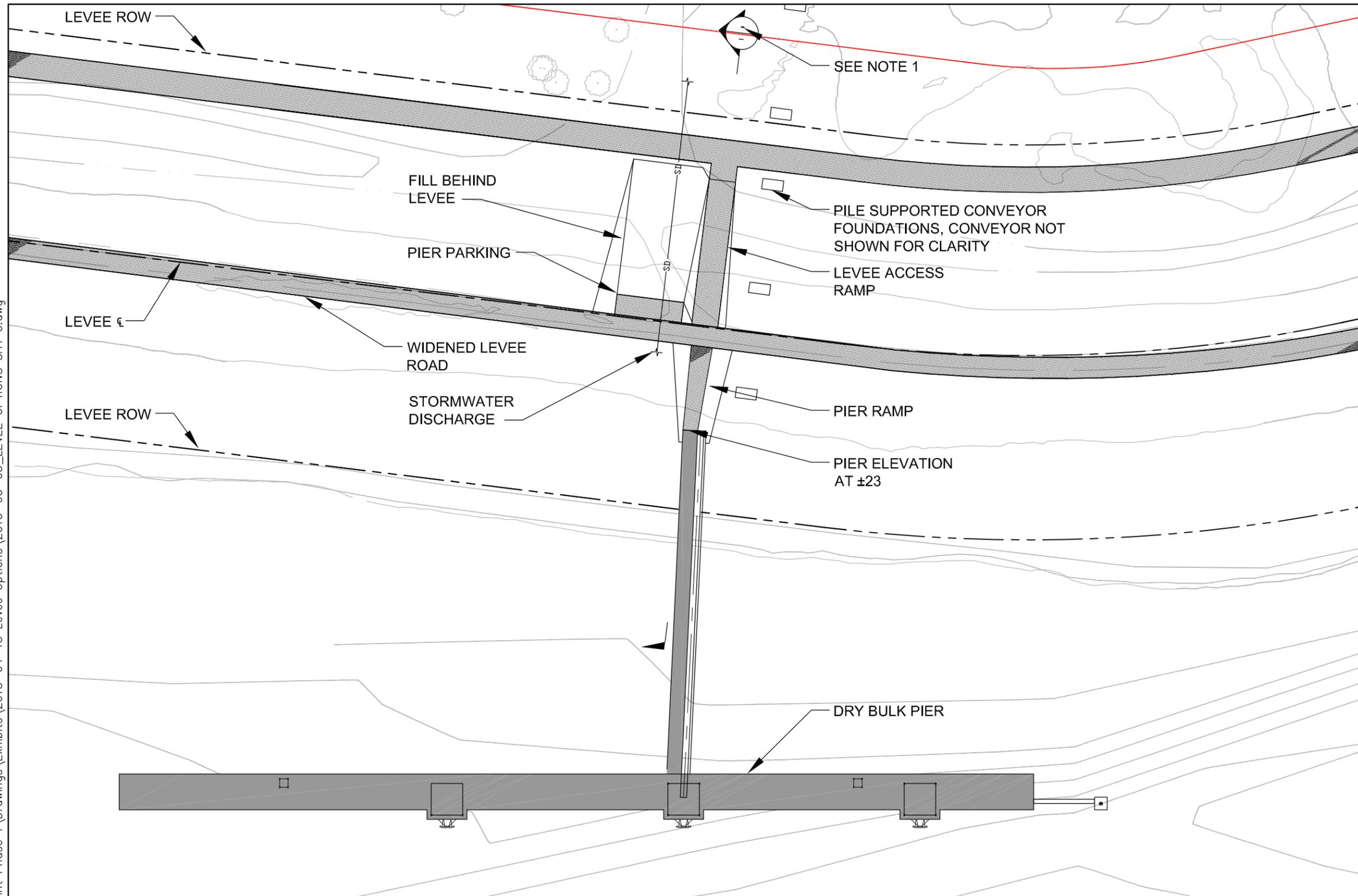
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PORT OF LONGVIEW
kpff
CargoVelocity

**BARLOW POINT
 LEVEE OPTIONS
 GENERAL PROPOSED SITE**

DATE: 2015-05-05	SCALE: AS SHOWN
DRAWN BY: ESB	SHT 2 OF 5

Plotted: Aug 24, 2015 - 5:32pm jchapman Layout: Exhibit A
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- NOTES:
1. SEE SHEETS 4 AND 5 FOR SECTIONS. SECTIONS SHOWN ARE FOR OPTIONS TO CONSTRUCT NEW OUTFALL(S) UNDER OR OVER THE LEVEE.

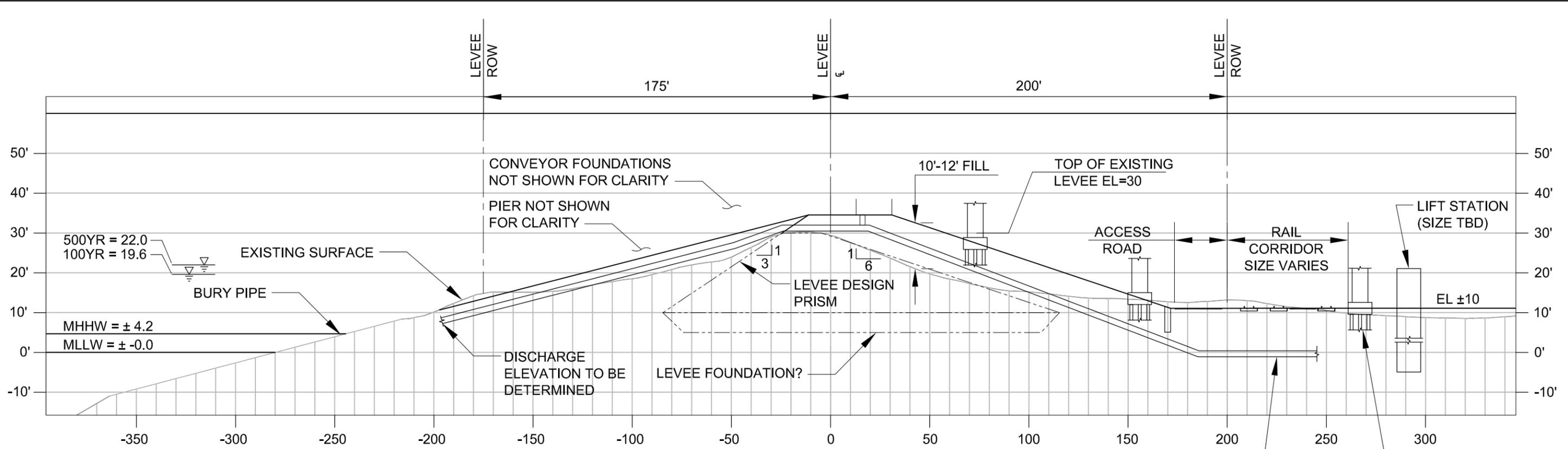
ALL INFRASTRUCTURE SHOWN IS CONCEPTUAL IN BOTH SIZE AND LOCATION. INTENT OF OPTIONS SHOWN IS TO GAIN FEEDBACK FROM PERMIT AGENCIES RELATED TO ACCEPTABILITY AND POTENTIAL MITIGATION FOR PROPOSED IMPROVEMENTS.

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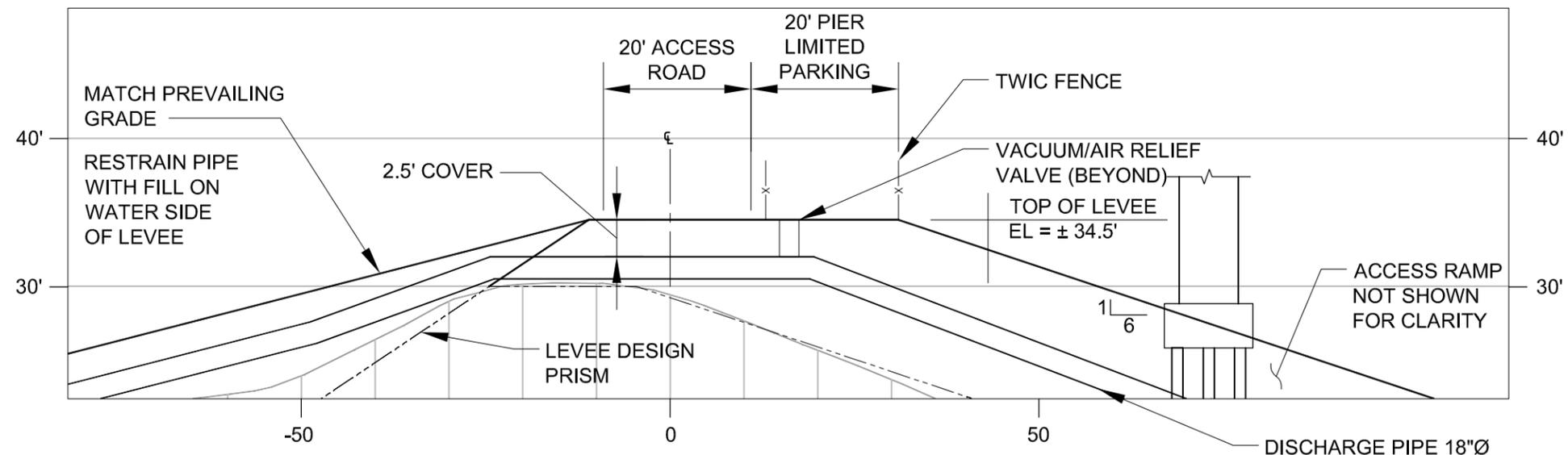


BARLOW POINT LEVEE OPTIONS ENLARGED PLAN	
DATE: 2015-05-05	SCALE: AS SHOWN
DRAWN BY: ESB	SHT 3 OF 5

Plotted: Aug 24, 2015 - 5:33pm jchapman Layout: Exhibit A
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SECTION A
 VERT: 1"=25'
 HORZ: 1"=50'



SECTION A1
 VERT: 1"=10'
 HORZ: 1"=20'

ALL INFRASTRUCTURE SHOWN IS CONCEPTUAL IN BOTH SIZE AND LOCATION. INTENT OF OPTIONS SHOWN IS TO GAIN FEEDBACK FROM PERMIT AGENCIES RELATED TO ACCEPTABILITY AND POTENTIAL MITIGATION FOR PROPOSED IMPROVEMENTS.

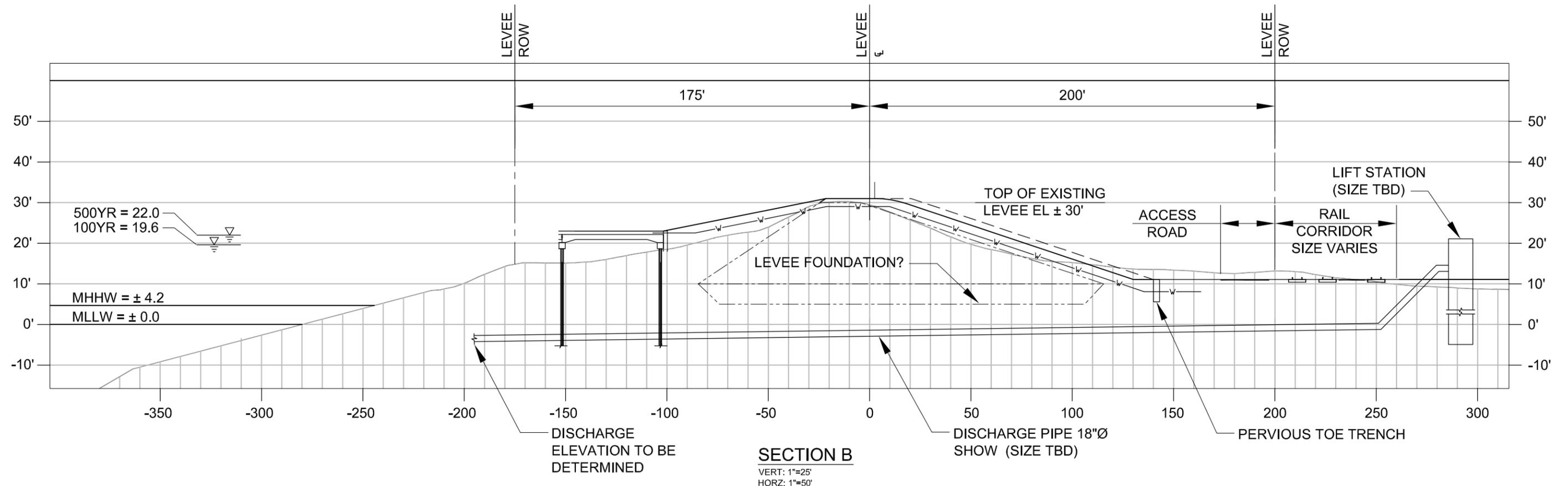
- NOTES:**
1. TOP OF LEVEE (PERMIT ELEV) IS BETWEEN ELEVATION 29.4' TO 29.8' NAVD88.
 2. PARKING WOULD BE LOCATED AT EACH PIER.

DRAFT

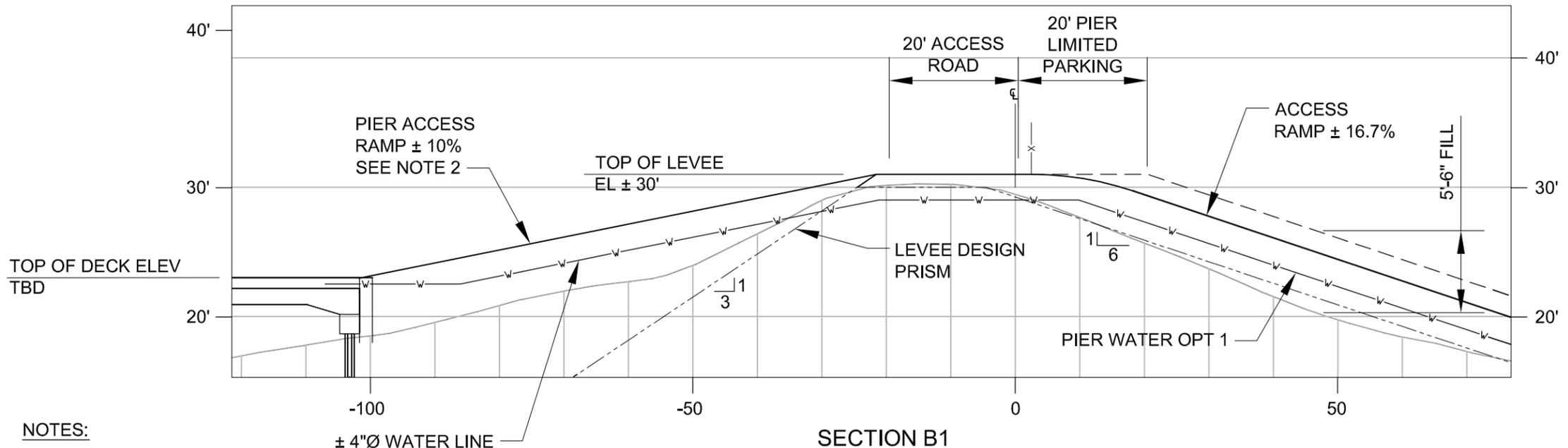


BARLOW POINT LEVEE OPTIONS SECTIONS	
DATE: 2015-05-05	SCALE: AS SHOWN
DRAWN BY: ESB	SHT 4 OF 5

Plotted: Aug 24, 2015 - 5:36pm jchapman Layout: Exhibit B
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SECTION B
 VERT: 1"=25'
 HORZ: 1"=50'



SECTION B1
 VERT: 1"=10'
 HORZ: 1"=20'

ALL INFRASTRUCTURE SHOWN IS CONCEPTUAL IN BOTH SIZE AND LOCATION. INTENT OF OPTIONS SHOWN IS TO GAIN FEEDBACK FROM PERMIT AGENCIES RELATED TO ACCEPTABILITY AND POTENTIAL MITIGATION FOR PROPOSED IMPROVEMENTS.

- NOTES:**
1. TOP OF LEVEE (PERMIT ELEV) IS BETWEEN ELEVATION 29.4' TO 29.8' NAVD88.
 2. TOP OF DECK AND RAMP IS SIMILAR FOR ALL OPTIONS.
 3. PARKING WOULD BE LOCATED AT EACH PIER.

DRAFT



BARLOW POINT LEVEE OPTIONS SECTIONS	
DATE: 2015-05-05	SCALE: AS SHOWN
DRAWN BY: ESB	SHT 5 OF 5

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ATTACHMENT D:
CITY OF LONGVIEW STORMWATER
MANUAL LOCAL AND STATE
REQUIREMENTS FLOWCHART

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FIGURE 2.1.1: “LOCAL” REQUIREMENTS FLOWCHART (all projects)

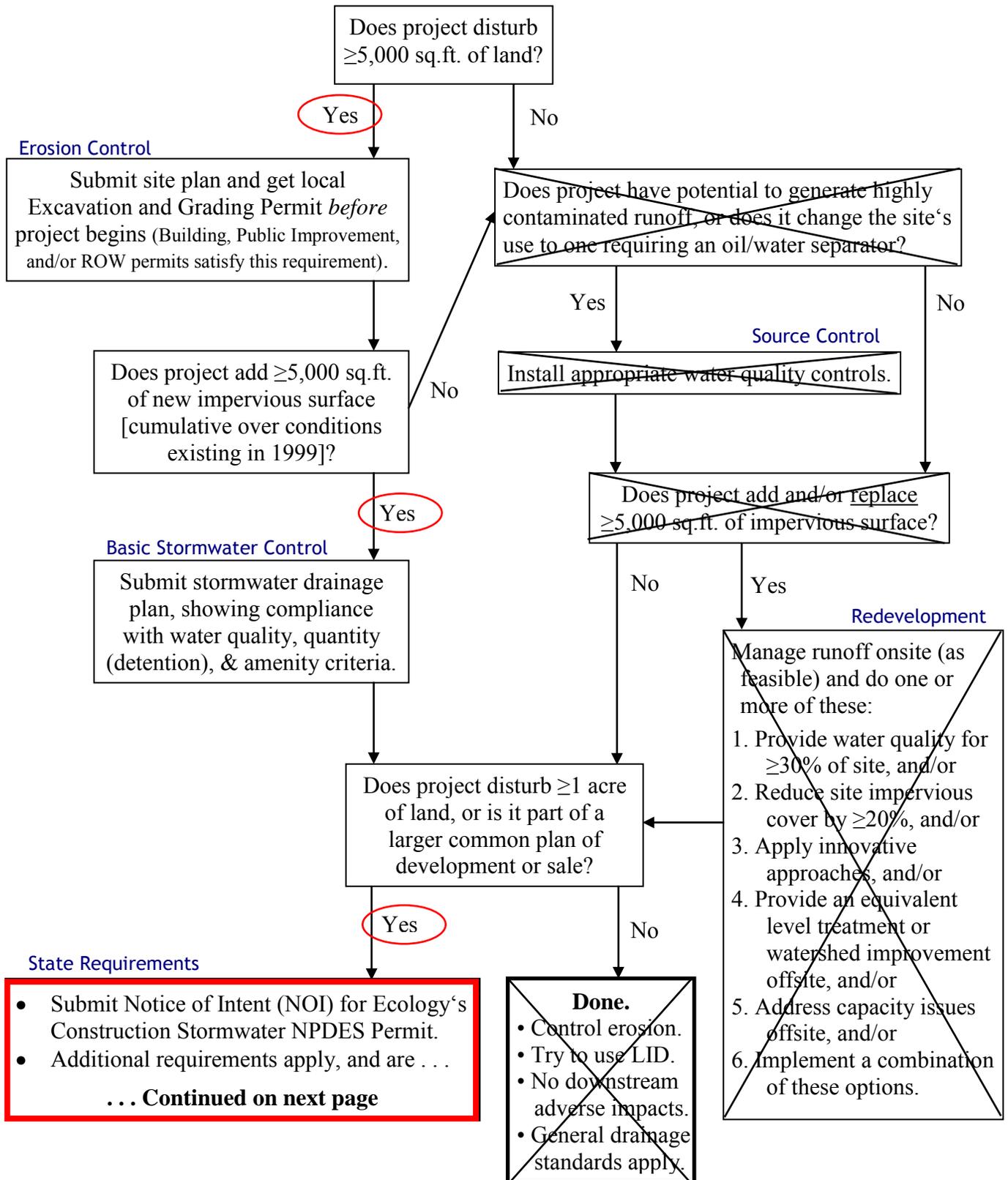
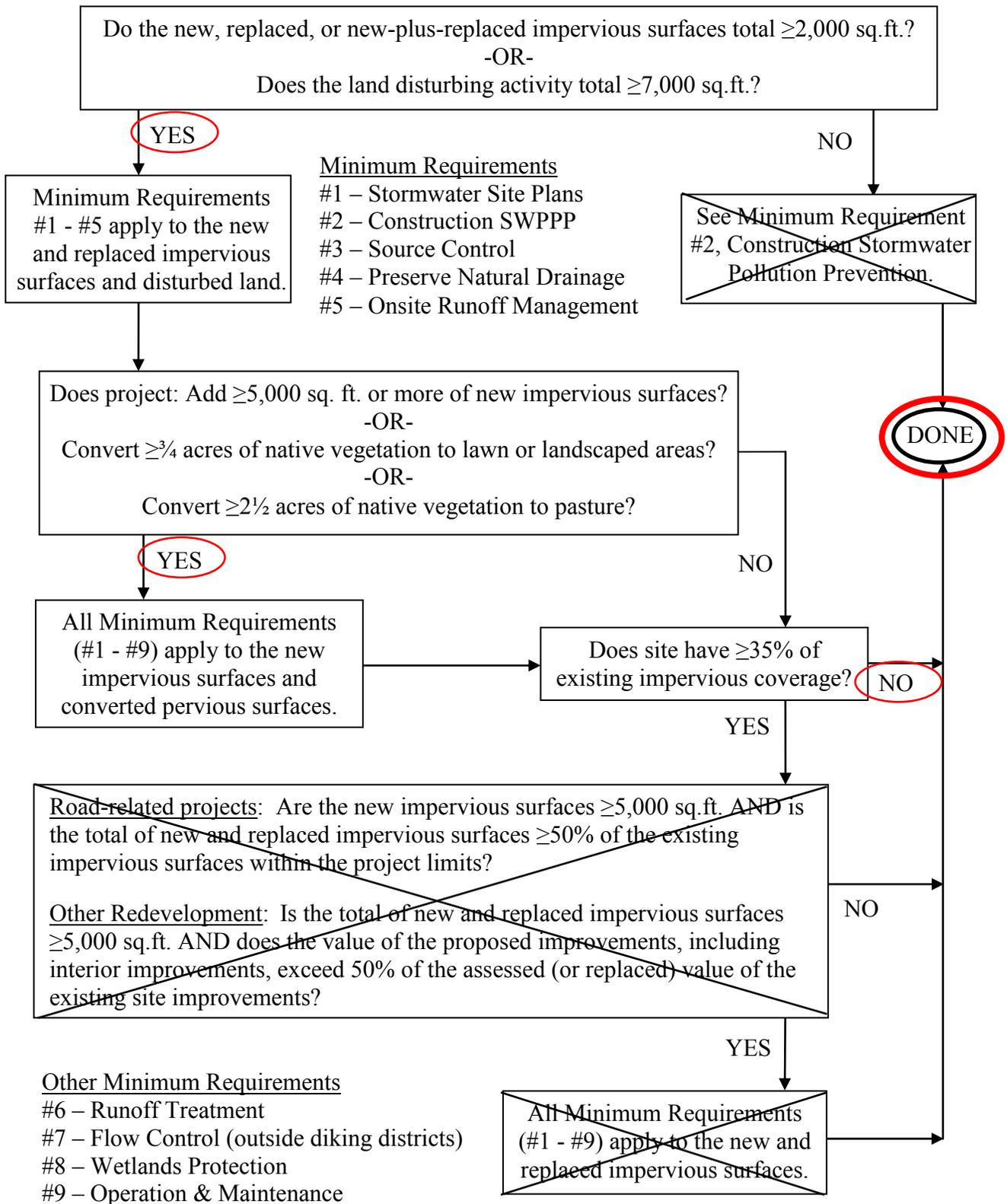


FIGURE 2.1.2: “STATE” REQUIREMENTS FLOWCHART (Projects ≥ 1 -Acre)
[Applies to projects disturbing ≥1-acre, or less if part of a larger plan of development or sale. Local requirements will apply where more protective (see previous flowchart)].



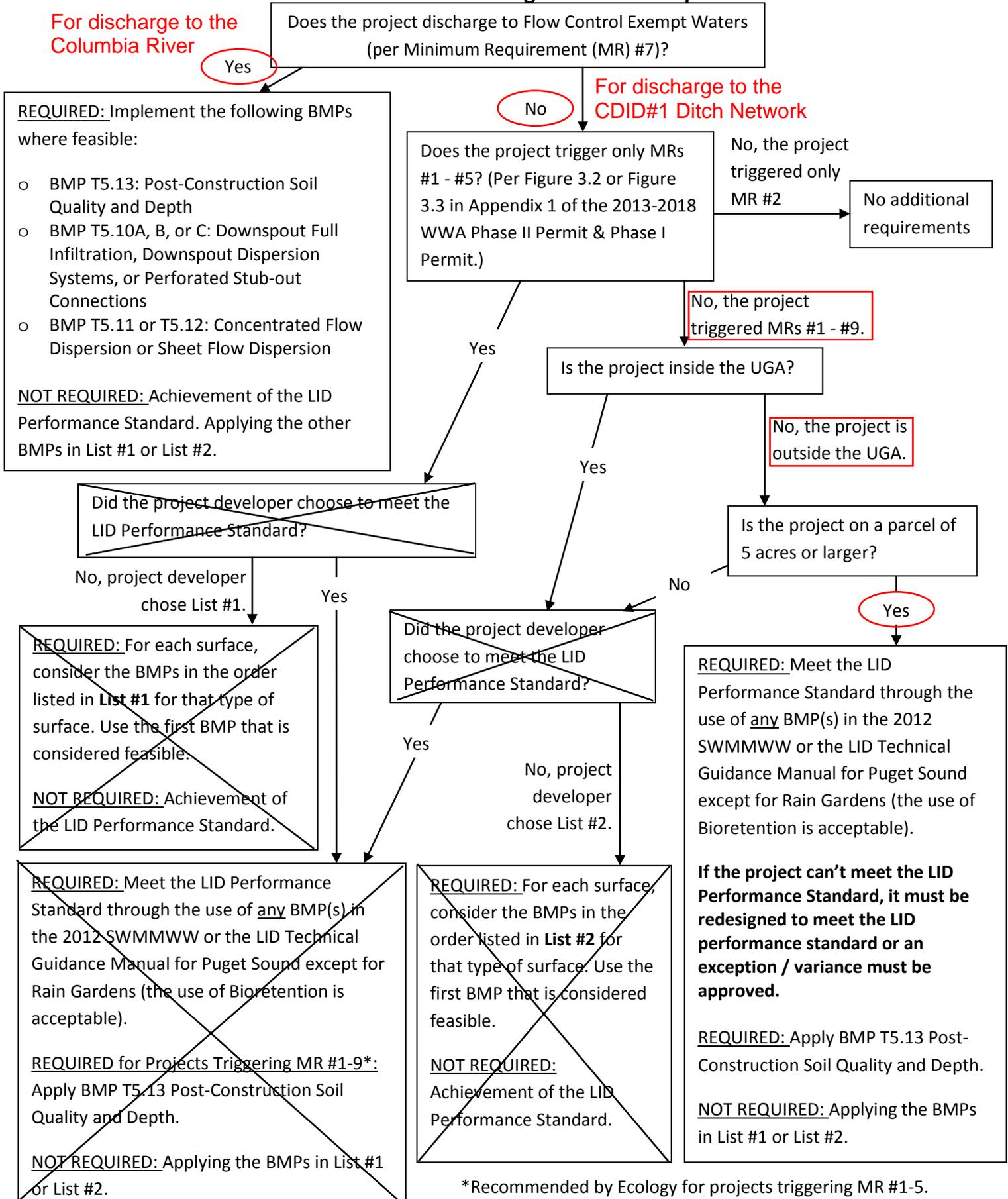
ATTACHMENT E:
SWMMWW 2014 LID FLOW CHART AND
CITY LID REQUIREMENTS

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Flow Chart for Determining LID MR #5 Requirements

For discharge to the Columbia River

For discharge to the CDID#1 Ditch Network



*Recommended by Ecology for projects triggering MR #1-5.

List #1 & List #2: For each surface, consider the BMP’s in the order listed for that type of surface. Use the first BMP that is considered feasible.

BMPs	List #1 (Project triggers Minimum Requirements #1-5)	List #2 (Project triggers Minimum Requirements #1-9)
Lawn & Landscaped Areas:	<ul style="list-style-type: none"> • Post-Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V of the <i>SWMMWW</i> 	<ul style="list-style-type: none"> • Post-Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V of the <i>SWMMWW</i>
Roofs:	<ol style="list-style-type: none"> 1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the <i>SWMMWW</i>, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 of Volume III of the <i>SWMMWW</i>. 	<ol style="list-style-type: none"> 1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the <i>SWMMWW</i>, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 of Volume III of the <i>SWMMWW</i>.
	<ol style="list-style-type: none"> 2. Rain Gardens in accordance with the “Rain Garden Handbook for Western Washington,” or Bioretention in accordance with Chapter 7 of Volume V of the <i>SWMMWW</i>. The rain garden or bioretention facility must have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it. 	<ol style="list-style-type: none"> 2. Bioretention (See Chapter 7 of Volume V of the <i>SWMMWW</i>) facilities that have a minimum horizontally projected surface area below the overflow which is at least 5% of the of the total surface area draining to it
	<ol style="list-style-type: none"> 3. Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2 of Volume III of the <i>SWMMWW</i>. 	<ol style="list-style-type: none"> 3. Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2 of Volume III of the <i>SWMMWW</i>.
	<ol style="list-style-type: none"> 4. Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3 of Volume III of the <i>SWMMWW</i>. 	<ol style="list-style-type: none"> 4. Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3 of Volume III of the <i>SWMMWW</i>.
Other Hard Surfaces:	<ol style="list-style-type: none"> 1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the <i>SWMMWW</i>. 	<ol style="list-style-type: none"> 1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the <i>SWMMWW</i>.
	<ol style="list-style-type: none"> 2. Permeable pavement¹ in accordance with BMP T5.15 in Chapter 5 of Volume V of the <i>SWMMWW</i>, or Rain Gardens in accordance with the “Rain Garden Handbook for Western Washington,” or Bioretention in accordance with Chapter 7 of Volume V of the <i>SWMMWW</i>. The rain garden or bioretention facility must have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it. 	<ol style="list-style-type: none"> 2. Permeable pavement¹ in accordance with BMP T5.15 in Chapter 5 of Volume V of the <i>SWMMWW</i>
	<ol style="list-style-type: none"> 3. Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5 of Volume V of the <i>SWMMWW</i>. 	<ol style="list-style-type: none"> 3. Bioretention (See Chapter 7, Volume V of the <i>SWMMWW</i>) facilities that have a minimum horizontally projected surface area below the overflow which is at least 5% of the of the total surface area draining to it.
		<ol style="list-style-type: none"> 4. Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5 of Volume V of the <i>SWMMWW</i>.

Refer to your Municipal Stormwater Permit, 2012 Stormwater Management Manual for Western Washington, and/or your local jurisdiction for more information about these requirements and other requirements.

¹ This is not a requirement to pave these surfaces. Where pavement is proposed, it must be permeable to the extent feasible unless full dispersion is employed.

ATTACHMENT F:
LOW IMPACT DEVELOPMENT BMP
OPTIONS

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Attachment F – Low Impact Development BMP Options

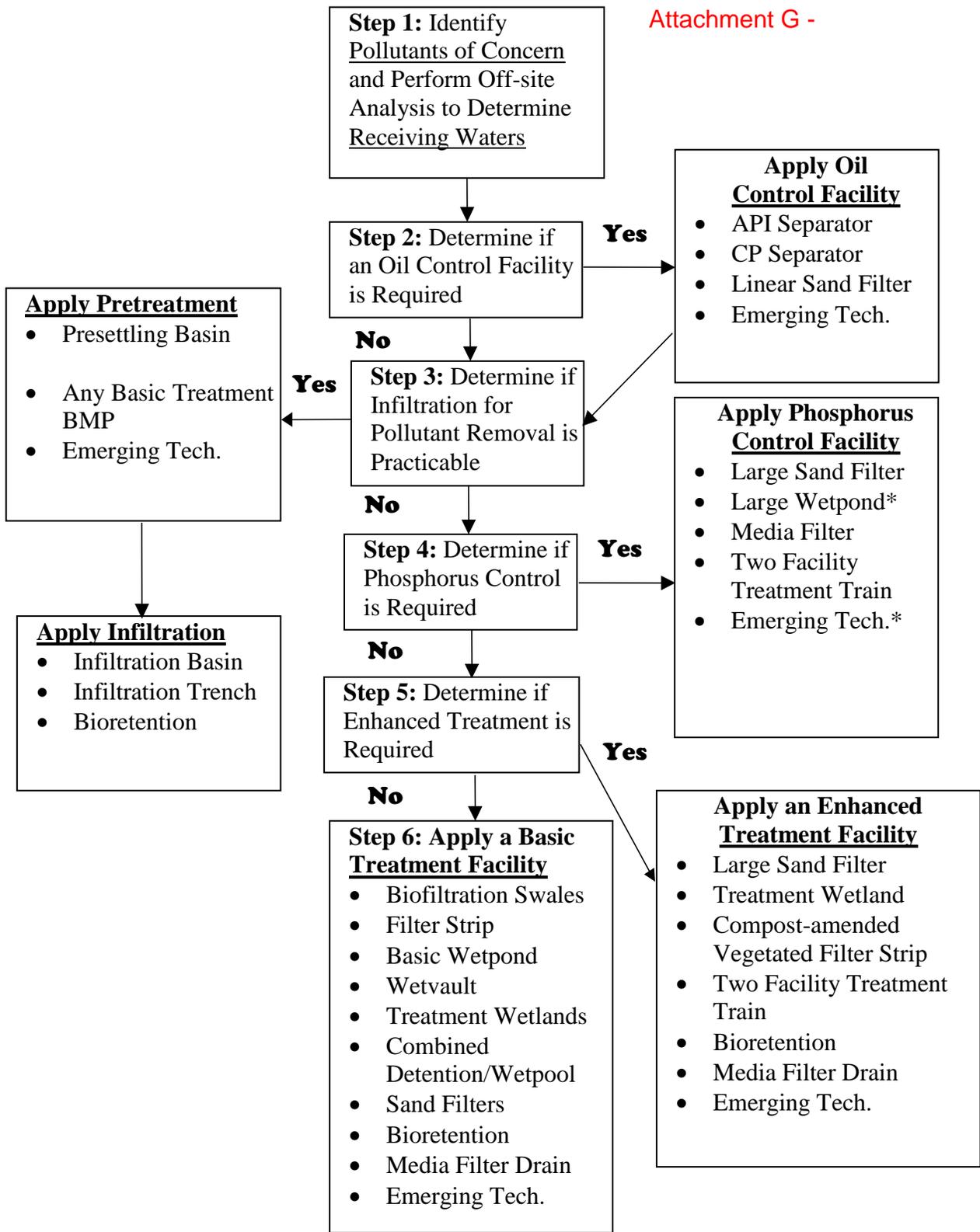
BMP ¹	Name	Description
T5.10A	Downspout Full Infiltration	Not applicable due to poorly draining soils.
T5.10B	Downspout Dispersion Systems	Not applicable due to poorly draining soils and flat grades.
T5.10C	Perforated Stub-Out Connections	Utilization may be possible but due to modeling restrictions, no credit can be taken toward the LID performance standard.
T5.11	Perforated Stub-Out Connections	Not likely applicable due to flat grades and potential site layout.
T5.12	Sheet Flow Dispersion	This is typically utilized with T5.11 and is not likely applicable.
T5.13	Post Construction Soil Quality Depth	Required to discharge to CDID#1 ditch network.
T5.14A	Rain Gardens (and planters)	Rain gardens may not be used to meet the performance standard for projects required to meet Min. Req. #6 thru #9. Rain gardens and planters are identified as a CoL LID credit and may be applicable.
T5.14B	Bioretention (w/out underdrains)	This may be utilized to meet the performance standard but would likely require underdrains due to poorly draining soils. Underdrains reduce the ability to meet the performance standard. Bioretention may also be considered for treatment of stormwater. This feature is best suited for small tributary areas.
T5.15	Permeable Pavements (with storage)	Not applicable due to poorly draining soils and high groundwater. Permeable pavements are also not considered applicable to industrial zones due to the risk of concentrated pollutant spills.
T5.15	Permeable Pavements (without storage)	Permeable pavements without storage could be used to address LID requirements without restrictions regarding infiltration. They are suitable in low use areas like sidewalks and employee parking.
T5.16	Tree Retention and Tree Planting	This identified as a CoL credit and may be utilized for landscaping around administrative buildings, public access areas and/or as screening along the site boundary.
T5.17	Vegetated Roofs	This BMP is a simple way to address LID requirements on constrained sites. This may be utilized on the administrative buildings but is not likely applicable to any industrial process areas or storage buildings. Buildings roofs will need to be designed specifically for green roof systems.
T5.18	Reverse Slope Sidewalks	Not applicable.
T5.19	Minimal Excavation Foundations	Not applicable due to geotechnical conditions.
T5.20	Rainwater Harvesting	Use of harvested rain water for grey water at administrative buildings may be applicable. Capturing rain water may have water rights issues that would require further investigation.
T5.30	Full Dispersion	Not applicable due to potential development type.

¹BMP Designation from the SWMMWW 2014. Items struck through are not recommended or applicable.

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ATTACHMENT G:
SWMMWW 2014 TREATMENT FACILITY
SELECTION FLOW CHART

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*When **Phosphorous Control and Enhanced** treatment are required, the Large Wetpond and certain types of emerging technologies will not meet both types of treatment requirements. A different or an additional treatment facility will be required to meet Enhanced treatment.

Figure 2.1.1 – Treatment Facility Selection Flow Chart

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ATTACHMENT H:
WATER QUALITY TECHNOLOGIES
MATRICES

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Barlow Point Stormwater Assessment
 Port of Longview - Due Diligence Study
 KPFF Project Number 114180

ATTACHMENT H - WATER QUALITY BEST MANAGEMENT PRACTICES SUITABILITY MATRIX

WATER QUALITY METHOD	ADVANTAGE	DISADVANTAGE	DOE DESIGNATION		MAINTENANCE	COST	NOT RECOMMENDED	RECOMMENDED	CODE SECTION
			BASIC	ENHANCED					
Oil Control									
<i>Oil Water Separator</i>	Oil water separator may be used to target untreated high-use areas upstream of any planned treatment facility				Low	Low		X	T11.10
Pretreatment Menu									
<i>Pre Settling Basin</i>	Smaller and less likely to build up excessive levels of heavy metals than wet ponds	Similar constraints to wet ponds; constructability will be based on the amount of fill placed on the site			Low	Medium	X		T6.10
<i>Contech Hydro-dynamic Separator</i>	Only non-blocking screening technology available. Simple maintenance using a vacuum truck. Shallow profile ideal for high ground water sites	Where petroleum spills are common, more frequent maintenance is required			Low	Low		X	T6.10
Basic Water Quality Treatment Menu									
<i>Infiltration</i>	Infiltration can provide both water quality and flow control.	Requires a minimum of 3 feet of separation from the bottom of the facility and the ground water elevation.	X		High	High	X		T7.10, T7.20
		Existing site has poorly draining soils and high groundwater making infiltration less effective.							
		Imported soils may be necessary for this BMP because on-site soils may not suitable for water quality treatment.							
<i>Bioretention</i>	Shallow landscaped depressions with a designed soil mix which can receive stormwater from small contributing areas.	Not recommended due to the large size of the facility resulting from the large tributary areas.	X	X	Low	Low	X		T7.30
	Facility is designed to mimic natural conditions where healthy soil structure and vegetation promote infiltration, storage, and slow release of stormwater flows.	Existing site has poorly draining soils and high groundwater making infiltration less effective. May require underdrains due to poorly infiltrating soils.							
	Infiltration reduces conveyance system infrastructure.	Existing site has poorly draining soils and high groundwater making infiltration less effective.							
<i>Compost-Amended Vegetated Filter Stripes (CAVFS)</i>	Use a mix of infiltration and biologic uptake to improve water quality. Can provide flow control.	Require flat-cross slope and overland flow from impervious area	X	X	Low	Low		X	T7.40

WATER QUALITY METHOD	ADVANTAGE	DISADVANTAGE	DOE DESIGNATION		MAINTENANCE	COST	NOT RECOMMENDED	RECOMMENDED	CODE SECTION
			BASIC	ENHANCED					
<i>Compost-Amended Biofiltration Swale (CABS)</i>	WSDOT Stormwater Treatment Method	Holds water longer than non-Compost-Amended Biofiltration Swales resulting in longer flow durations	X	X	Low	Low		X	T7.30
	Superior treatment performance compared to regular biofiltration swales								
<i>Sand Filters</i>	When used in a treatment train can achieve high levels of water quality treatment and enhanced treatment.	At least 2 feet between the bottom of the sand filter and groundwater or base flows must be achieved to allow the sand to drain free and dry.	X	X	High	High	X		T8.10
	Sand filters can be in vaults, basins, or long shallow linear systems making them versatile for site conditions.	A vertical head of 4 feet between the inlet and the outlet is required and these facilities can be difficult to maintain.							
	Sand filters can be amended with processed steel fiber or crushed calcitic limestone for metals removal.	Sand filters are prone to clogging and must have pre-settlement treatment.							
	This BMP may able to meet future W/Q thresholds.	Sand filter treatment trains require a lot of square footage and depth.							
<i>Media Filter Drain (Ecology Embankment)</i>	Capable of treating large sheet flow paved areas through surface runoff	Require flat-cross slope and overland flow from impervious area	X	X	Low	Low		X	T8.40
	Has General Use Level Designation (GULD) for basic, enhanced and phosphorus treatment.								
<i>Biofiltration Swale</i>	Shallow surface BMP providing basic water quality treatment without necessitating deep excavation.	Low volume treatment BMP which cannot accommodate large tributary areas.	X		Low	Low		X	T9.10
	The BMP is a shallow grass swale which is simple to maintain.	Minimum length is 100 feet and the minimum width is 12 feet wide.							
	Dual purpose use providing conveyance and water quality.	Only 4 inches of runoff can be conveyed and all water must enter at one end of the swale and discharge at the other end.							
	Swales can help meet enhanced treatment goals when used in a treatment train.	The swale would discharge into an underground treatment system of a pump system for pumping to another treatment facility.							
<i>Wet Biofiltration Swale</i>	This BMP has all of the same characteristics of a biofiltration swale with the exception that it can accept continuous discharge into it.	To qualify for continuous discharge, the residence time must be increased from 9 minutes to 18 minutes making the facility much larger than typical swales.	X		Low	Low		X	T9.20
	May be used where longitudinal slopes are below 2%.								
<i>Basic Filter Strips</i>	Grassy slopes that can receive runoff from an adjacent impervious area such as parking lots, driveways, or roadways.	Similar to CAVFS but with less effective treatment capability.	X		Low	Low		X	T9.40
	The filter strip may be a maximum of 15% on the slope.	The maximum cross slope of the contributing area is 5% in general and 2% at the edge of the facility..							

WATER QUALITY METHOD	ADVANTAGE	DISADVANTAGE	DOE DESIGNATION		MAINTENANCE	COST	NOT RECOMMENDED	RECOMMENDED	CODE SECTION
			BASIC	ENHANCED					
<i>Basic Wet Pond</i>	Wet Ponds are large structures but require very little maintenance.	Pre-settlement with sediment storage is required. Liners are required for the presediment and wet pond areas. Because the facilities are frequently five to six feet deep, they are often in conflict with groundwater. Liners are difficult to stabilize with high groundwater conditions.	X		Low	Medium	X		T10.10
	Wet Ponds do not require media beds, and frequent changing of filter systems.	Large wetponds capable of meeting enhanced treatment are 1.5 times larger than regular wet ponds.							
	Wet ponds are capable of being modified for future water quality treatment requirements by adding mechanical treatment BMPs like a Chitosan systems.	Maintenance access requirements make the footprint of this BMP extremely large.							
		This BMP has setback requirements from buildings, property lines, and 50 foot set backs for steep slopes which increase required footprint.							
		Facility is ineffective in removal of dissolved pollutants including metals.							
<i>Basic Water Quality Wet Vault</i>	Similar to a wet pond but may be installed in such a manner as to allow site use over the top.	Large wet vaults are difficult to access and may need extra anchoring if constructed below the groundwater elevation.	X		Low	High	X		T10.20
	May be used in conjunction with other BMP's like electrocoagulation and chitosan enhanced treatments should enhanced treatment become necessary in future code requirements.	High initial construction costs, but lower long term maintenance costs.							
	Relatively simple long term cost solution for basic water quality treatment while preserving surface area for site use.	Solution is only viable with bypassed flows to reduce the size of the vault.							
	May be retrofitted for oil/water separation.	Facility is ineffective in removal of dissolved pollutants including metals.							
<i>Stormwater Treatment Wetland</i>	This BMP is similar to a wet pond.	This BMP also has a large surface area impact - larger than wet ponds.	X	X	Low	High	X		T10.30
<i>Combined Detention and Wetpool Facilities</i>		Similar constraints to wet pond	X		Low	Medium	X		T10.40
Phosphorous Control									
<i>Enhanced Treatment</i>	Phosphorous and enhanced treatment is not necessary because the Columbia River is designated as a Basic Treatment Receiving Water Body.	This criteria may change in the future and all basic water quality treatment facilities may need to be improved to enhanced treatment facilities.	n/a	n/a			N/A		
		Phosphorous control may be required for discharge to CDID#1 ditch network. The ditch network historically has maintenance issues with aquatic plant growth.							



Barlow Point Stormwater Assessment
 Port of Longview - Due Diligence Study
 KPFF Project Number 114180

ATTACHMENT H - WATER QUALITY EMERGING TECHNOLOGIES SUITABILITY MATRIX

WATER QUALITY METHOD	ADVANTAGE	DISADVANTAGE	DOE DESIGNATION		MAINTENANCE	COST	NOT RECOMMENDED	RECOMMENDED	TSS	Copper	Zinc
			BASIC	ENHANCED							
Emerging Technologies											
<i>Filterra Units</i>	Units are similar to catch basins.	Units require secondary bypass inlets adjacent to them for high flow bypass.	X	X	Low	Medium	X		Claims of 85% TSS	Claims of 58% Copper removal	Claims of 66% total zinc and 58% dissolved zinc removal
	Units can be fitted with trees, bushes, and other vegetation to help replace vegetation removed as part of the shoreline restoration work.	Difficult to install and monitor discharge for compliance.									
	Maintenance is relatively simple.	Installation and connections may require City approved deviations or adjustments to modify standard connections with manholes and catch basins to allow for point of compliance monitoring locations.									
	Units can accept sheet flows well and provide basic treatment without large structures.	A significant number of units is required to treat large areas with this BMP. The number required is based on a maximum treatment capability of 0.35 acres per unit.									
<i>Contech Stormfilters - General</i>	This BMP can be applied in catch basins, vaults, and manholes.	System requires significant repeat maintenance.	X	X	High	Medium		X			
	System can be expanded as necessary or modified with different filter media to target pollutants.	System requires at least 2.3 feet of head loss between the inflow and outflow. Replacement of the canisters can be as frequent as every year and as infrequent as every 3 years. Current costs are about \$180 per cartridge to replace.									
	Inlets can be coupled with filter cartridges for treatment at the source.	Per DOE, each cartridge can only process 7.5 gallons per minute or 0.017 cfs (manufacturer states 15 gallons per minute or 0.033 cfs).									
<i>Contech StormFilter with MetalRx Cartridge</i>	Ease of Maintenance, more accurate data when compared to Jellyfish, this is the preferred cartridge media compared to the Perlite/ZPG option		X	X					80% TSS for influent concentrations greater than 100 mg/L	60% Dissolved zinc for influent greater than 20 µg/L	30% Dissolved copper for influent greater than 5 µg/L
<i>Contech StormFilter with Perlite/ZPG Blended Cartridge</i>		MetalRx product more likely to meet required goals for this project with a similar configuration and cost.							80% TSS for influent concentrations greater than 100 mg/L	Dept of Ecology does not recognize a removal rate for Copper	Dept of Ecology does not recognize a removal rate for Zinc
<i>Contech Jellyfish</i>	Minimal drop across structure, Inflow can be placed below outflow. CULD rating from Department of Ecology. Out of state department claims it can remove 89% TSS, and 50% Dissolved Metals.	Minimal testing has been done on the Jellyfish for zinc and copper removal.	X		High	Medium		X	Approx 89% TSS	Unknown approx 50% total metals, Dept of Ecology does not recognize a removal rate for Copper	Unknown approx 50% total metals, Dept of Ecology does not recognize a removal rate for zinc

WATER QUALITY METHOD	ADVANTAGE	DISADVANTAGE	DOE DESIGNATION		MAINTENANCE	COST	NOT RECOMMENDED	RECOMMENDED	TSS	Copper	Zinc
			BASIC	ENHANCED							
<i>Bay Saver Filter Units</i>	This unit can provide basic and enhanced treatment with manholes structures or vault structures.	The unit can be equated to maintenance issues similar to the Contech canister systems.	X	X	High	Medium		X			
	This unit is similar to many other filter type BMP's and is a reasonable alternative to Filterra, Contech, or other proprietary system.	System requires 2.67 feet of drop between the inlet and outlet.									
	The unit can operate efficiently with minimal head losses and process high flows.										
<i>FloGard Perk Filter</i>	Similar benefits as Contech systems, except these filters can process more flows (each Cartridge can process 13.6 gpm or 0.03 cfs).	This BMP requires frequent replacement of cartridges similar to the Contech canister system.	X		High	Medium		X	Claims of 82-85% (dry bulk only)	Claims of 62% total copper (dry bulk only)	Claims of 61% total zinc (dry bulk only)
	Modular system design provides ease of maintenance and installation	Minimal testing on zinc and copper									
<i>Modular Wetland with MWS Liner</i>	Claims to have cheaper O/M costs when compared to similar products, cartridges cost \$80/cartridge; currently GULD status for DOE	System requires significant repeat maintenance.	X	X	Medium	Medium		X	80% TSS for concentration ranges between 100 and 200 mg/L	30% dissolved copper at concentrations of 0.003 and 0.02 mg/L	60% dissolved zinc at concentrations between 0.02 and 0.30 mg/L
	Only other product to incorporate plants into system other than Filterra	Likely requires pumping stormwater to structure to treat sizable flat areas.									
<i>Up-Flo Filter</i>	Currently at Conditional Use Level for DOE, removes 80% TSS; media type can easily be changed in the unit	System requires significant repeat maintenance.	X		High	Medium		X	80% TSS	Unknown, says that it can provide a higher rate of dissolved metals removal than competitors	Unknown, says that it can provide a higher rate of dissolved metals removal than competitors
<i>StormwaterRx Aquip</i>	Designed for above ground installation, and is customizable depending on the conditions.	System requires significant repeat maintenance. The footprint of the structure is larger than cartridge type treatment options	X	X	High	Medium		X	98% TSS for concentration ranges between 100 and 200 mg/L	Does not give actual values, says that it meets DOE requirements for dissolved copper, dissolved zinc and total phosphorus, and exceeds DOE's Basic, Enhanced, and Phosphorus treatment	
	It meets DOE requirements for TSS, dissolved copper, dissolved zinc and total phosphorus, and exceeds DOE's Basic, Enhanced, and Phosphorus treatment levels										
<i>Inlet Filters</i>	Inexpensive and can be easily installed in catch basins.	This is better suited as an additional measure to a broader stormwater treatment approach; Spreads maintenance out									
<i>Chitosan Enhanced Treatment Systems</i>	Approved for Construction Use Only but DOE will permit permanent installations.	Typically not considered for a permanent installation, but due to increasingly strict stormwater requirements, permanent installations are becoming more prevalent	C	C	High	High	X		Chitosan will be engineered based upon the specific influent characteristics and the effluent requirements		
	Chitosan is likely the most dependable solution	Chitosan System is likely a more costly solution when compared to the others on this list; Requires pumping									
<i>Electrocoagulation</i>	System can treat for a wide variety of target pollutants. Approved for Construction Use Only but DOE will permit permanent installations.	Extremely expensive and not considered necessary for the pollutant loads anticipated for this site.	C	C	High	High	X		Electrocoagulation will be engineered based upon the specific influent characteristics and the effluent requirements		
	Electrocoagulation is likely a dependable solution										

Barlow Point Stormwater Assessment

Port of Longview

KPFF Project Number 114180



ATTACHMENT H - WATER QUALITY EMERGING TECHNOLOGIES SUMMARY MATRIX

ID #	Emerging Technologies Water Quality BMPs*	Cost	Maintenance	DOE Rating - Basic Treatment	DOE Rating - Enhanced Treatment	DOE Rating - Phosphorus	Treatment Options to Consider				
							Access Road	Parking Lots	Support Areas	Rail Corridor	Industrial Areas
1	Filtterra	\$\$	\$\$\$	GULD	GULD	GULD	X	X			
2	Bay Saver Filter Units	\$\$	\$\$\$	GULD	CULD	CULD	X	X	X	X	X
3	Contech Stormfilters**	\$\$	\$\$\$	GULD	CULD	CULD	X	X	X	X	X
4	Contech Jellyfish	\$\$	\$\$	CULD	N/A	PULD	X	X	X	X	X
5	FloGard Perk Filter	\$\$	\$\$\$	GULD	N/A	GULD	X	X	X	X	X
6	Modular Wetland with MWS-Linear	\$\$	\$	GULD	GULD	GULD	X	X	X	X	X
7	Up-Flo Filter	\$\$	\$\$\$	PULD	N/A	N/A	X	X	X	X	X
8	Stormwater Rx Aquip	\$\$\$	\$\$\$	CULD	CULD	CULD			X	X	X
9	Inlet Filters	\$	\$	N/A	N/A	N/A					
10	Chitosan Enhanced Treatment Systems	\$\$\$\$	\$\$\$\$	***	***	***			X	X	X
11	Electrocoagulation	\$\$\$\$\$	\$\$\$\$\$	***	***	***			X	X	X

Department of Ecology (DOE) Ratings:

GULD - General Use Level Designation

CULD - Conditional Use Level Designation

PULD - Pilot Use Level Designation

Notes:

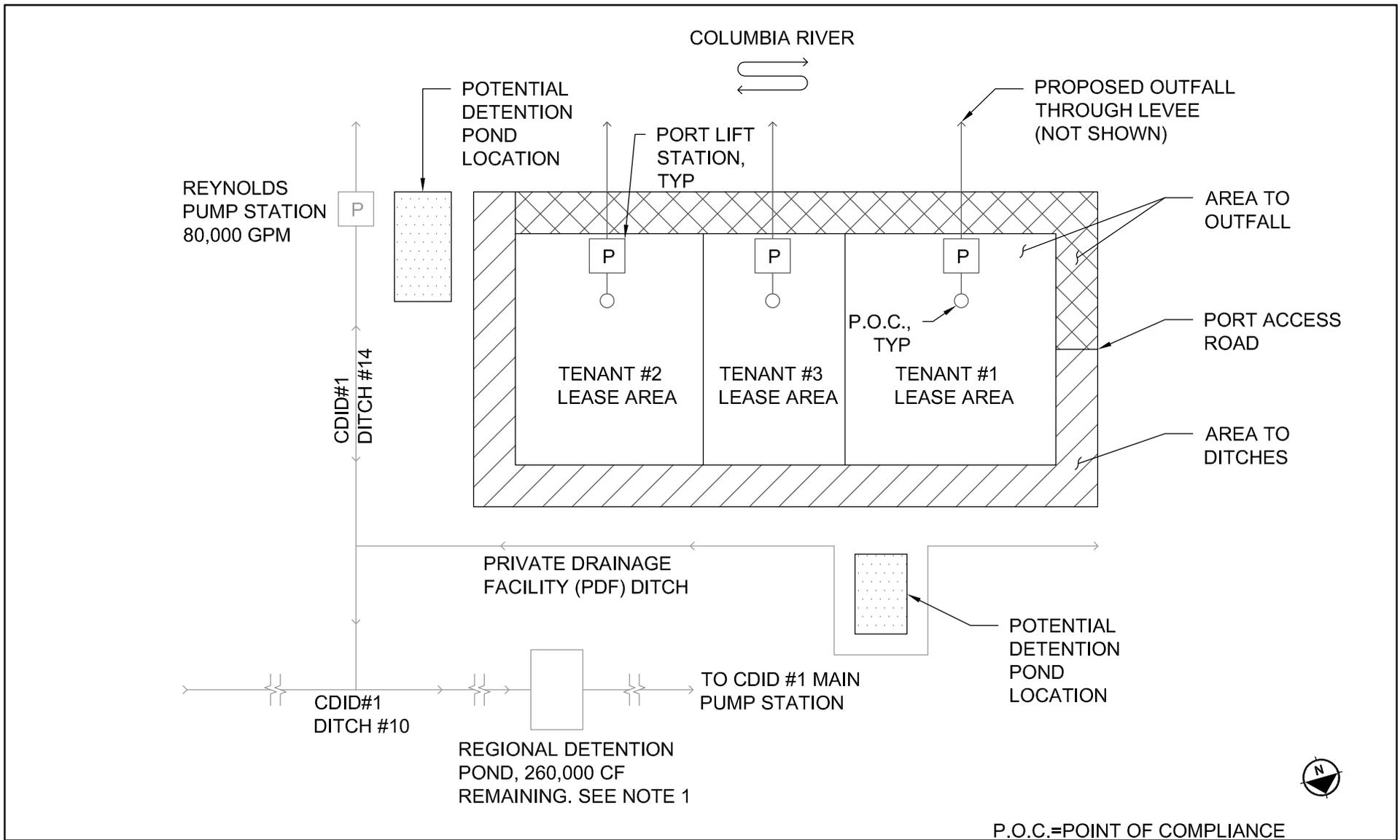
*Technologies reported are being evaluated for potential port infrastructure only

** Rating depends on the type of media in the filter cartridge.

*** Department of Ecology rated GULD for Temporary Erosion and Sediment Control and general construction permits. Systems are frequently implemented with Department of Ecology review and approval for permanent treatment systems.

ATTACHMENT I:
STORMWATER SCHEMATIC

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P.O.C.=POINT OF COMPLIANCE



NOTES

1. VOLUME REMAINING IN REGIONAL DETENTION POND REPORTED AS OF MAY 2015.

**BARLOW POINT - PORT OF LONGVIEW
ATTACHMENT I - STORMWATER
SCHEMATIC**

DATE: 2015-08-12	SCALE: NTS
DRAWN BY: ESB	SHT 1 OF 1

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ATTACHMENT J:
POTENTIAL TENNANT AREAS

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1601 5th Avenue, Suite 1300
 Seattle, Washington 98101
 p (206) 382-0600

Project: Barlow Point Due Diligence Study Date: 6/16/2015
 Location: Barlow Point, City of Longview, WA Sheet # 1 of 2
 Client: Port of Longview Job # 114180
 By: E. Beckwith

Land Use Assumptions

Option 1 - Dry Bulk		Site Development Impervious Area		Site Development Impervious Area	
Tenant	Lease Area AC	Low %	High %	Low AC	High AC
Potash	70	50%	100%	35.0	70.0
Urea	60	75%	100%	45.0	60.0
Wood Pellets	15	75%	100%	11.3	15.0
Sub-Total	145			92.0	145.0

Option 2 -Liquid Bulk		Site Development Impervious Area		Site Development Impervious Area	
Tenant	Lease Area AC	Low %	High %	Low AC	High AC
Crude Oil	70	75%	100%	52.5	70.0
Methanol	60	75%	100%	45.0	60.0
Biodiesel	15	75%	100%	11.3	15.0
Sub-Total	145			109.0	145.0

Notes:

- 1) Final conditions for each tenant are unknow. A range for development (impervious surface) will be used for planning.
- 2) Examples of both fully impervious and partially impervious facilities are available (Barlow Point Meeting #2 presentation dated 12/5/14) Potash varies the most widely with Canpotex in Vancouver, BC being fully impervious and BHP in Portland,OR being mostly pervious.
- 3) Industrial/marine tenant facilities will most likely be fully built out (impervious) to maximize site use.
- 4) The levee slopes, which can not be developed, almost entirely satisfy the Heavy Industrial requirment for 85% maximum impervious.



1601 5th Avenue, Suite 1300
 Seattle, Washington 98101
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Project: Barlow Point Due Diligence Study Date: 6/16/2015
 Location: Barlow Point, City of Longview, WA Sheet # 2 of 2
 Client: Port of Longview Job # 114180
 By: E. Beckwith

Existing Conditions

Predeveloped	Distribution				
	Subtotal	Percent of	Potash	Urea	Wood Pellets
	AC	Total	Crude	Methanol	Biodiesel
			70 Acre	60 Acre	15 Acres
C, Pasture Flat	188.0	0.75	52.4	44.9	11.2
C, Pasture Steep	15.0	0.06	4.2	3.6	0.9
SAT, Pasture Flat	28.6	0.11	8.0	6.8	1.7
Road/Flat	12.0	0.05	3.3	2.9	0.7
Pond	7.4	0.03	2.1	1.8	0.4
	251.0		70.0	60.0	15.0

Proposed Conditions

	Low Use			High Use		
	Potash	Urea	Wd. Chips	Potash	Urea	Wd. Chips
	Acres	Acres	Acres	Acres	Acres	Acres
C, Pasture Flat	31.5	12	3	0.0	0	0
A/B, Lawn Flat	3.5	3	0.75	0.0	0	0.0
Parking/Flat	31.5	42	10.5	66.5	57.0	14.25
Pond	3.5	3	0.75	3.5	3.0	0.75
	70	60	15	70	60	15

	Low Use			High Use		
	Crude	Methanol	Biodiesel	Potash	Urea	Wd. Chips
	Acres	Acres	Acres	Acres	Acres	Acres
C, Pasture Flat	14.0	12	3	0.0	0	0
A/B, Lawn Flat	3.5	3	0.75	0.0	0	0.0
Parking/Flat	49.0	42	10.5	66.5	57.0	14.25
Pond	3.5	3	0.75	3.5	3.0	0.75
	70	60	15	70	60	15

- Notes:**
- 1) Proposed conditions are based on land use assumptions above.
 - 2) Assume pond size of 5% of land area.
 - 3) Assume A/BI Lawn Flat of 5% of land area.

ATTACHMENT K:
POTENTIAL PORT AREAS

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1601 5th Avenue, Suite 1300
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p (206) 382-0600

Project: Barlow Point Due Diligence Study
Location: Barlow Point, City of Longview, WA
Client: Port of Longview
By: E. Beckwith

Date: 6/16/2015
Sheet # 1 of 1
Job # 114180

Port Backbone Infrastructure Land Use Assumptions

Access road

Width	32	FT
Length	6,160	LF
Area	197,120	SF
Area	4.53	AC

Maintenance Road

Width	30	FT
Length	7,320	LF
Area	219,600	SF
Area	5.04	AC

Dike Road Including Ramps

Width	24	FT
Length	6,300	LF
Area	151,200	SF
Area	3.47	AC

Subtotal		13.04	AC
----------	--	-------	----

Subtotal	Use	14.00	AC
----------	-----	--------------	----

Substation		1.00	AC
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Subtotal	Use	2.00	AC
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Rail

Option 1	Area	1,152,432	SF
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		26.46	AC
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Use	27	AC
-----	-----------	----

Option 2	Area	1,388,451	SF
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		31.87	AC
--	--	-------	----

Use	32	AC
-----	-----------	----

Subtotal

Option 1	Area	43	AC
----------	------	-----------	----

Option 2	Area	48	AC
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ATTACHMENT L:
LEVEL 1 DOWNSTREAM ANALYSIS

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PORT OF LONGVIEW MASTER PLAN PHASE I FEASIBILITY STUDY Level 1 Downstream Analysis



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TASK 2: REVIEW AVAILABLE MATERIAL..... 3

TASK 3: FIELD INSPECTION..... 5

TASK 4: DESCRIBE EXISTING DOWNSTREAM DRAINAGE SYSTEM 6

ATTACHMENTS

- Attachment 1: USGS 1:24000 Quadrangle Map
- Attachment 2: Existing Site Plan
- Attachment 3: USDA Soils Map
- Attachment 4: DRAFT ELS Wetlands Delineation Map
- Attachment 5: FEMA Maps
- Attachment 6: Photo Key Map and Photo Log
- Attachment 7: CDID #1 District Facilities Map
- Attachment 8: CDID #1 Drainage Profile and Inventory

INTRODUCTION

In 2010 the Port of Longview (Port) purchased property in Longview, WA at Barlow Point. The Port is performing a due diligence study to assess the feasibility to develop Barlow Point into a marine terminal. As part of that due diligence study, a Level 1 Downstream analysis was performed to identify and evaluate off-site water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by development of the site. The Level 1 downstream analysis is a qualitative analysis and was performed per Section 2.6.2 of the Department of Ecology (Ecology) Stormwater Management Manual for Western Washington (SWMMWW 2014). This report is intended to be a stand-alone report that provides additional information and resources on the existing conditions of the site.

TASK 1: DEFINE AND MAP AREA

EXISTING LAND USE & SURFACE COVER

The Barlow Point property consists of approximately 282.5 acres located approximately 4 miles down-river (West) of the Lewis and Clark Bridge. The site is zoned heavy industrial (HI) and is contained within the Longview City limits (see Attachment A and Attachment B). The site is considered Greenfield which typically refers to a piece of undeveloped agricultural land that is being considered for development.

The site is bounded to the north by State Route (SR) 432 and Mt. Solo Landfill. SR 432 is adjacent to the property between approximately State Route Milepost 2.17 to 2.78. The majority of the northern site boundary is Mt. Solo Landfill, a capped landfill, and is separated from the landfill by a large private ditch (Private Drainage Facility or PDF). The property line generally runs along the center of the ditch which acts as a shared stormwater discharge location. The shared ditch meanders forming oxbows which defines the atypical northern property boundary.

The southern boundary of the site is adjacent to the Columbia River at approximately River Mile 62. The site, which is at elevation $10' \pm$ NAVD88, is separated from the river by a large levee with a top elevation at $30' \pm$ NAVD88. The levee is part of the broader Longview-Kelso flood protection system which is overseen by United States Army Corps of Engineers (USACE) and locally through the Consolidated Diking District #1 (CDID#1). The portion of the levee on the property is approximately 6,170 linear feet long and is sited within a 375 foot wide easement granted to the CDID#1 (see the Land Use, Zoning, Comprehensive Plan and Easements Report located in Appendix C of the main report). The landward design slope of the levee is 6 to 1 and the water-side design slope is 3 to 1 but is typically shallower. The majority of the levee side slopes and area within the easement are covered in grasses except for where the gravel road connects up onto the levee. The downstream two-thirds of the water-side shoreline is occupied by a dense stand of trees located between the toe of the levee and the edge of water. A gravel road runs along the top of the

levee for the length of the site and continues down the landward side of the levee on both the east and west property line. The road continues around the perimeter of the site creating a looped maintenance roadway. The site is gate controlled at each end of the property.

The east boundary of the site is defined by Ditch #14, one of many large ditches owned by CDID#1. The CDID #1 Reynolds Pump Station is located next to the south-east corner of the site at the toe of the levee. The pump station discharges to the Columbia River at a maximum rate of 80,000 gallons per minute through large diameter pipes that penetrates through the levee. A 900 foot wide high power transmission easement granted to Bonneville Power Administration (BPA) also runs over the eastern portion of the site. Three of the four transmission towers within the 900 foot easement are located in the south-east corner of the site. The adjacent property to the east beyond the Ditch #14 is zoned and utilized for heavy industrial purposes.

The site is bounded to west by undeveloped farm land also zoned for heavy industrial. Aside from SR432, the site can be accessed from Barlow Point Road where the paved portion of the road at the base of the levee terminates approximately 460 feet west of the site. A gravel road continues from this point where it transitions to the top of the levee and continues on to the site.

The existing site, which is at elevation $10' \pm$ NAVD88, is composed of undeveloped farm land with isolated pockets of trees near the center of the site. A portion of the site is currently contracted out by the Port to be farmed. Approximately 1/10th of the site contains preliminary and unverified Category III or Category IV wetlands. Both the PDF and portions of the CDID#1 ditch network are classified as fish bearing Type F streams as defined by WAC 222-16-030 (see the Riverfront Environmental and Other Regulatory Considerations Report located in Appendix D of the main report).

GROUNDWATER

Groundwater was observed by ongoing piezometer readings performed by Ecological Land Service, Inc. starting in 2010 and by a field investigation performed by Hart Crowser in May of 2015 (see the Riverfront Environmental and Other Regulatory Considerations Report located in Appendix D and Preliminary Geotechnical Assessment located in Appendix F of the main report). Ground water was observed to be 3 feet below grade in the unverified wetlands areas during the rainy season and 5 to 6 feet below grade during the dry season. Groundwater elevation was observed in the test pit locations outside of the unverified wetlands at 2 to 4 feet below grade. In general, groundwater was observed ranging from 2 to 6 feet below ground surface and has been observed to fluctuate in response to seasonal rainfall patterns.

EXISTING SITE DRAINAGE PATTERNS

The existing site is broken into two distinct drainage basins separated by the levee (see Attachment 2). The area from the center line of the levee road to the south drains down the water-side face of the levee at approximately 3 to 1 side and discharges directly to the Columbia River. The area from the center line of the levee road to the north drains down the land-side face of the levee at approximately 6 to 1 side

slope into the main body of the site.

The main site north of the levee is comprised of several sub-basins and is generally flat with slopes varying from 0% to 2%. The sub-basins are drained via several shallow agricultural ditches. Flow is conveyed to the large ditch to the north (Private Drainage Facility or PDF) and CDID#1 Ditch #14 to the east and discharged through series of 24" to 36" ADS culverts under the gravel maintenance road. The PDF and Ditch #14 combine in the north-east corner of the site and connect to the CDID#1 Ditch #10 which runs adjacent to SR 432 conveying flow to the north and west.

There is a gated access point to Mt. Solo landfill at the north-west corner of the site. The PDF connects to the drainage ditch that runs along the base of Mt. Solo landfill through an approximately 18 to 24 inch diameter culvert which appears to be plugged by debris. CDID#1 also indicated that a trio of 48 inch diameter culverts located at the site entrance to SR 432 are undersized, hindering the flow of Ditch #10. During the field visit, only one culvert was observed and it appeared to be damaged and partially plugged (see Attachment 6).

The site stormwater is ultimately discharged to the Columbia River through sheet flow from the riverside face of levee or through one of two pump stations. When activated, the Reynolds Pump Station located at the south-east corner of the site discharges Ditch #14 directly to the Columbia River at a rate of 80,000 gallons per minute maximum capacity. According to CDID#1, the Reynolds Pump Station is manually operated and only activated as a precautionary measure when a large storm event is predicted while water levels in the ditch network are high. During normal operations when the Reynolds Pump Station is idle, Ditch #14 flows to the west and north to the main CDID#1 pump station located approximately 3 miles downstream where the pump station discharges at a rate of 336,000 gallons per minute total maximum capacity to the Columbia River via Coal Creek.

TASK 2: REVIEW AVAILABLE MATERIAL

The following is a summary of the resources and documents reviewed for this downstream analysis.

SENSITIVE AREA FOLIOS

- Wetlands: Approximately 28.5 acres of preliminary and unverified Category III and IV wetlands are present on the site (Ecological Land Services, 2015).
- Streams: The private drainage facility (PDF) ditch and the portion of the CDID#1 Ditch #14 on site are classified as Type F streams (Ecological Land Services, 2015).
- Erosion Hazard Areas: Cowlitz County NetMaps identifies no erosion hazard areas on-site or downstream of the project area. The United States Army Corps of Engineers (USACE) completed a river bank erosion protection project in early 2000. An approximately 1,500 linear foot gabion

mattress was installed on a portion of the downstream 1/3 of the on-site levee.

- Landslide Hazard Areas: Mapping identifies no landslide hazard areas.
- Water Resource Inventory Areas (WRIA): Netmaps indicates that the site is located within WRIA 25 Grays-Elochman watershed.
- Critical Aquifer Recharge Area (CARA): Netmaps indicates the water-side and land-side faces of the dike are classified as "Severe Sensitivity" CARA zones.

USDA SOILS SURVEY

The near-surface soils at the site are mapped by the U.S. Department of Agriculture in the Soil Survey of Cowlitz County, Washington as found on the Web Soil Survey (USDA 2006) website. The report generated by the Soil Survey for the site indicates several soil subtypes are mapped at the site, including; Arents (Dike fill), 0 to 5 percent slopes; Caples silty clay loam, 0 to 3 percent slopes; Pilchuck loamy fine sand, 0 to 8 percent slopes; Riverwash (Outwash deposits on the riverside of the dikes); Schneider-Rock outcrop complex, 15 to 65 percent slopes; and Snohomish silty clay loam, 0 to 1 percent. The Schneider-Rock outcrop complex represents a small outcrop of bedrock near Mt. Solo Road and won't be discussed further.

The site is effectively split into two areas displaying similar soil types; 1) the inland portion of the site, covering nearly 75% of the land area, comprised of the Caples and Snohomish soil units, and 2) the levee portion of the site comprised of the Arents, Pilchuck, and Riverwash soil units. In general, for site planning purposes, the soils found at the site should be classified mainly as silt and sand with areas of organic silt possibly present in the Snohomish soil unit.

Soils in the inland portion of the site are typical alluvial deposits that form near bodies of water such as the Columbia River. Drainage characteristics of the soils range from moderately well drained in the Caples soil unit to poorly drained in the Snohomish. Permeability of the soil ranges from moderately low to moderately high between 0.06 and 0.6 inches/hour. These soils types are prime farmland provided they are drained and not exposed to excessive flooding.

Soils in the levee portion of the site range from typical alluvial deposits in the Riverwash and Pilchuck soil units, to manmade fills for the flood control levee in the Arents soil unit. Drainage characteristics of the soils range from somewhat poorly drained in the Riverwash soil unit, moderately well drained in the Arents soil unit, to somewhat excessively drained in the Pilchuck soil unit. Permeability of the soil ranges from moderately high to very high, between 0.6 and 20 inches/hour, in the Pilchuck and Arents soil unit. Permeability estimates for Riverwash is not mapped at the site. Pilchuck is considered prime farmland provided the soils are irrigated (See Attachment 3 USDA Soils Map).

Reference: USDA, National Resources Conservation Service. Soil Survey of Cowlitz County, Washington. By Russell F. Pringle and Robert L. Evans, USDA, 1988. Web Soil Survey - <http://websoilsurvey.nrcs.usda.gov/>

WASHINGTON STATE 303D LIST

There are no listed water bodies located within a mile of the Barlow Point site.

FLOODPLAIN & FLOODWAY (FEMA) MAPS

The site is classified by the Federal Emergency Management Agency (FEMA) as Zone X which indicates that the area is protected from the one percent annual chance (100-year) flood by a levee. The top of the levee is at approximately +30' NAVD88 and the 100-year and 500-year flood stage elevations are +19.6' NAVD88 and +22.0' NAVD88 which means the levee in the vicinity of Barlow Point provides protection up to the 500-year flood event.

DOWNSTREAM DRAINAGE COMPLAINTS

Both CDID#1 and the City of Longview Stormwater Division were contacted in June of 2015. Neither agency had record of drainage complaints in the area covered by this Level 1 Downstream Analysis.

TASK 3: FIELD INSPECTION

A field inspection was completed using the guidelines for a Level 1 downstream analysis outlined in Volume I Section 2.6.2 of the SWMMWW 2014 (see Attachment 6 Photo Key Map and Photo Log). The inspection of the project site and the downstream conveyance system was conducted on May 13th, 2015.

The basin boundaries were verified and the on-site and off-site drainage conditions and systems were examined. This included locating and verifying the diameter (if possible) of multiple culverts on the site and observing the minor drainage ditches and the PDF and CDID#1 ditches adjacent to the site. Site features such as ground cover, slopes, soil types, and other topographic features were also observed.

As required by the SWMMWW 2014, the downstream system was investigated to a minimum distance of ¼ mile. Approximately 255 acres of the site drains north to the larger CDID#1 ditch network. All major accessible culverts between the site and the CDID#1 main lift station were observed for a distance downstream of approximately 3 miles (15,700 feet) along SR 432. The remaining 27.5 acres comprised of the water-side face of the levee drains south directly to the Columbia River. The levee road was driven and the shoreline was observed.

The nearest upstream culvert that crosses SR 432 was also observed and is located approximately ½ mile upstream to the east.

TASK 4: DESCRIBE EXISTING DOWNSTREAM DRAINAGE SYSTEM

The following gives a detailed description of the drainage system downstream of the site. References to photos can be found in Attachment 6 Photo Key Map and Photo Log.

COLUMBIA RIVER

Barlow Point is located on the Columbia River at approximately Statute Mile 61.7 (River Mile 53.4). Channel width varies from approximately 2,200 to 2,700 feet along the site.

CONSOLIDATED DIKING DISTRICT #1 DITCH NETWORK

The Longview-Kelso area is protected from flooding of the Cowlitz and Columbia Rivers by an extensive levee system. As part of the levee system, a 35 mile network of canals, ditches and sloughs collects stormwater and directs it to the main pump station located in the northwest corner of the City of Longview where it is discharged to the Columbia River via Coal Creek (see Attachment 7 CDID#1 District Facilities Map and Attachment 8 CDID#1 Ditch Profile and Inventory).

CDID#1 DITCH #14

Ditch #14 connects to Ditch #10 at the north-east corner of the site. Ditch #14 has bottom width that varies between 40 to 50 feet, side slopes of approximately 2 to 1, and an approximate depth of 8 feet. According to the CDID#1 profile for Ditch #14, the ditch is generally sloped to drain south toward the Reynolds Pump Station (see Attachment 6 Photo Key Map and Photo Log, Photo 15). This means that Ditch #14 is typically standing water and only drains to Ditch #10 when the water level rises. Note that, unlike the CDID#1 profile for Ditch #10, the profile for Ditch #14 does not provide inverts. Further investigation of Ditch #14 is required.

The Reynolds Pump Station is located at southern terminus of Ditch #14 directly land-side of the levee (see Attachment 6 Photo Key Map and Photo Log, Photo 3). The pump station is capable of 80,000 GPM and discharges through the levee to the Columbia through a large diameter outfall. CDID#1 indicated that the pump station is not an automatic pump station due to intake screen clogging issues and is manually operated only when the water level in the ditch network is high and a large storm event is approaching.

PRIVATE DRAINAGE FACILITY (PDF) DITCH

The PDF ditch is located adjacent to Mt. Solo landfill and the majority of the ditch straddles the property line between the two sites. The ditch is shallow and wide with a bottom width that varies between 25 to 150 feet at the bends, side slopes of approximately 2 to 1, with an approximate depth of 8 feet. The ditch

meanders around Mt. Solo Landfill to the east and west connecting to the CDID#1 ditch network in two locations. The upstream connection to Ditch #14 is located in the north east corner of the site (see Attachment 6 Photo Key Map and Photo Log, Photo 14) and the downstream connection to Ditch #10 is located approximately 1,700 linear feet from the region detention pond (see Attachment 6 Photo Key Map and Photo Log, Photo 34).

Field inspection showed the water surface elevation in the ditch to be below the invert elevation of the culvert to Ditch #14 (see Attachment 6 Photo Key Map and Photo Log, Photo 17). The ditch also has an obstructed culvert located at the northwest corner of the site (see Attachment 6 Photo Key Map and Photo Log, Photo 23). The portion of the ditch shared with Barlow Point likely only drains to Ditch #14 during high water events.

CDID#1 DITCH #10

Ditch #10 runs along the southwest of the City of Longview for 22,300 feet from the upstream connection to Ditch #5 to the main pump station. Downstream of Barlow Point, Ditch #10 flows west along the south side of SR 432 for approximately 3 miles to the main pump station. The ditch varies widely in width from approximately 25 to 60 feet with localized areas in excess of 150 to 200 feet. Several driveways cross the ditch and the ditch crosses SR 432 and Ocean Beach Highway. See Attachment 8 CDID#1 Drainage Profile and Inventory for ditch features including inverts and ditch feature locations.

Notable features of the ditch are the undersized culverts at the Barlow Point driveway and the regional detention pond (see Attachment 6 Photo Key Map and Photo Log, Photo 32).

Approximately 900 feet downstream of the Ditch #14 connection point, Ditch #10 crosses under the main site entrance through three 48" diameter CMP culverts according to the CDID#1 ditch profiles. Only a single culvert was observed during the field inspection (see Attachment 6 Photo Key Map and Photo Log, Photo 31). CDID#1 indicated that these culverts were undersized and were hindering the performance of the ditch.

The regional detention pond is located approximately 2,500 feet downstream of the main site entrance on the south side of Ditch#10. The regional detention pond is controlled through an adjustable weir and outlet pipe with control (see Attachment 6 Photo Key Map and Photo Log, Photo's 34-35). CDID#1 stated that the detention pond has 260,000 cubic feet of storage remaining for purchase.

LEVEL 1 DOWN STREAM ANALYSIS ATTACHMENT 1

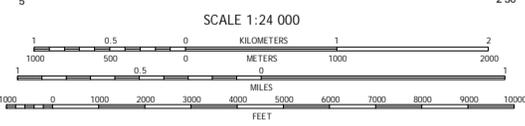


PROJECT SITE

Produced by the United States Geological Survey
 North American Datum of 1983 (NAD83)
 World Geodetic System of 1984 (WGS84). Projection and
 1 000-meter grid. Universal Transverse Mercator, Zone 10T
 10 000-foot ticks: Washington Coordinate System of 1983 (south
 zone), Oregon Coordinate System of 1983 (north zone)

This map is not a legal document. Boundaries may be
 generalized for this map scale. Private lands within government
 reservations may not be shown. Obtain permission before
 entering private lands.

Imagery NADIP, August 2011
 Roads ©2006-2013 TomTom
 Names ©2013
 Hydrography National Hydrography Dataset, 2011
 Contours National Elevation Dataset, 2012
 Boundaries Census, IBRC, BC, USGS, 1972 - 2012
 Public Land Survey System BLM, 2011

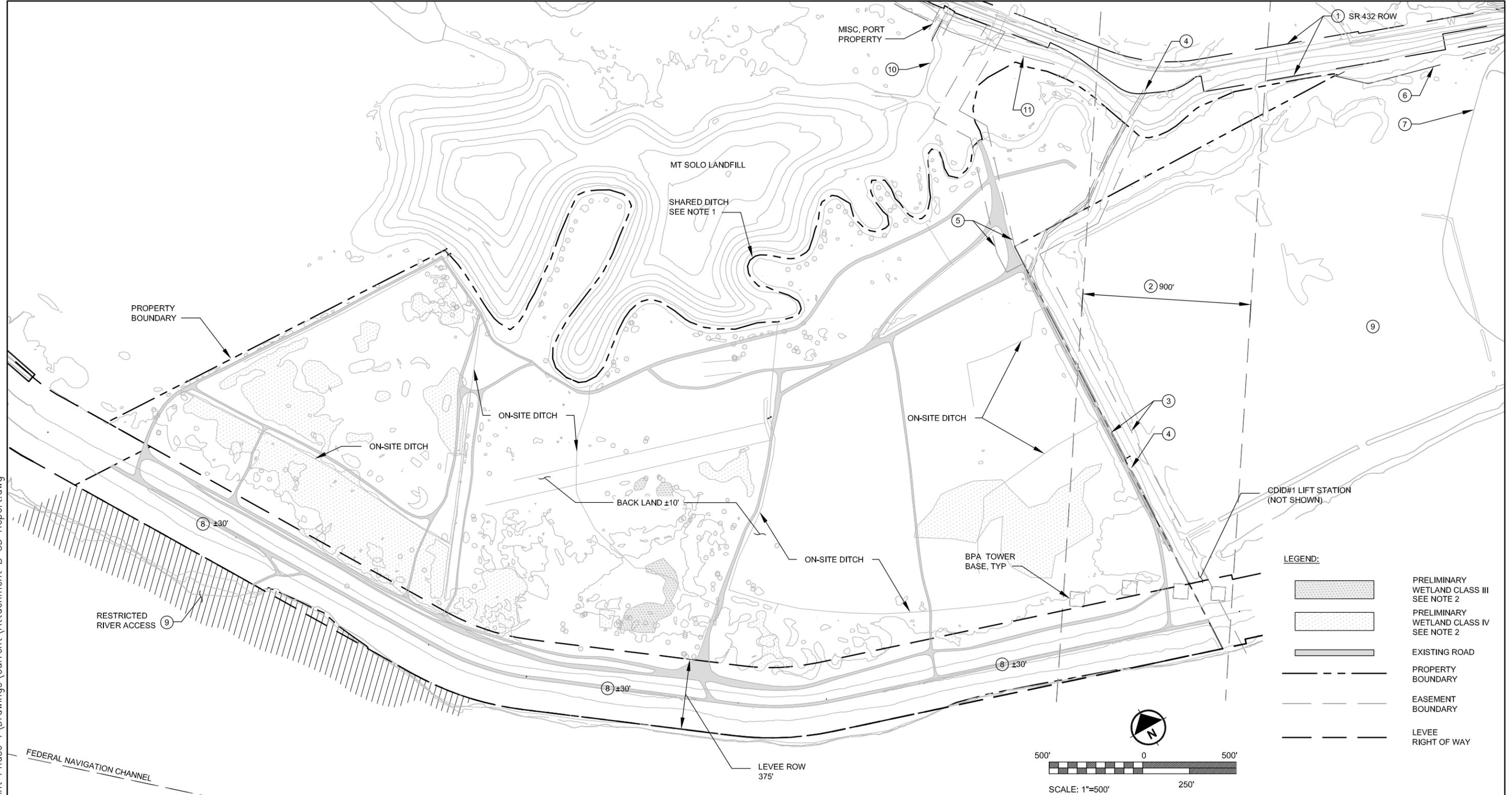


Elochman Lake	Abernathy Mountain	Castle Rock
Oak Point	Coal Creek	Kelso
Clatskanie	Delena	Rainier

COAL CREEK, WA-OR
 2014

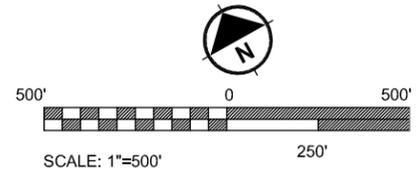
ADJOINING 7.5' QUADRANGLES

Plotted: Mar 09, 2016 - 2:01pm ebeckwith Layout1
 M:\2014\114180 Barlow Point Phase 1\Drawings\Current\Attachment B SD Report.dwg



LEGEND:

	PRELIMINARY WETLAND CLASS III SEE NOTE 2
	PRELIMINARY WETLAND CLASS IV SEE NOTE 2
	EXISTING ROAD
	PROPERTY BOUNDARY
	EASEMENT BOUNDARY
	LEVEE RIGHT OF WAY



- | | |
|------------------------------------|-----------------------------|
| ① SR432 (NHS, ROW VARIES 70'-185') | ⑧ CDID#1 LEVEE |
| ② BPA EASEMENT (900') | ⑨ NORTHWEST ALLOYS PROPERTY |
| ③ CDID#1 DITCH EASEMENT (100') | ⑩ INGRESS/EGRESS EASEMENT |
| ④ CDID#1 ELECTRICAL EASEMENT (20') | ⑪ DITCH EASEMENT |
| ⑤ ACCESS EASEMENT (100') | |
| ⑥ BNSF PARCEL PER GIS (APPROX.) | |
| ⑦ BNSF RAIL SPUR (APPROX.) | |

NOTES:

- PROPERTY BOUNDARY RUNS ALONG CENTER OF SHARED DITCH.
- WETLAND BOUNDARIES SHOWN ARE PRELIMINARY AND UNVERIFIED.

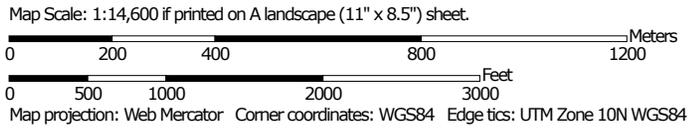
DRAFT



**PORT OF LONGVIEW - BARLOW POINT
 SITE CONCEPT
 EXISTING CONDITIONS**

DATE: 2015-08-07	SCALE: AS SHOWN
DRAWN BY: ESB	1 OF 1

Soil Map—Cowlitz County, Washington
(USDA Soils Map)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Cowlitz County, Washington

Survey Area Data: Version 14, Sep 15, 2014

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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

Map Unit Legend

Cowlitz County, Washington			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2f2r	Maytown silt loam, 0 to 3 percent slopes	23.7	5.4%
2f45	Pilchuck loamy fine sand, 0 to 8 percent slopes	24.5	5.6%
2f4w	Caples silty clay loam, 0 to 3 percent slopes	253.4	58.1%
2f52	Riverwash	8.0	1.8%
2f5s	Schneider-Rock outcrop complex, 15 to 65 percent slopes	7.1	1.6%
2f63	Snohomish silty clay loam, 0 to 1 percent slopes	39.6	9.1%
2f77	Centralia silt loam, 8 to 20 percent slopes	1.5	0.4%
2fg8	Arents, 0 to 5 percent slopes	41.9	9.6%
2fp6	Hazeldell gravelly silt loam, 8 to 20 percent slopes	1.8	0.4%
2g0m	Water	34.3	7.9%
Totals for Area of Interest		435.9	100.0%

6/1/2015 4:05 PM S:\ELSIWA\Cowitzi\County-Projects\2163-KPFF Consulting Engineers\2163.03-Barlow Pt. Ph. 1 Scoping and Due Diligence\2163.03-Figures\2163.03_GPS.dwg Jennifer



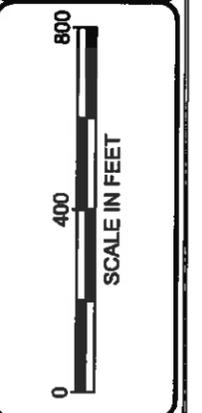
NOTE(S):

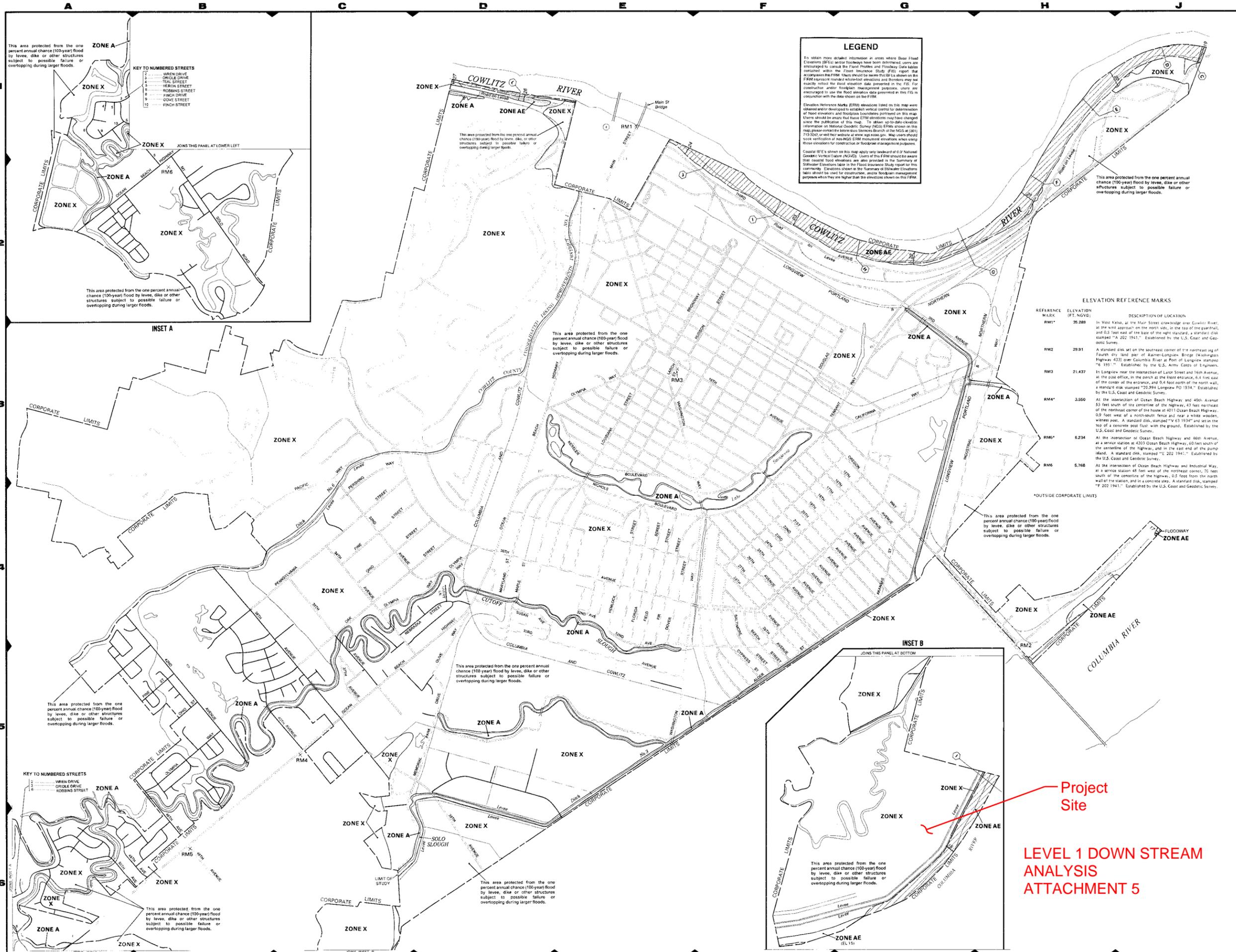
1. Aerial photo from Google Earth™
2. Wetland and ditch boundaries by ELS, Inc. biologists were field located using a hand-held GPS unit with submeter accuracy
3. OHWM of Type F stream from aerial photo analysis.

Figure 1
Barlow Point GPS Data
Barlow Point
Port of Longview

DATE: 6/1/15
DWN: ###
REQ. BY: ###
PRJ. MGR: ###
CHK: ###
PROJECT NO:
2163.03

ECOLOGICAL LAND SERVICES, INC.
1157 3rd Ave., Suite 220
Longview, WA 98632
Phone: (360) 578-1371 Fax: (360) 414-9305





LEGEND

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data Tables contained within the Flood Insurance Study (FIS) report. The accompanying FIRM Users Guide to the FIS should be used to obtain up-to-date elevation information on Flood Profiles and Floodway Data Tables. Users are encouraged to use the Flood Profiles and Floodway Data Tables to determine the flood elevation data presented in the FIS. For construction under floodplain management programs, users are encouraged to use the Flood Profiles and Floodway Data Tables in conjunction with the data shown on the FIS.

Coastal Flood Hazard (CFH) elevations based on this map were obtained and/or developed to establish vertical control for determination of flood elevations and floodway boundaries portrayed on this map. Users should be aware that these CFH elevations may have changed since the publication of this map. To obtain up-to-date elevation information on Coastal Flood Hazard (CFH) elevations shown on this map, please contact the National Oceanic and Atmospheric Administration (NOAA) at (202) 775-7200 or visit their website at www.ncei.noaa.gov. Map users should seek verification of NOAA CFH elevation information when using these elevations for construction or floodplain management purposes.

Coastal BFE's shown on this map apply only to areas of 0.5 National Geodetic Vertical Datum (NGVD). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations Table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations Table should be used for construction, advance floodplain management purposes which they are higher than the elevations shown on this FIRM.

- LEGEND**
- SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD**
 - ZONE A** No base flood elevations determined.
 - ZONE AE** Base flood elevations determined.
 - ZONE AH** Flood depths of 1 to 3 feet usually are from on-levee terrain; average depth shown; base flood elevations determined.
 - ZONE AD** Flood depths of 1 to 3 feet usually are from on-levee terrain; average depth shown; base flood elevations determined.
 - ZONE ABB** To be protected from 100-year flood by future flood protection system under construction; no base flood elevations determined.
 - ZONE V** Coastal flood with velocity hazard; base flood elevations determined.
 - ZONE VE** Coastal flood with velocity hazard; base flood elevations determined.
 - FLOODWAY AREAS IN ZONE AE**
 - OTHER FLOOD AREAS**
 - ZONE X** Area of 500-year flood; area of 100-year flood with drainage area less than 1 square mile; and area protected by levee from 100-year flood.
 - OTHER AREAS**
 - ZONE X** Area of 500-year flood; area of 100-year flood with drainage area less than 1 square mile; and area protected by levee from 100-year flood.
 - ZONE D** Area in which flood hazards are undetermined.
 - UNDEVELOPED COASTAL BARRIERS**
 - Identified FIRM
 - Identified FIRM
 - Other than FIRM
- *Coastal barrier areas are normally located within or adjacent to special flood hazard areas.
- Floodplain Boundary
 - Floodway Boundary
 - Zone D Boundary
 - Boundary Dividing Special Flood Hazard Zones and Boundary Dividing Area of Other Level Coastal Base Flood Hazard Within Special Flood Hazard Zone
 - Base Flood Elevation Line; Elevation in Feet
 - Cross Section Line
 - Base Flood Elevation - Feet Where Uniform Within Zone*
 - Location Reference Mark
 - Area Mile
 - MI 1.5
- *Referenced to the National Geodetic Vertical Datum of 1929.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM1*	35.289	In West Kelso, at the Main Street drawbridge over Cowlitz River, at the east approach on the north side, in the top of the guardrail, and 0.5 foot east of the base of the right handrail; a standard disk stamped "A 202 1941." Established by the U.S. Coast and Geodetic Survey.
RM2	29.91	A standard disk set on the southeast corner of the northeast leg of Fourth dry land pier of Rainier-Longview Bridge (Washington Highway 433) over Columbia River at Port of Longview, stamped "6 1951." Established by the U.S. Army Corps of Engineers.
RM3	21.437	In Longview near the intersection of Lorot Street and 18th Avenue, at the post office, in the porch at the front entrance, 6.4 feet east of the center of the entrance, and 0.4 foot north of the north wall; a standard disk stamped "20 394 Longview PD 1934." Established by the U.S. Coast and Geodetic Survey.
RM4*	3.550	At the intersection of Ocean Beach Highway and 490th Avenue 5.5 feet south of the centerline of the highway, 43 feet northeast of the northeast corner of the house at 4011 Ocean Beach Highway, 0.9 foot west of a north-south fence and near a white wooden witness post. A standard disk, stamped "6 1934" and set on the top of a concrete post flush with the ground. Established by the U.S. Coast and Geodetic Survey.
RM5*	6.234	At the intersection of Ocean Beach Highway and 46th Avenue, at a service station at 4303 Ocean Beach Highway, 60 feet south of the centerline of the highway, and in the east end of the pump island. A standard disk, stamped "6 200 1941." Established by the U.S. Coast and Geodetic Survey.
RM6	5.768	At the intersection of Ocean Beach Highway and Industrial Way, at a service station 48 feet west of the northeast corner, 7.0 feet south of the centerline of the highway, 0.5 foot from the north wall of the station, and in a concrete step. A standard disk, stamped "6 202 1941." Established by the U.S. Coast and Geodetic Survey.

*OUTSIDE CORPORATE LIMITS

NOTES

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage basins of small size or intermittent streams outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on SFHAs and for any amendments to floodway dimensions, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AG, AV, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic computations with regard to responsibilities of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Tables where floodway widths are shown at 100-foot intervals.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

MAP REPOSITORY
 City Hall
 Planning and Building Department
 1525 Broadway
 Longview, Washington 98602
 (Maps available for reference only, not for distribution.)
 INITIAL BENTON/CATCH
 JUNE 28, 1974

FLOOD HAZARD REVISIONARY MAP REVISION:
 DECEMBER 10, 1978

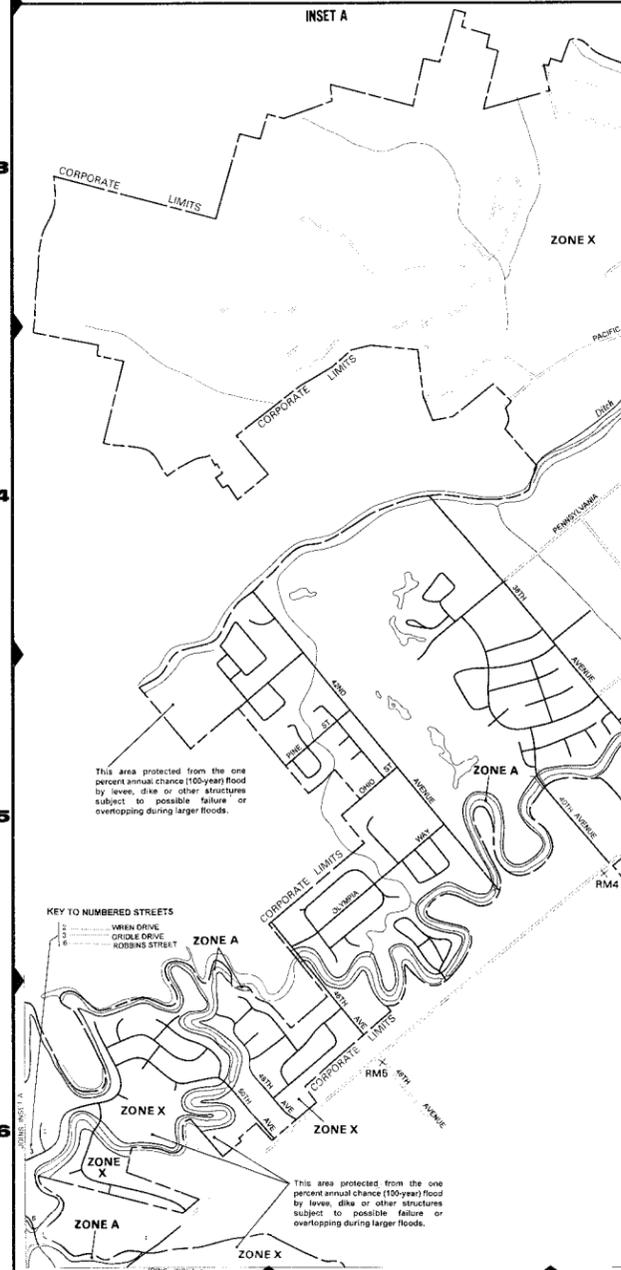
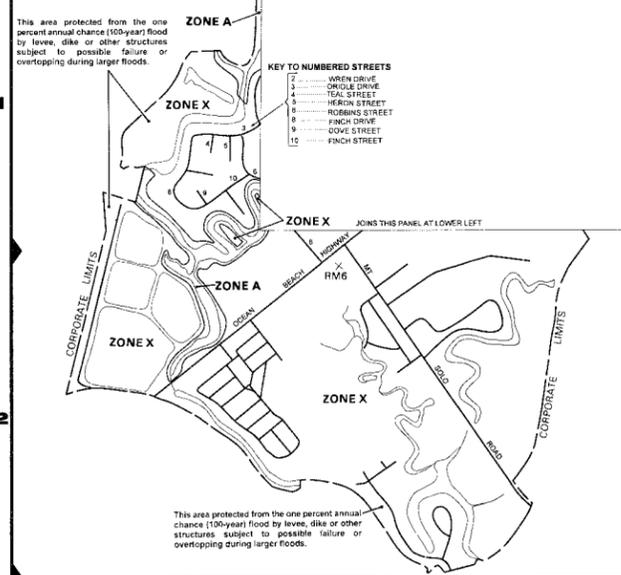
FLOOD INSURANCE RATE MAP EFFECTIVE:
 DECEMBER 18, 1979

FLOOD INSURANCE RATE MAP REVISIONS:
 SEPTEMBER 2, 1993

Map revised December 20, 2001 to update corporate limits, to change base flood elevations, to change special flood hazard areas, to change zone designations, and to change floodway.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 636-6232.

APPROXIMATE SCALE IN FEET
 1000 0 1000



Project Site

LEVEL 1 DOWN STREAM ANALYSIS ATTACHMENT 5

NATIONAL FLOOD INSURANCE PROGRAM

FIRM FLOOD INSURANCE RATE MAP

CITY OF LONGVIEW, WASHINGTON
 COWLITZ COUNTY

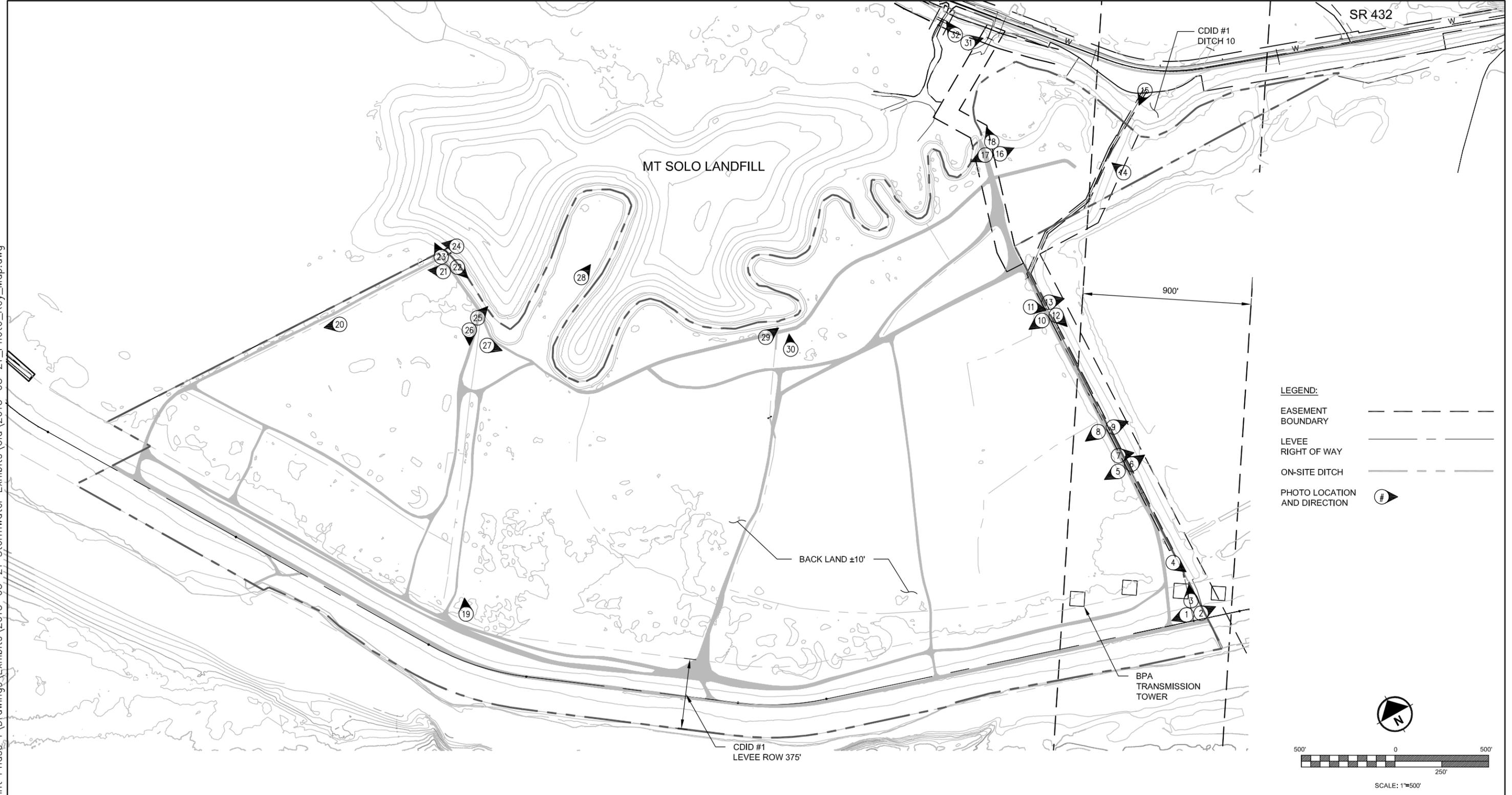
ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
 5300340005 D

MAP REVISED:
 DECEMBER 20, 2001

Federal Emergency Management Agency

Plotted: Aug 24, 2015 - 4:13pm jchapman Layout: Layout1
 M:\2014\114180 Barlow Point Phase 1\Drawings\Exhibits\2015-05-21 Stormwater Exhibits\Old\2015-08-21_Photo_Key_Map.dwg



 	BARLOW POINT FIELD INVESTIGATION PHOTO LOG	
	DATE: 2015-05-21	SCALE: AS SHOWN
DRAWN BY: JAC	1 OF 2	

LEVEL 1 DOWN STREAM ANALYSIS
ATTACHMENT 6



BARLOW POINT
PROJECT AREA

MT SOLO
LANDFILL

BARLOW POINT
PHOTO KEY MAP
2 OF 2
27/MAY/15

C o l u m b i a

432

All photos are based on a site visit on 5/28/2015. The weather was overcast with light intermittent rain, high temperature of 65° F.



Photo 1: Dike road located on top of the levee, approximately 20' above adjacent areas.



Photo 2: Dike road to the east showing adjacent parcel, area drains directly to ditch 14. Valve boxes for Reynolds pump station can be seen.



Photo 3: Ditch 14 runs north/south adjacent to property line and access road. Reynolds pump station for ditch 14 is shown.



Photo 4: Intake for Reynolds pump station includes debris screens.



Photo 5: Subbasin 2 drains via overgrown ditches through multiple 24" Corrugated PE culvert pipe which discharges directly to ditch 14.



Photo 6: The 24" corrugated PE culvert pipes conveys surface water under the maintenance access road to the shown discharge point into ditch 14 shown in the background.



Photo 7: The adjacent parcel drains similarly and discharges via culverts directly to ditch 14



Photo 8: The eastern portion of the site drains via overgrown ditches through multiple 24" Corrugated PE culvert pipes which discharge directly to ditch 14.



Photo 9: The 24" corrugated PE culvert pipe conveys surface water under the maintenance access road to the shown discharge point into ditch 14 shown in the background.



Photo 10: On site private shallow ditches vary in depth from approximately 3.5 to 5 feet deep. Ditch shown is approximately 5 feet deep.



Photo 11: The 5 foot deep ditch shown in Photo 10 conveys surface flow to the shown 24” corrugated PE culvert pipe. This culvert pipe passes below the maintenance access road to discharge to ditch 14 located on the near side of the embankment shown at the back of the picture.



Photo 12: Ditch 14 located adjacent to site is approximately 40 to 50 feet wide.



Photo 13: The 24" corrugated PE culvert pipe conveys surface water under the maintenance access road to the shown discharge point into ditch 14 shown in the background.



Photo 14: Ditch adjacent to Mt Solo Landfill shown to left flows into ditch 14 prior to comingling with ditch 10 (shown in background adjacent to SR 432).



Photo 15: Ditch 14 (shown beyond) flows into ditch 10 which flows west (page right) along SR 432.



Photo 16: Large private ditch shared with Mt Solo Landfill is approximately 8 feet deep and varies in width from 25 feet to 150 feet. All surface flow from subbasin 1 is gathered and discharges to this ditch. Significant surface flows from Mt Solo landfill also discharge to this ditch.



Photo 17: Shared large private ditch with Mt Solo Landfill passes under the property access road via a 48" corrugated PE culvert pipe.



Photo 18: Shared large private ditch with Mt Solo Landfill passes under the property access road via a 48" corrugated PE culvert pipe.



Photo 19: Looking from Dike Road north across site. Mt Solo Landfill shown in background. Site shown slopes gradually to shallow private on-site ditches, draining to large private ditch shared with Mt Solo Landfill.



Photo 20: Gravel road at western property boundary. Small berm along property line (page right) isolates property from off-site flow. Ditch east of road (page left) drains road and adjacent area.



Photo 21: Ditch east of road (page left) channels flow to 36” corrugated PE culvert pipe. The 36” corrugated PE culvert pipe conveys surface water to the shared large private ditch with Mt Solo landfill.



Photo 22: Shared large private ditch with Mt Solo Landfill has extensive aquatic plant growth.



Photo 23: Plugged culvert preventing shared large private ditch from flowing west partially shown (center of photo).



Photo 24: Significant aquatic growth in shared large private ditch west of site.



Photo 25: 36" corrugated PE culvert pipe discharges to shared large private ditch with Mt Solo landfill.



Photo 26: Surface water in shallow private ditches builds elevation prior to being conveyed to 36" corrugated PE culvert pipe, and shared large private ditch.



Photo 27: Shared large private ditch with Mt Solo landfill widens to as much as 150' wide at some of the major bends.



Photo 28: This area has been used for piling slash from general maintenance of property. Pile shown (photo left) is 6' to 8' tall and as much as 100' wide.



Photo 29: 36" corrugated PE culvert pipe discharges to shared large private ditch with Mt Solo landfill.



Photo 30: 24" corrugated PE culvert pipe discharges to shared large private ditch with Mt Solo landfill.



Photo 31: Ditch 10 channels through three 48" CMP culverts that appear to be partially damaged and partially plugged. Only one culvert can be seen.



Photo 32: Dual 95" diameter CMP culverts pass under the next entrance approximately 100 yards downstream of the undersized 48" culvert pipes.



Photo 33: Dual 95" diameter CMP culverts convey flow under the access road to the Regional Detention Pond.



Photo 34: Regional Detention Pond is located approximately 3000' downstream of where Ditch 14 enters Ditch 10. Inflow to pond is controlled with an adjustable weir.



Photo 35: Regional Detention Pond appears dry.



Photo 36: Trash screens covering dual 48" diameter CMP culverts attached to Ditch 8 upstream of Ditch 10.



Photo 37: Ditch 10 is conveyed under SR 432 via 114" diameter CMP culvert.



Photo 38: Ditch 10 follows SR 432 towards the main pump station.



Photo 39: Ditch 14 crosses under SR 423. See Photo 37 for exit.



Photo 40: Ditch 10 is conveyed under Ocean Beach Highway via a large diameter culvert.



Photo 41: Stormwater is stored upstream of the main pump station prior to being pumped up and discharged to the Columbia River via Coal Creek.



Photo 42: Main pump station (336,000 gpm) discharges to the Columbia River via Coal Creek.



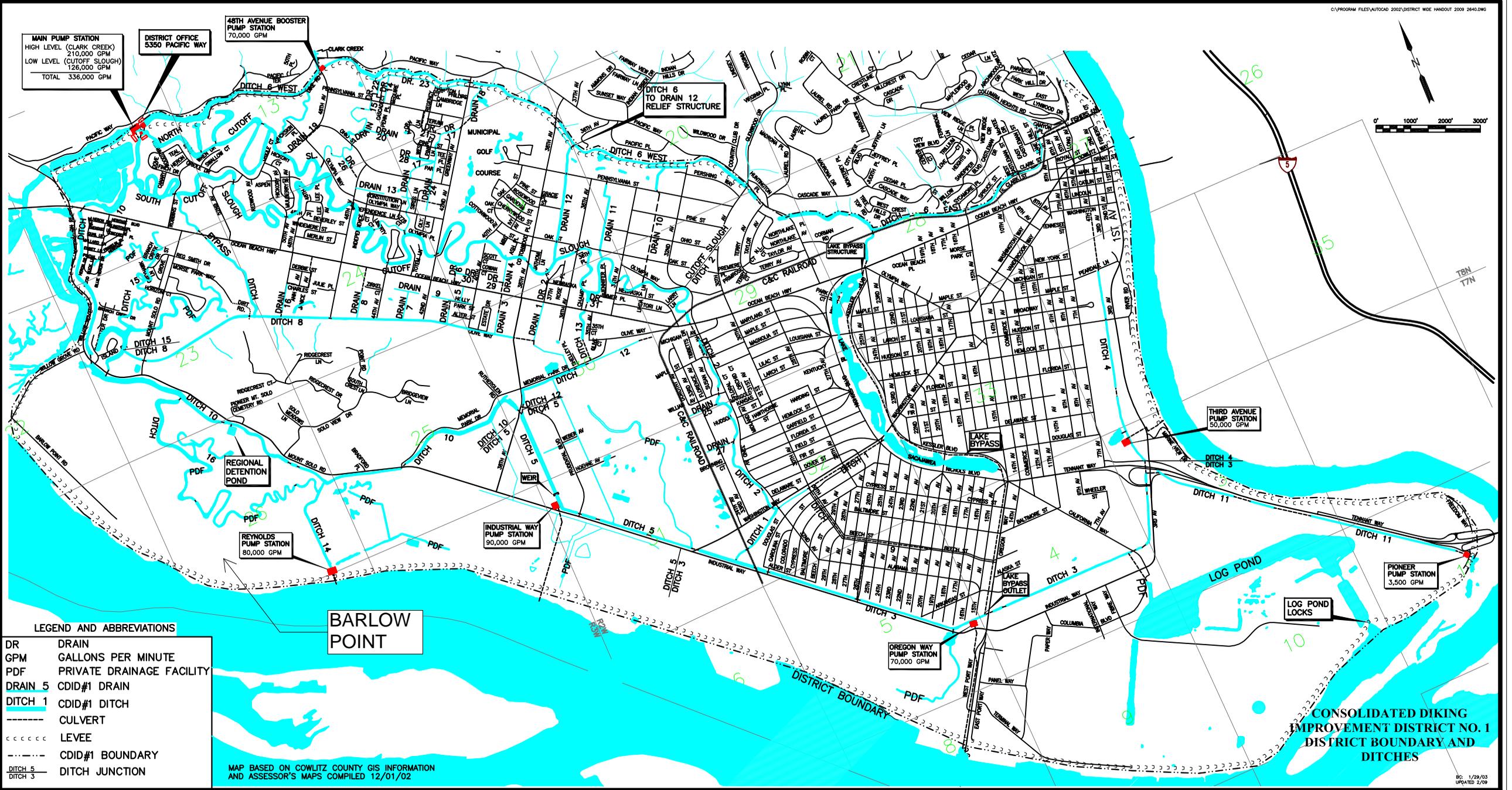
Photo 43: Approximately ½ mile upstream of the undersized 30” culvert pipe (see Photo 31), an 84” diameter CMP culvert conveys Ditch 10 across Industrial Way (SR 432).



Photo 44: Ditch 10 upstream of project site.

LEVEL 1 DOWN STREAM ANALYSIS ATTACHMENT 7

CV:PROGRAM FILES\AUTOCAD 2002\DISTRICT WIDE HANDOUT 2009 2840.DWG



MAIN PUMP STATION
HIGH LEVEL (CLARK CREEK)
210,000 GPM
LOW LEVEL (CUTOFF SLOUGH)
126,000 GPM
TOTAL 336,000 GPM

DISTRICT OFFICE
5350 PACIFIC WAY

48TH AVENUE BOOSTER PUMP STATION
70,000 GPM

DITCH 6 TO DRAIN 12 RELIEF STRUCTURE

THIRD AVENUE PUMP STATION
50,000 GPM

REGIONAL DETENTION POND

REYNOLDS PUMP STATION
80,000 GPM

INDUSTRIAL WAY PUMP STATION
90,000 GPM

OREGON WAY PUMP STATION
70,000 GPM

PIONEER PUMP STATION
3,500 GPM

BARLOW POINT

LEGEND AND ABBREVIATIONS

DR	DRAIN
GPM	GALLONS PER MINUTE
PDF	PRIVATE DRAINAGE FACILITY
DRAIN 5	CDID#1 DRAIN
DITCH 1	CDID#1 DITCH
---	CULVERT
-----	LEVEE
-----	CDID#1 BOUNDARY
DITCH 5 DITCH 3	DITCH JUNCTION

MAP BASED ON COWLITZ COUNTY GIS INFORMATION
AND ASSESSOR'S MAPS COMPILED 12/01/02

**CONSOLIDATED DIKING
IMPROVEMENT DISTRICT NO. 1
DISTRICT BOUNDARY AND
DITCHES**

BC: 1/29/03
UPDATED 2/09

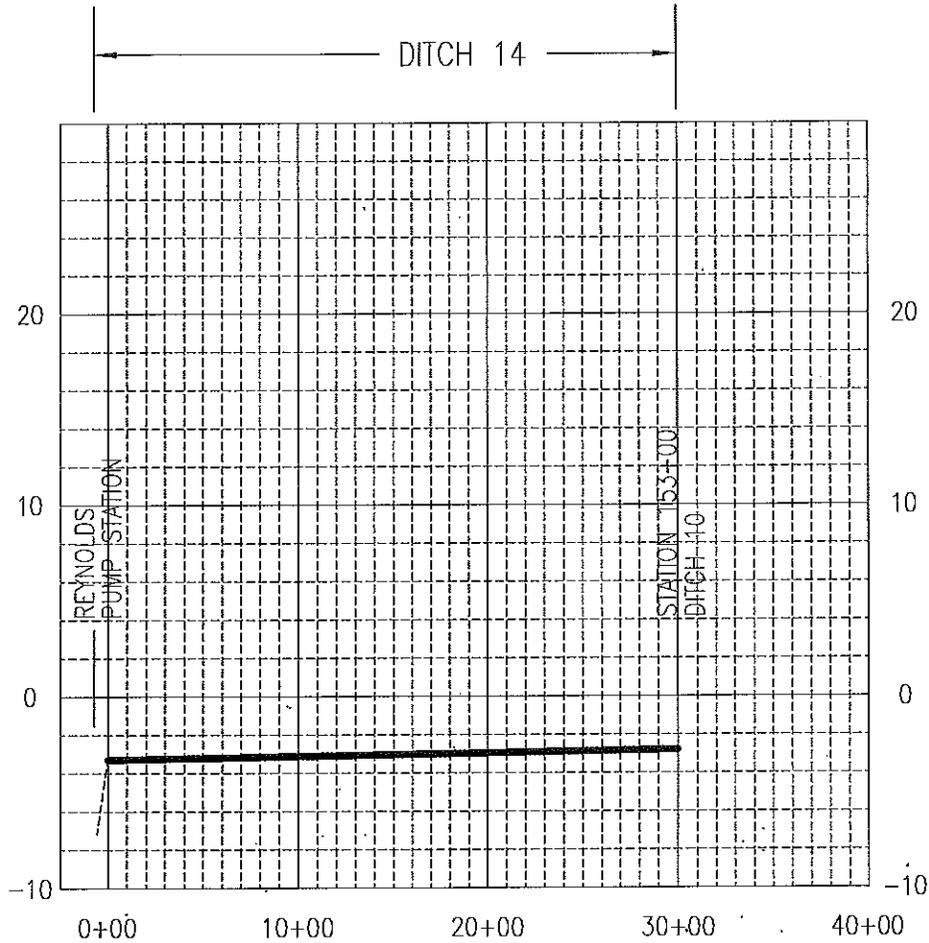
DRAINAGE INVENTORY

DITCH 14 FROM REYNOLDS PUMP STATION TO DITCH 10
11/21/07

STATION	TYPE	SIZE	INV. ELEVATION	
			DOWNSTREAM	UPSTREAM
0+00	REYNOLDS PUMP STATION			
2+00	DEBRIS BOOM			
30+00	DITCH 10 (STATION 153+00)			

DATUM = NAVD "88"

DITCH 14 PROFILE FROM REYNOLDS PUMP STATION TO DITCH 10



SCALE: 1" = 1000' HORIZ.
 1" = 10' VERT.
 DATUM: NAVD "88"

LEGEND

- CMP CORRUGATED METAL PIPE
- RCP REINFORCED CONCRETE PIPE
- ARCH..... ARCH PIPE
- OPEN DITCH
- ▬..... CULVERT
- CULVERT - DRAIN ENTERING DITCH

NOTE:
 STATIONING AND ELEVATIONS ARE APPROXIMATE AND SHOULD
 NOT BE USED FOR DESIGN OR CONSTRUCTION
 PURPOSES WITHOUT FIELD VERIFICATION

CDID #1
 DITCH 14 PROFILE
 SCALE: AS SHOWN
 DATUM: NAVD 88
 FILE: 1014 PROFILE
 DRAWN: BC 9/2007

DRAINAGE INVENTORY

DITCH 10 FROM CUTOFF TO DITCH 5

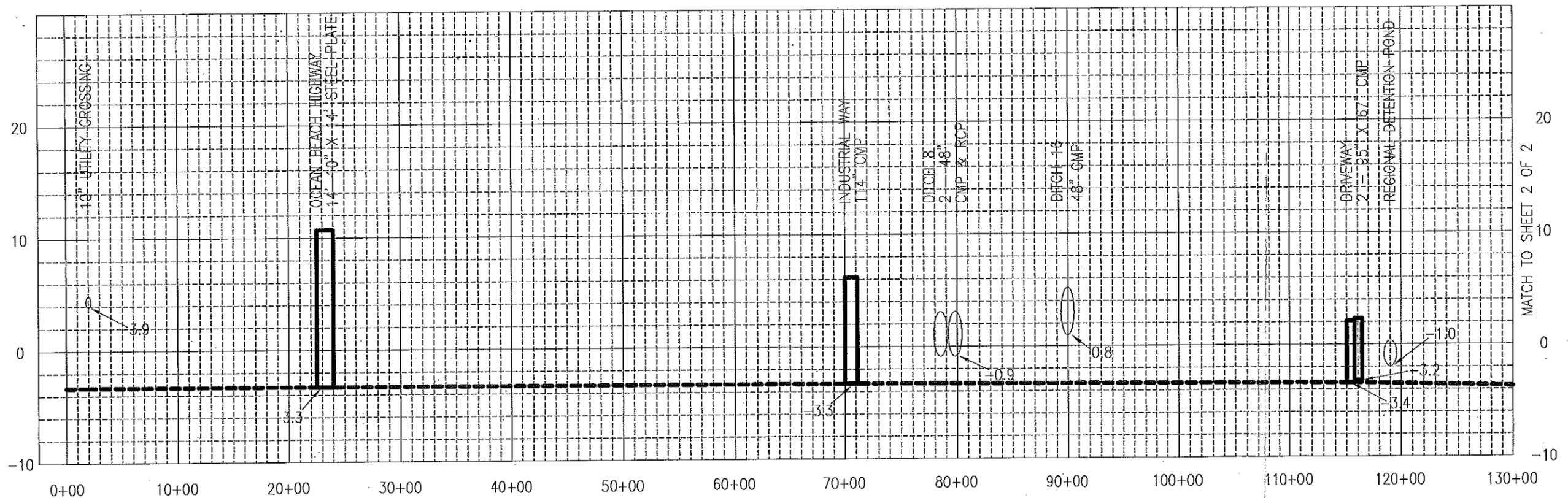
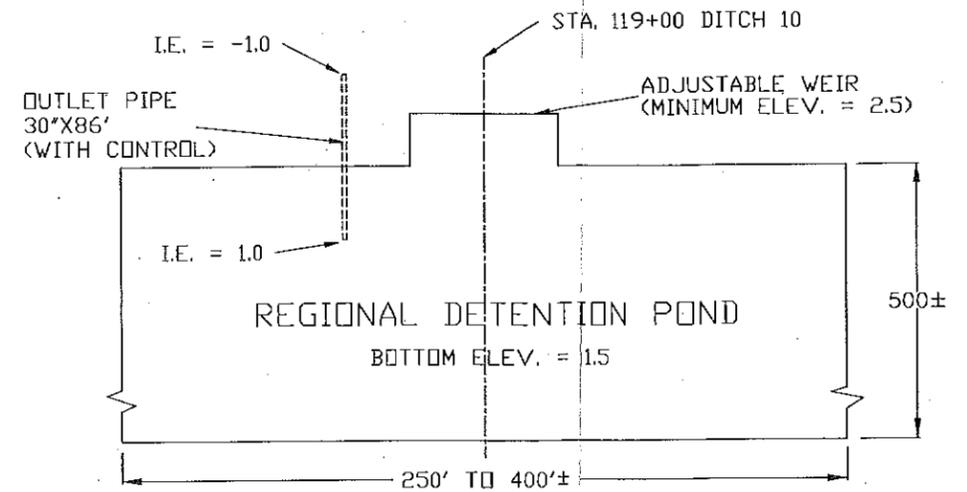
11/21/07

STATION	TYPE	SIZE	INV. ELEVATION	
			DOWNSTREAM	UPSTREAM
0+00	CUTOFF SLOUGH			
0+50	SAN. SEWER	10"	3.9	
22+50	CMP PLATE	178" X 168" X 150'	-3.3	-3.3
70+00	CMP	114" X 240'	-3.3	-3.3
78+00	DITCH 8 INTERSECTS		-0.9	
90+00	DITCH 16 INTERSECTS			
115+00	CMP	95" X 67" X 70'	-3.4	-3.4
115+00	CMP	95" X 67" X 70'	-3.2	-3.2
119+00	REGIONAL DETENTION POND ENTERS		-1.0	1.0
140+00	CMP	95" X 67" X 70'	-3.5	-3.5
140+00	CMP	95" X 67" X 70'	-3.9	-3.9
144+00	CMP	48"	-2.6	-2.6
144+00	CMP	48"	-2.6	-2.6
144+00	CMP	48"	-2.6	-2.6
153+50	DITCH 14 INTERSECTS		-1.0	
179+20	CMP	84" X 345'	-2.3	-2.3
223+00	CMP	84" X 120'	-1.5	-1.4
223+00	BEGIN DITCH 5			

DATUM = NAVD "88"

DITCH 10 PROFILE FROM CUTOFF SLOUGH TO DITCH 5

PAGE 1 OF 2



SCALE: 1" = 1000' HORIZ.
1" = 10' VERT.
DATUM: NAVD "88"

NOTE:
STATIONING AND ELEVATIONS ARE APPROXIMATE AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES WITHOUT FIELD VERIFICATION

LEGEND

- CMP CORRUGATED METAL PIPE
- RCP REINFORCED CONCRETE PIPE
- ARCH ARCH PIPE
- OPEN DITCH
- CULVERT
- CULVERT - DRAIN ENTERING DITCH

CDID #1
DITCH 10 PROFILE
SCALE: AS SHOWN
DATUM: NAVD 88
FILE: 1010 PROFILE 1
DRAWN: BC 9/2007

DITCH 10 PROFILE FROM CUTOFF SLOUGH TO DITCH 5 PAGE 2 OF 2



SCALE: 1" = 1000' HORIZ.
1" = 10' VERT.
DATUM: NAVD "88"

LEGEND

- CMP CORRUGATED METAL PIPE
- RCP REINFORCED CONCRETE PIPE
- ARCH..... ARCH PIPE
- OPEN DITCH
- ▭..... CULVERT
- CULVERT - DRAIN ENTERING DITCH

NOTE:
STATIONING AND ELEVATIONS ARE APPROXIMATE AND SHOULD
NOT BE USED FOR DESIGN OR CONSTRUCTION
PURPOSES WITHOUT FIELD VERIFICATION

CDID #1
DITCH 10 PROFILE
SCALE: AS SHOWN
DATUM: NAVD 88
FILE: 1010 PROFILE 2
DRAWN: BC 9/2007

DRAINAGE INVENTORY

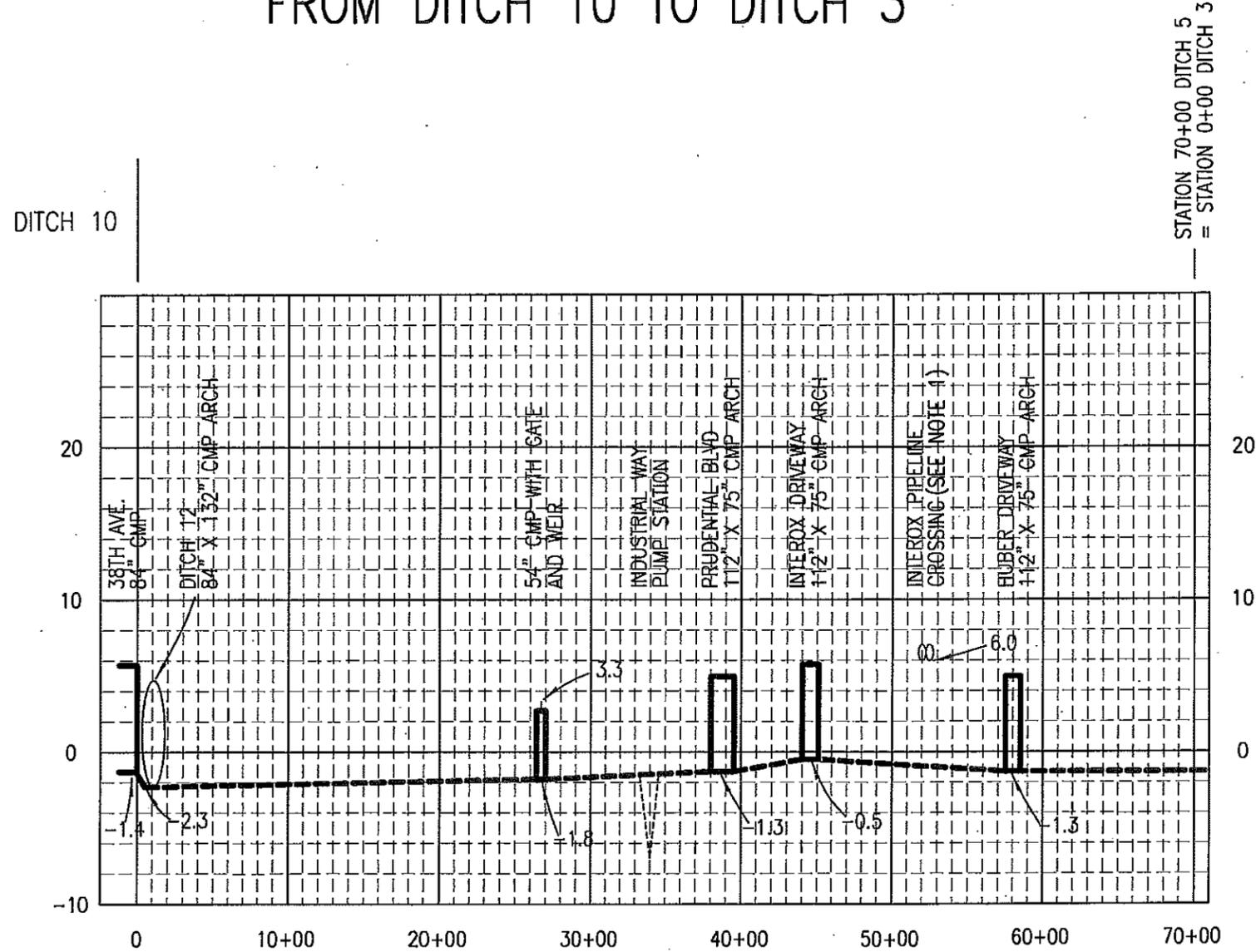
DITCH 5 FROM DITCH 10 TO DITCH 3

06/04/01

STATION	TYPE	SIZE	INV. ELEVATION	
			DOWNSTREAM	UPSTREAM
DITCH 5				
0+00	DITCH 10 BEGINS			
0+40	DITCH 12 INTERSECTION			
21+50	CMP W/GATE	54" X 60'	-4.3	-4.3
21+70	WEIR		TOP OF WEIR 3.3	
34+00	INDUSTRIAL WAY PUMP STATION			
38+00	CMP	112" X 75" X 153'	-1.3	-1.3
44+00	CMP	112" X 75" X 108'	-0.5	-0.5
52+50	INTEROX PIPELINE CROSSING		6.0	
57+50	CMP	112" X 75" X 110'	-1.3	-1.3
70+00 = 0+00 DITCH 3				

DATUM = NAVD "88"

DITCH 5 PROFILE FROM DITCH 10 TO DITCH 3



SCALE: 1" = 1000' HORIZ.
 1" = 10' VERT.
 DATUM: NAVD "88"

NOTES:

- 1) MULTIPLE PIPES CROSSING. DITCH IS RESTRICTED BY SHEET PILING TO 12' WIDE
- 2) STATIONING AND ELEVATIONS ARE APPROXIMATE AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES WITHOUT FIELD VERIFICATION

LEGEND

- CMP CORRUGATED METAL PIPE
- RCP REINFORCED CONCRETE PIPE
- ARCH ARCH PIPE
- OPEN DITCH
- CULVERT
- O CULVERT - DRAIN ENTERING DITCH

CDID #1
 DITCH 5 PROFILE
 SCALE: AS SHOWN
 DATUM: NAVD "88"
 FILE: 1005 PROFILE
 DRAWN: BC 9/2007

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