



ECHELON ENGINEERING, INC.

Civil/Marine Consulting Engineers

Underwater Inspection Hylebos Bridge No. 27 Hylebos Structure ID 0002376A Tacoma, WA

Date of Inspection: October 5, 2022



Prepared For:

Fickett Structural Solutions
2840 Crites St. SW, Suite 104
Tumwater, WA 98512

ATTN: Mr. Michael Beglin, PE
Project Engineer
Tel: [REDACTED]

Prepared By:

Echelon Engineering, Inc.
21027 61st Avenue West
Lynnwood, WA 98036

ATTN: Ms. Shelley Sommerfeld, PE
President

Tel: [REDACTED]

November 29, 2022

Fickett Structural Solutions
2840 Crites St. SW, Suite 104
Tumwater, Washington 98512

ATTN: Mr. Michael Beglin, PE
Project Engineer

**RE: Underwater Inspection Hylebos Bridge, No. 27 Hylebos
Tacoma, Washington**

Dear Mr. Beglin:

This report is submitted to document the findings of our recent underwater inspection of the Hylebos Bridge in Tacoma, Washington. The structure is a double leaf trunnion bascule bridge which crosses the Hylebos Waterway. Both of the Bascule Piers, (i.e. Pier 4 and 5), as well as the Approach Piers 2, 3 and 6 were located in the waterway at the time of the inspection. The project was conducted by Echelon Engineering on October 5, 2022.

1. EXECUTIVE SUMMARY

Based on the observed conditions, the inspected substructure components are sound below water and are in satisfactory / good condition. Although minor spalling on both bascule piers and several localized areas of shallow unconsolidated concrete on Pier 4 were noted, no evidence of any significant damage or deterioration was found associated with the underwater portions of the Bascules or with the Approach Piers 2, 3 and 6. Inspection did find that the top of the footing and seal on the channel side of both Piers 4 and 5 have become exposed since the 2017 inspection. The maximum vertical exposure of the seals was measured at 12 inches.

Investigation of the timber fender systems protecting Pier 4 and 5 found them to be in overall fair to good condition and noted evidence of minor to major damage to the piling as a result of marine borers in the intertidal and submerged zones. Observations on the above water portions of the timber fender systems noted localized areas of significant fungal damage to the piles and framing timbers. However, the horizontal timber lagging has been replaced and is in generally good condition.

No general or localized scour patterns were identified around the approach piers. However, degradation of the channel is evident and ranges from 0 to ~2,5 feet along the channel side of Piers 4 and 5 resulting in exposure of the footing and the top of the seal on both Piers 4 and 5. No other significant aggradation or degradation of the channel bottom was found.

When compared to the findings reported in the previous 2017 underwater inspection, no significant change in the condition of the submerged concrete or steel components is evident. However, degradation of the channel bottom between the two bascule piers was noted. The recommended inspection frequency for the submerged portions of the bridge is 60 months.

2. INSPECTION FINDINGS

The Hylebos Bridge is located on East 11th Street in Tacoma, WA. The bridge is a Double Leaf Trunnion Bascule bridge consisting of concrete Approach Piers 2 and 3 on the southwest, the Western Bascule Pier 4, the Eastern Bascule Pier 5 and Approach Pier 6 on the northeast. Refer to the attached drawings. A protective timber fender system is located along the channel side of each bascule pier. Stationing for the structure and numbering of the piers has been designated from west to east, consistent with design drawings and previous inspection reports. The two Bascule Piers 4 and 5 and the Approach Piers 2, 3 and 6 were located within the channel during the inspection. The previous underwater inspection report dated October 20, 2017 was available at the time of this inspection.

Inspection of the Bascule Piers, 4 and 5, found the submerged concrete surfaces to be in generally satisfactory condition. All submerged surfaces are covered with a moderate to heavy growth of marine fouling. Although minor spalling on both bascule piers and several localized areas of shallow unconsolidated concrete on Pier 4 were noted, no evidence of any significant damage or deterioration was found. With the exceptions noted above, inspection of the concrete on both bascules found it to be sound with good rebound when struck with a hammer. Specific areas of defects are noted in the table below:

TABLE 1 - OBSERVED DEFECTS

Defect Location	Observed Condition / Details
Pier 4; NE Corner El. -21.5' / MDL	Minor Spall (8"h x 12" w x 4.5" dp)
Pier 4; NW Corner El. +2.5'	Minor Spall (2'h x 8"w x 2"dp)
Pier 4; SW Corner El. +0' / -8'	Imminent Corner Spall
Pier 5; N Face El. -20.0'	Minor Spall (4'h x 10"w x 1"dp)
Pier 5; NW Corner El. -8.0'	Imminent Corner Spall
Pier 5; SE Corner El. -8.0'	Corner Spall (4"h x 6"w x 2'dp)
Pier 5; SE Corner El. -20.0'	Deteriorated Cold Joint (4"h x 1.5"w x 2"dp)



Inspection of the Approach Piers, 2, 3 and 6, found them to be in overall good condition. The steel shafts on the three piers were noted to have general surface corrosion and minor pitting. The steel shaft on Pier 2 is mostly buried with only the top visible. Investigation of the concrete columns on all three piers found them to also be in good condition with no evidence of any cracking, spalling, rust bleeding or other significant defects.

Level I Investigation of the timber fender systems which protect the bascule piers found them to be in overall fair to good condition. Both the eastern and western fender systems are constructed with a combination of older creosote treated members and newer Chemonite treated members. Inspection of the piling noted localized areas of minor to heavy marine borer damage identified in the intertidal and submerged zones of several piling, as well as heavy fungal decay noted above water in a number of piling. The majority of the significant damage, both above and below water was found in the piling located within the timber dolphins. It was also noted that several of the older creosote piling are salvaged piles, as barnacle basal plates are visible on the piles above high water. Investigation of the horizontal lagging timbers found the majority have been replaced with newer Chemonite treated member which are in good condition. Inspection of the wire rope connections noted them to be in generally fair to good condition with minor to moderate corrosion.

All elevations have been referenced to Chart Datum (MLLW). The fathometric data obtained has been shown on the enclosed drawings.

The channel bottom in the vicinity of the bridge consists of silty-sand and mud with localized areas of small rock. Probing of the channel bottom in the vicinity of the Bascules and the Approach Piers using a #3 rebar allowed from 6" to greater than 30" of penetration. Inspection of the Pier 4 and 5 foundations did note exposure of the top of the footing and the top of the seal along the channel sides. Measurement found a maximum vertical height of 12 inches as measured along the seal. Based on the findings of this inspection no evidence of any scour patterns, or evidence of significant scour was noted in the vicinity of the approach piers. However, degradation of the mudline along the channel between Pier 4 and Pier 5 (i.e. the bascule piers) is evident and ranges from 0 to ~2.5 feet.

COMPARISON STUDY

Comparison of the current findings with those of the previous underwater inspection conducted by Echelon Engineering in November 2017 found that there has been little if any change in the condition of the submerged bridge components. Although minor spalling on both bascule piers and several localized areas of shallow unconsolidated concrete on Pier 4 were noted, no evidence of any significant damage or deterioration was found associated with the underwater portions of the Bascules or with the Approach Piers 2, 3 and 6. Inspection did find additional exposure of the top of the footing and seal on both Pier 4 and 5. This exposure is confined to the channel side of the bascule piers. Measurements of the vertical exposure


found the maximum height of the exposed seal to be 12 inches. When compared to the findings of the previous inspection there has been additional degradation of the mudline and further exposure of the footing and seal on these piers.

Comparison of the condition of the timber fender systems found apparent localized repairs. Additionally, there appears to have been a slight increase in the amount of localized fungal decay in the above water portion of the systems, but that the underwater condition remains similar with several piles noted to have sustained localized heavy marine borer damage. The majority of these heavily damaged piling were found within the dolphin clusters.

Comparison of the channel bottom elevations obtained during this investigation with those of the previous 2017 inspection indicate that overall, there has been minor shifting of the mudline around the piers. Additionally, there has been degradation of the mudline along the channel side of both Pier 4 and Pier 5 ranging from 0 to ~2.5 feet. This degradation did result in additional exposure of the footings and seals along the channel side of both Pier 4 and Pier 5. No undermining or exposure of the foundation piles was found on either of the bascule piers.

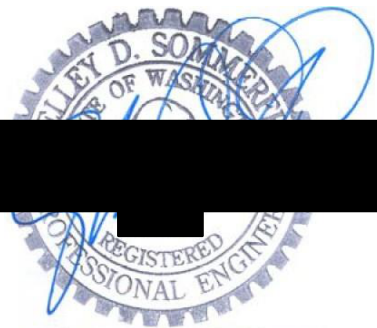
It has been a pleasure to have worked with you on this project. Should you have any questions concerning this report, or if we can assist you further, please do not hesitate to contact our office.

Sincerely,
Echelon Engineering, Inc.



Shelley D. Sommerfeld, P.E.
President

SDS:jds
Enclosures



EXPIRES: 6 / 6 / 2023



**Echelon
Engineering**

Underwater Inspection Report

Bridge Number 27 Hylebos	Route East 11 th Street	Agency/Owner City of Tacoma	Date October 5, 2022
Bridge Name Hylebos Bridge			Intersecting Hylebos Waterway
Inspector Shelley Sommerfeld, P.E.		Identification No. WA Br. Insp. No. G9912	Hours on Site 12.5
Dive Contractor Echelon Engineering, Inc.			
Diver Name Shelley Sommerfeld		Diver Name Brady Rohrig / George Tzortzis	
Structure Type Double Leaf Trunnion Bascule Bridge		Substructure Type Conc. Bascule Pier & Conc. Columns w/ Steel Shafts	
Foundation Type Conc. Spread Footing & Drilled Conc. Column/Shaft		Number of Spans 7	Number of Piers in Water 5

<input checked="" type="checkbox"/> Interior Bents (1)	1	Pier 4 & Pier 5 Bascules -
Abut/Pier Wall (2)	2	- Inspection found the submerged portions of the bascule piers to be in overall
Web Wall (3)	9	satisfactory/good condition with no significant damage/deterioration noted.
Columns (4)		- Several areas of minor spalling were noted on both Pier 4 and Pier 5, as well as
Shaft (5)		small areas of poorly consolidated concrete noted on Pier 4 in the intertidal and
Piles (6)		submerged zones. At this time these defects are not structurally significant.
Bracing (7)		- No other evidence of significant cracking, spalling or scale was encountered.
Foundation (8)		- The top of footing and seal are exposed on Bascule Piers 4 & 5 along the
Footing (9)		channel side. The max. vertical exposure of the seal on both piers is 12 inches.
Seal (10)		- No undermining of the either seal was found & no significant debris was noted.
Piles (11)		
<input checked="" type="checkbox"/> Scour (12)	1	Pier 2, 3 & 6 Concrete Columns w/ Drilled Steel Shafts -
Scour Mitigat. (13)	4	- Inspection of the pier columns found them to be in overall good condition with
<input checked="" type="checkbox"/> Channel (14)	5	no evidence of any significant cracking, spalling or rust bleeding of the concrete.
Streambed(15)		- Additionally, inspection of the steel shafts on the piers found them to also be
Drift(16)		in overall good condition with general surface corrosion and no visible thinning.
Flow (17)		
		Timber Fender Systems For Pier 4 & Pier 5 Bascules -
		- Inspection of the timber fender systems found them to be in generally fair/good condition with evidence
		of marine borer damage and fungal decay. The systems were noted to be a combination of older
		treated and newer Chemonite treated piling. Inspection of the wire rope connections noted them to be
		in fair to good condition with minor to moderate corrosion. The horizontal lagging has been replaced.
14		- Both channel banks are stable with the shoreline consisting of industrialized waterfront facilities.
15		- The channel bottom in the vicinity of the piers was found to consist of soft silt and mud. Probing of the
		bottom with a #3 rebar allowed from 6 to > 30 inches of penetration.
16		- No accumulation of drift material was found around any of the piers or within the fender systems.
17		- No perceptible flow was encountered.

Daily Site Dive Log

Inspector Shelley Sommerfeld, P.E. (WA Bridge Inspector No. G9912)		Date October 5, 2022
Bridge Number 27 Hylebos	Bridge Name Hylebos Bridge	
Bridge Type Double Leaf Trunnion Bascule Bridge		Waterway Name Hylebos Waterway
Dive Objective Inspect submerged bridge members and obtain hydrographic data.		

Dive Operation	
Type of Operation	<input checked="" type="checkbox"/> SCUBA <input type="checkbox"/> Snorkel <input type="checkbox"/> Other _____
Equipment	Suit <u>Dry Suit</u>
	Air Supply <u>Aluminum 80 / Air</u>
	Site Access <u>Dive Boat</u>
	Inspection Tools <u>Nikonos camera, probing rod, hammer, scraper, U/W light, misc. inspection tools</u>
	Repair Tools <u>Not Applicable</u>
	Repair Materials <u>Not Applicable</u>

Conditions	
Water	<input checked="" type="checkbox"/> Salt <input type="checkbox"/> Fresh <input type="checkbox"/> Brackish Temperature <u>54</u> °F Visibility <u>3-5 ft.</u>
Surface	<input type="checkbox"/> Calm <input checked="" type="checkbox"/> Choppy <input type="checkbox"/> Rough
Surf	<input type="checkbox"/> Small <input type="checkbox"/> Medium <input type="checkbox"/> Large <input checked="" type="checkbox"/> Not Applicable
Tide	<input type="checkbox"/> High <input checked="" type="checkbox"/> Low <input checked="" type="checkbox"/> Flood <input type="checkbox"/> Ebb <input type="checkbox"/> Not Applicable
Current	<input type="checkbox"/> Fast <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Slow Velocity <u><0.5 ft./sec</u>
Weather	<input type="checkbox"/> Sunny <input checked="" type="checkbox"/> Cloudy <input type="checkbox"/> Overcast Air Temperature <u>59</u> °F
Thermocline	Temperature <u>N/A</u> °F Depth <u>N/A</u>

Dive Checks	
<input checked="" type="checkbox"/> First Aid Equipment on Site	<input checked="" type="checkbox"/> Physical Condition of Diver(s) Checked
<input checked="" type="checkbox"/> Communications For EMS	<input checked="" type="checkbox"/> Communications for Diver(s) Checked
<input checked="" type="checkbox"/> Dive Gear Inspected	<input checked="" type="checkbox"/> Team Briefed and Understand Dive Plan
<input checked="" type="checkbox"/> Air Source Checked	<input checked="" type="checkbox"/> Special Site Hazards Noted
<input type="checkbox"/> _____	
<input type="checkbox"/> _____	

Dive Plan and Dive Team Procedures
General – Verify drawings and investigate submerged elements.
1. All inspection activities conducted from the dive boat.
2. Hold pre-dive safety meeting to discuss planned dive, roles, responsibilities, review emergency procedures and condition of divers. Set-up dive equipment and conduct function and safety checks.
3. Conduct Level I visual/tactile and Level II cleaning/detailed inspection of Pier 6, Pier 5 (& fender system), Pier 4 (& fender system), Pier 3 and Pier 2.
4. Take underwater photos. Once photos complete, conduct probing of the mudline and obtain hydrographic information.

Dive Schedule					
Dive No.	Entry Time	Exit Time	Total Time in Water	Maximum Depth	Remarks
1	9:25 AM	10:05 AM	40 min.	28 fsw	GYT
2	10:25 AM	11:10 PM	45 min.	28 fsw	GYT
3	11:35 AM	12:05 PM	30 min.	32 fsw	GYT
4	12:20 PM	1:10 PM	50 min.	33 fsw	BAR
5	1:25 PM	2:15 PM	50 min.	28 fsw	BAR
6	2:25 PM	3:10 PM	45 min.	30 fsw	BAR

Dive Narrative

Investigation of the bridge was accessed using the dive support boat. Diving was conducted around the Approach Piers, the Bascule Piers and the timber Fender Systems to inspect the members, confirm mudline conditions and obtain probing information. Data during the dive was relayed to the support personnel using underwater wireless communications and voice communications.

Investigation of the drilled shafts and concrete columns supporting the Approach Piers 2, 3 and 6 found them to be in overall good condition with no evidence of any significant defects. Investigation of the Pier 4 and 5 Bascule Piers noted the concrete to be in generally fair to good condition with no significant defects. Minor areas of spalling on Piers 4 and 5 and of small areas of poorly consolidated concrete on Pier 4 were noted in the intertidal and submerged zones. No other significant defects were noted.

Inspection of the timber fender systems found them to be in generally fair to good condition with evidence of marine borer damage in the intertidal and submerged zones and fungal decay above water.

No locations of debris were noted around the piers or within the timber fender systems.

Investigation of the mudline in the area around the inspected structures found the bottom to consist primarily of soft silty sand and mud. Penetration of the bottom with a #3 rebar allowed from 6 to >30 inches of penetration in areas of mud and sand. Inspection found the top of the footing and seal on both Piers 4 and 5 to be exposed along the channel side with the maximum measured vertical height to be 12 inches. No undermining of either seal was found.

Dive Team Members

Shelley Sommerfeld, PE
(Print Name)

Team Leader / Notes
(Role)

Brady Rohrig
(Print Name)

Dive Inspector / Tender
(Role)

George Tzortzis
(Print Name)

Dive Inspector / Tender
(Role)

(Print Name)

(Role)

(Print Name)

(Role)



PHOTO No. 1 : Hylebos Bridge, Looking Southwest - The bridge is a double leaf trunnion bascule bridge with an approach located on the west and the east side of the span. Stationing for the structure and numbering of the substructure piers has been designated from west to east.



PHOTO No. 2 : Hylebos Bridge, Looking East - Note the approach pier, Pier 3 is supported by two concrete columns. Also note the older concrete bascule pier, Pier 4 and the protective timber fender system along the channel side of the pier.





PHOTO No. 3 : Pier 2, Looking Southwest
- Note the overall good condition of the concrete columns, beam and prestressed girders. Inspection of the columns found them to also be in overall good condition below water.



PHOTO No. 4 :
Pier 3 and Pier 4,
Looking Southeast -
Note Pier 3 supported
by two concrete
columns and Pier 4,
the Bascule pier, both
located on the west
side of the channel.
Also note the
protective timber
fender system along
the channel side of
Pier 4.





PHOTO No. 5 : Pier 5 and Pier 6, Looking Southeast - Note Pier 6 supported by two concrete columns and Pier 5, the Bascule pier, both located on the eastern side of the channel. Also note the protective timber fender system along the channel side of Pier 5.



PHOTO No. 6 : Pier 2, North Column - Note the moderate amount of marine fouling located on the concrete column. Inspection found the concrete to be in overall good condition, as well as noting fabric wrapped around the column at the mudline.





PHOTO No. 7 : Pier 3, North Column - Note the transition between the lower steel shaft and the upper concrete column. Inspection found the column to be in good condition with no significant damage noted to the concrete and minor surface corrosion of the lower steel shaft.



PHOTO No. 8 : Pier 4, Channel Side - Inspection of the bascule along the channel side found exposure of the footing and a portion of the seal pour. Note the overall fair condition of the top of the exposed concrete footing.





PHOTO No. 9 : Pier 4, Channel Side - Inspection found the top of the seal pour to be exposed along the channel side of the pier. Note the generally good condition of the seal and the silty-sand and shell which comprises the mudline at this location.



PHOTO No. 10 : Pier 5, Channel Side - Inspection found the top of the seal pour to be exposed along the channel side of this pier also. Note the generally good condition of the seal and the silty-sand which comprises the mudline at this location.





PHOTO No. 11 : Pier 4, Looking South - Note the protective timber fender system located along the channel side of the bascule pier. Although areas of fungal decay and marine borer damage were found, the overall condition of the system was found to be fair to good.



PHOTO No. 12 : Pier 5, Looking East - Note the overall fair to good condition of the protective timber fender system located on the channel side of the bascule pier. Inspection noted areas of fungal decay, as well as marine borer damage to the members.





PHOTO No. 13 : Pier 5 Fender System, North End - Note the vegetation located in the tops of the dolphin piles. Also note the fair condition of the wire rope cable connections and the newer Chemonite Treated horizontal lagging.



PHOTO No.14: Pier 5, Fender System - Note the overall good condition of the horizontal timber lagging with newer Chemonite treated members located in the intertidal zone.





PHOTO No. 15: Hylebos Bridge Edge, Looking Southeast.



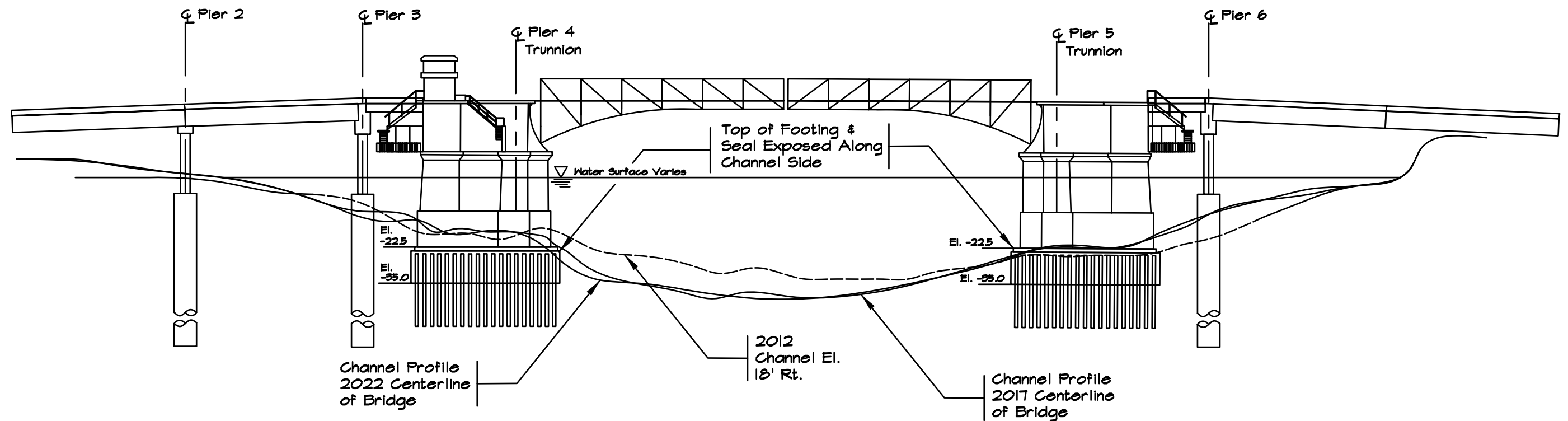
PHOTO No. 16 : Hylebos Bridge Edge, Looking Northwest.



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11/24/2022 9:56 AM

SDS/JDS, Echelon Engineering, Inc.



ELEVATION

(Looking North)

NOTES:

1. Reference elevation: Water Surface Varies
Datum = Chart Datum (MLLW). Soundings in feet.
2. Reference previous underwater inspection report by Echelon Engineering dated October 20, 2017.

FICKETT Structural Solutions
 Hylebos Bridge
 Br. No. 27 Hylebose; UW Inspection

ELEVATION

DATE: Nov. 2022

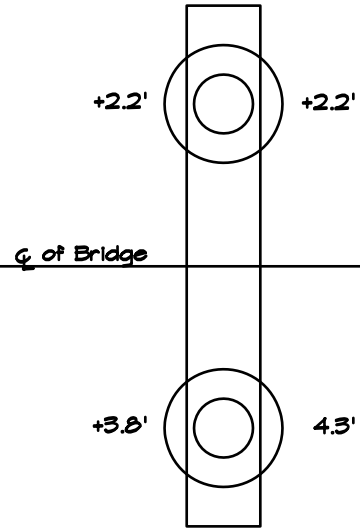
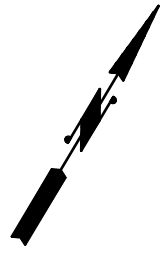
PROJECT: 22-2624

SHEET: 1 of 3

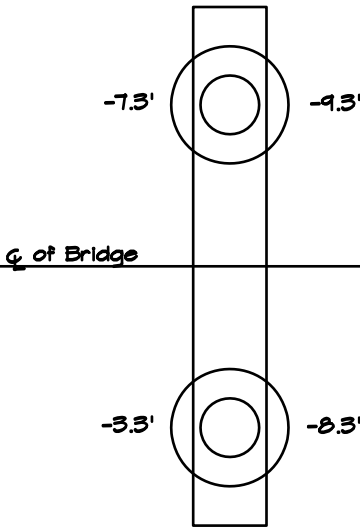
DRAWN: SDS / JDS

E ECHELON ENGINEERING, INC.
 CIVIL/Marine Consulting Engineers
 Lynnwood, Washington
 Tel: (425) 672-6424

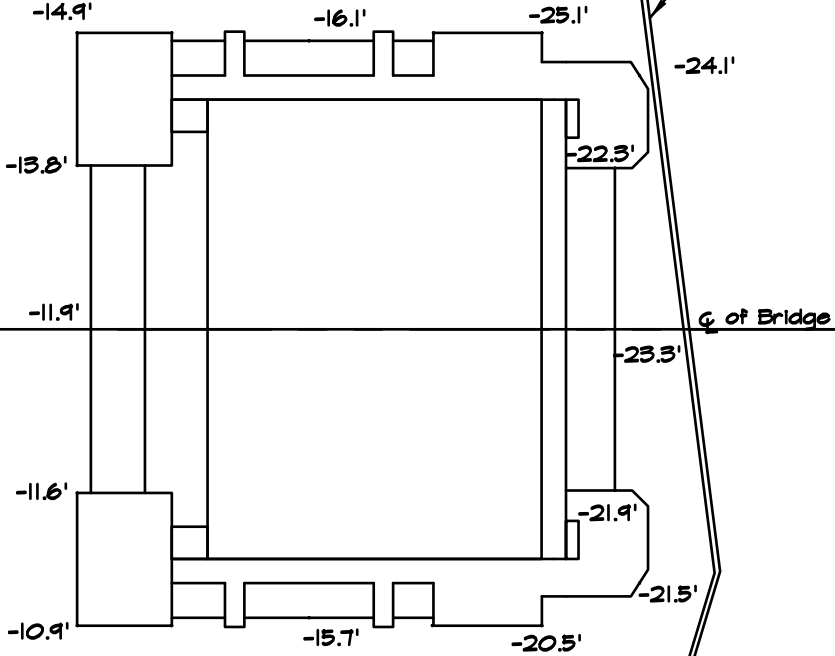
DATE	REVISION



Pier 2



Pier 3



Pier 4

Protective Timber Fender System (Typ)

NOTES:

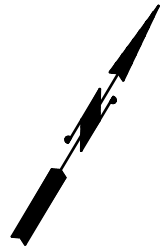
1. Reference elevation: Water Surface Varies
Datum = Chart Datum (MLLW). Soundings in feet.
2. Reference previous underwater inspection report by
Echelon Engineering dated October 20, 2017.

LEGEND:

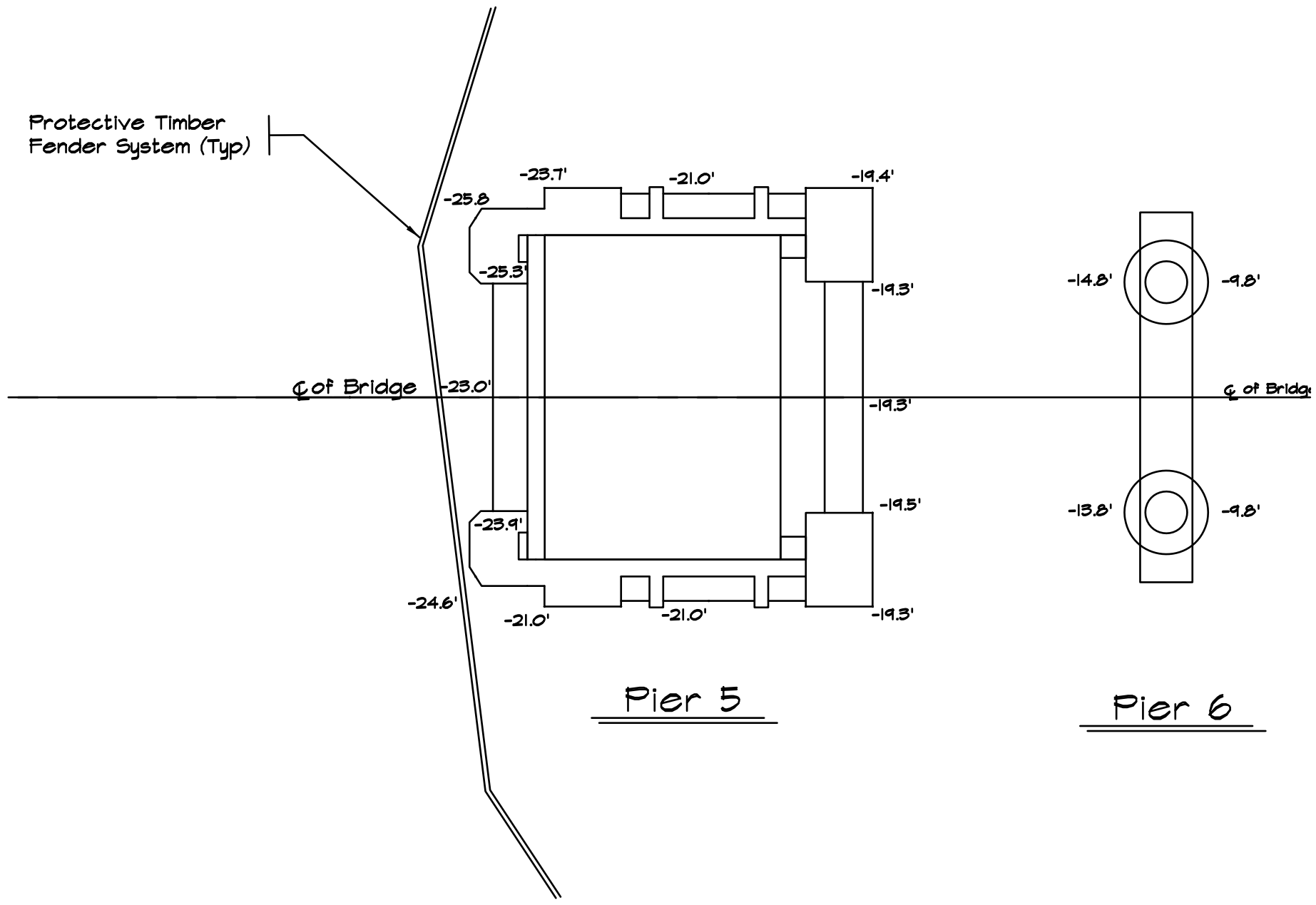
X.X' Mudline Elevation ft. (MLLW)

FICKETT Structural Solutions	
Hylebos Bridge	
Br. No. 27 Hylebose; UW Inspection	
PLAN: Piers 2, 3, and 4	
DATE:	Nov. 2022
PROJECT:	22-2624
SHEET:	2 of 5
DRAWN:	SDS / JDS
	E ECHELON ENGINEERING, INC. CIVIL/Marine Consulting Engineers
	Lynnwood, Washington Tel: (425) 672-8424

SDS/JDS, Echelon Engineering, Inc. 11/29/2022 9:56 AM 2526-dht 2.dwg



Protective Timber Fender System (Typ)




NOTES:

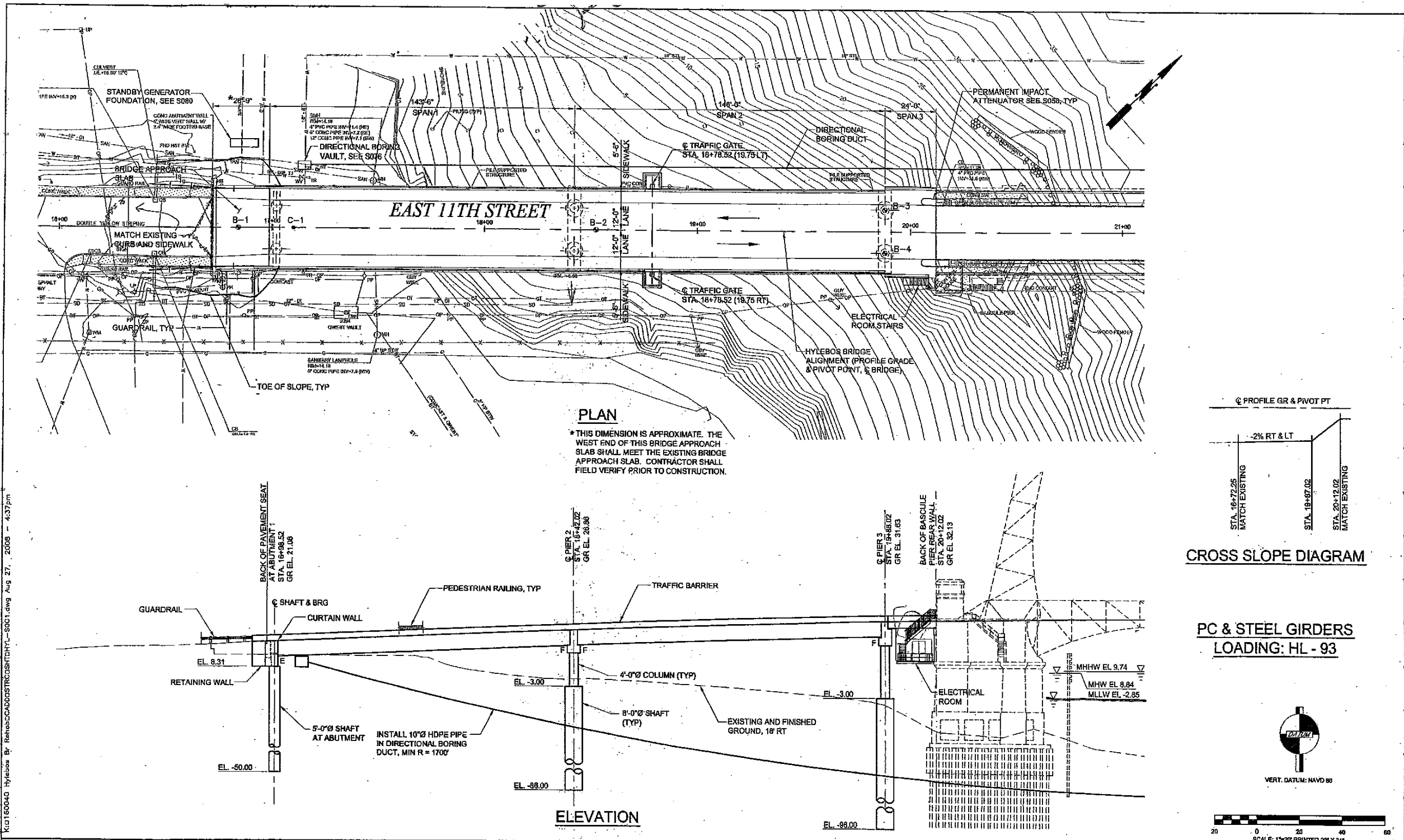
1. Reference elevation: Water Surface Varies
Datum = Chart Datum (MLLW). Soundings in feet.
2. Reference previous underwater inspection report by
Echelon Engineering dated October 20, 2017.

LEGEND:

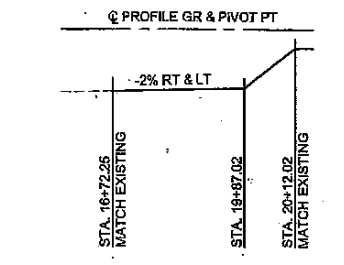
X.X' Mudline Elevation ft. (MLLW)

FICKETT Structural Solutions	
Hylebos Bridge	
Br. No. 27 Hylebose; UW Inspection	
PLAN; Piers 5 and 6	
DATE: Nov. 2022	 E ECHELON ENGINEERING, INC. CIVIL/Marine Consulting Engineers Lynnwood, Washington Tel: (425) 672-8424
PROJECT: 22-2624	
SHEET: 5 of 5	
DRAWN: SDS / JDS	

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PLAN
 *THIS DIMENSION IS APPROXIMATE. THE WEST END OF THIS BRIDGE APPROACH SLAB SHALL MEET THE EXISTING BRIDGE APPROACH SLAB. CONTRACTOR SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.



CROSS SLOPE DIAGRAM

**PC & STEEL GIRDERS
 LOADING: HL - 93**



VERT. DATUM: NAVD 83

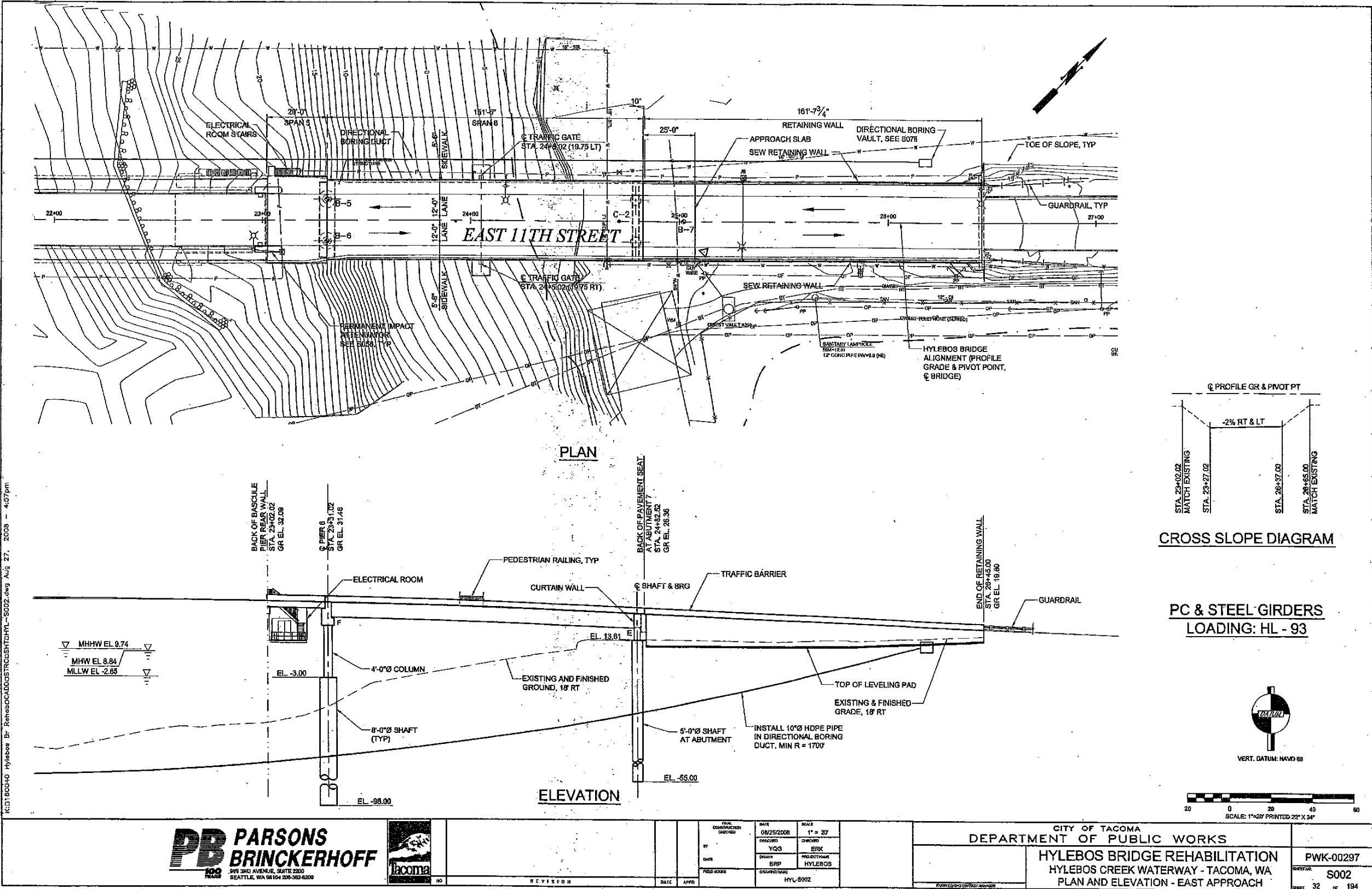
K:\160040 Hylebos Br Rehab\DCADD\STRUC\STRUC\H11-8001.dwg Aug 27, 2008 - 4:37pm



DATE	08/25/2008	SCALE	1" = 20'
DESIGNED BY	YOG	CHECKED BY	ERK
DRAWN BY	BRP	PROJECT/LOCATION	HYLEBOS
DATE		DATE	
APPD		APPD	

CITY OF TACOMA
 DEPARTMENT OF PUBLIC WORKS
HYLEBOS BRIDGE REHABILITATION
 HYLEBOS CREEK WATERWAY - TACOMA, WA
 PLAN AND ELEVATION - WEST APPROACH

PWK-00297
 SHEET NO. S001
 OF 31



K:\D18040 Hylebos Br Rehab\CADD\STRUCT\CHYL-S002.dwg Aug 27, 2008 - 4:57pm

PB PARSONS BRINCKERHOFF
 100 YEARS 399 3RD AVENUE, SUITE 2200 SEATTLE, WA 98104 206-392-6200



DATE	08/25/2008	SCALE	1" = 20'
BY	YQG	CHKD	ERK
DATE	BRP	PROJECT	HYLBOS
PROJECT	HYL-S002		

CITY OF TACOMA
 DEPARTMENT OF PUBLIC WORKS
HYLBOS BRIDGE REHABILITATION
 HYLBOS CREEK WATERWAY - TACOMA, WA
 PLAN AND ELEVATION - EAST APPROACH

PWK-00297
 SHEET S002
 32 OF 194