

Appendix E

Civil Engineering

**Puyallup River Basin
Flood Risk Management Feasibility Study**



Department of the Army
Seattle District, US Army Corps of Engineers

March 2016

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1.0 Survey and Mapping

LiDAR data was supplied by the Puget Sound LiDAR Consortium (PSLC) website from Pierce County flight dates 12/03/2010 - 12/10/2010. The accuracy of the data is adequate to develop 1-foot contours.

2.0 Earthwork Quantity Calculation Methodology

A digital terrain model (.dtm) of the existing topography was created using the above LiDAR data using Microstation InRoads software. The proposed levees were then modeled by creating a separate digital terrain model of them. Earthwork quantities could then be generated by InRoads and were calculated by determining the delta between the two surfaces. The raw inroads reports have been omitted from this appendix to reduce the file size. Those reports are available by request.

Note: Only earthwork and utility impact quantities are shown in this appendix. The footprint maps do indicate areas of proposed floodwalls. The quantity calculations for the flood walls are located in the Structural Appendix.

3.0 Order of Quantity Summary, Footprint, and Design Section by Reach

3.1 Lower Puyallup Right Bank

3.2 Lower Puyallup Left Bank and River Road Extension

3.3 Lower White

3.4 Pacific Park / Butte Avenue

3.5 SR410

3.6 Jones

4.0 Utility Impact Discussion.

A cursory review of existing records of the existing utilities within the project footprint commensurate with a Utility quality level D as defined in the Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (38-02) 2002 American Society of Civil Engineers).

The assumed utility impacts are summarized in this appendix. There is a high risk of omissions in the included summary which results in a large cost contingency. In order to reduce the risk and subsequent contingency, a utility survey commensurate with ASCE 38-02 quality level B will be conducted prior to beginning the feasibility level design.

DRAFT

Puyallup River General Investigation

TSP Quantities - Lower Puyallup Right Bank

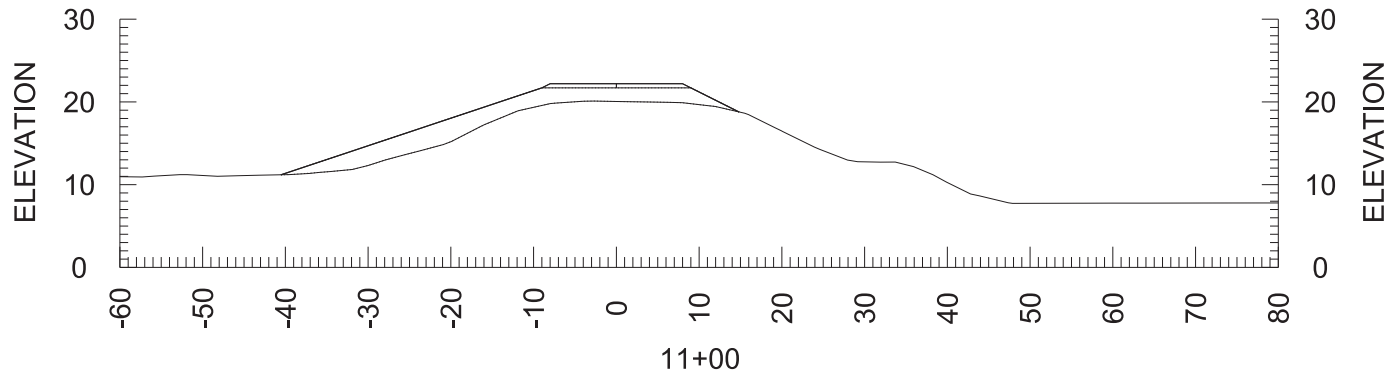
Material

	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut	33	38
Fill	5,305	6,101
<i>Rock</i>	<u>Quantity (CY)</u>	
Wearing	1,275	

Material Notes

1. Levee Fill: Silty sand (SM) preferrably with 10-20% passing the #200 sieve.

Puyallup Right Bank Levee Improvement
InRoads Generated Section



Puyallup River General Investigation

TSP Quantities - North Levee Road Set-Back

Material

	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut (stripping, spalls and buried toe excavation)	244,398	281,058
Cut (existing levee removal)	349,686	402,139
Fill	558,189	641,917
FILL IMPORT REQUIRED	262,265	301,604
		340,313

Rock

	<u>Quantity (CY)</u>
Riprap (buried toe + slope protection)	32,383
Base Course	21,437
Top Course	4,868
Asphalt	6,443
Wearing (Right Bank tie-in)	6,692

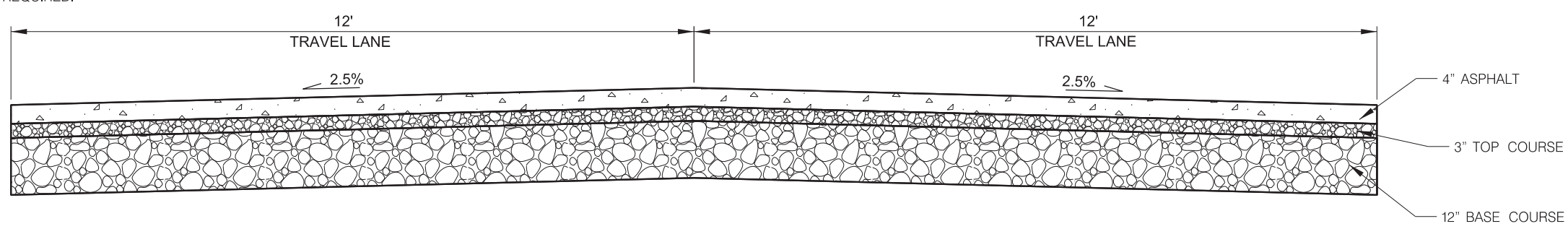
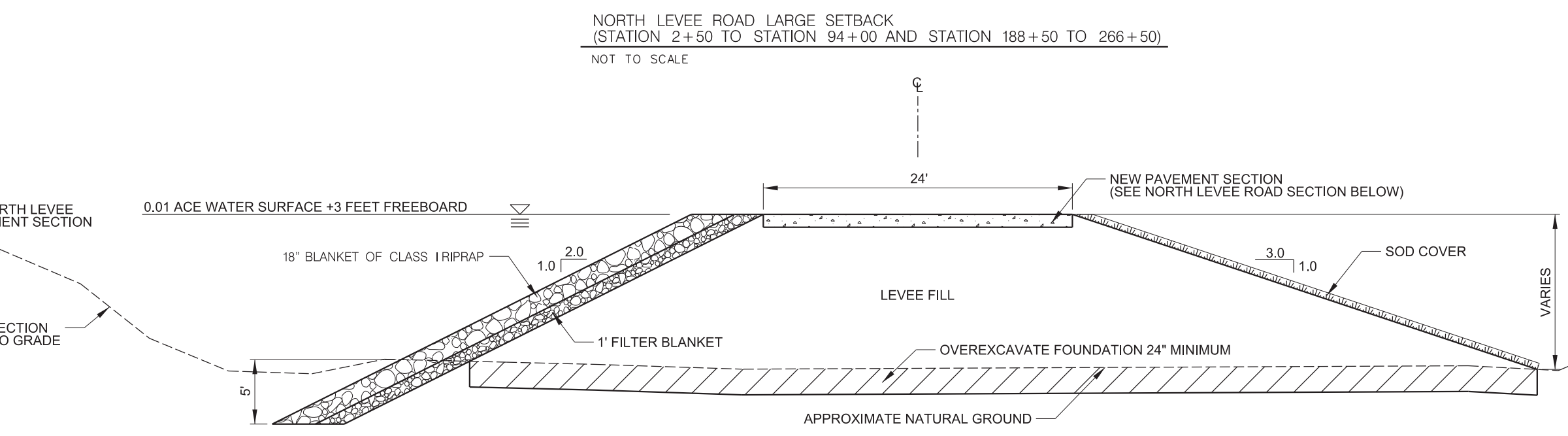
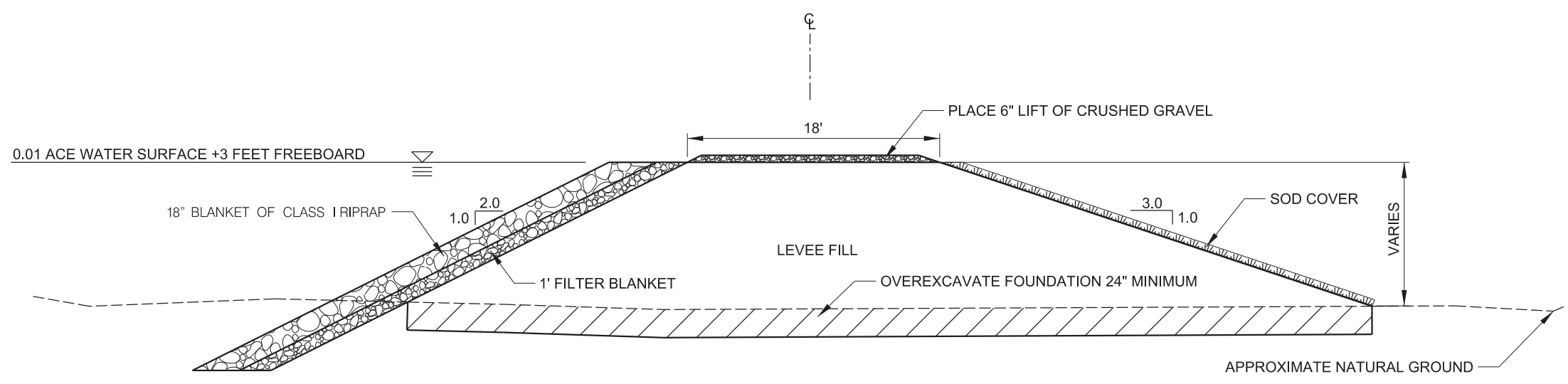
Material Notes

1. Levee Fill: Silty sand (SM) preferrably with 10-20% passing the #200 sieve.
2. Filter: 2" – 4" rock
3. See typical section for rip rap size.
4. Wearing: 1.25" CSBC or similar
5. Per Geotech assume able to reuse 75% of existing levee fill

Description	Date	Appr.	Symbol

Designed by:	M. GONIA	Date:	05 JAN 2016
Drawn by:	M. GONIA	File #:	
Checked by:	K. OHSIEK	Rev.:	
Prepared by:	CENWS-EN-GB-SS/GONIA		

PUYALLUP GENERAL INVESTIGATION
CONCEPTUAL LEVEE DESIGNS
NORTH LEVEE ROAD
TYPICAL SECTION
PIERCE COUNTY
WA



CONSTRUCTION NOTES

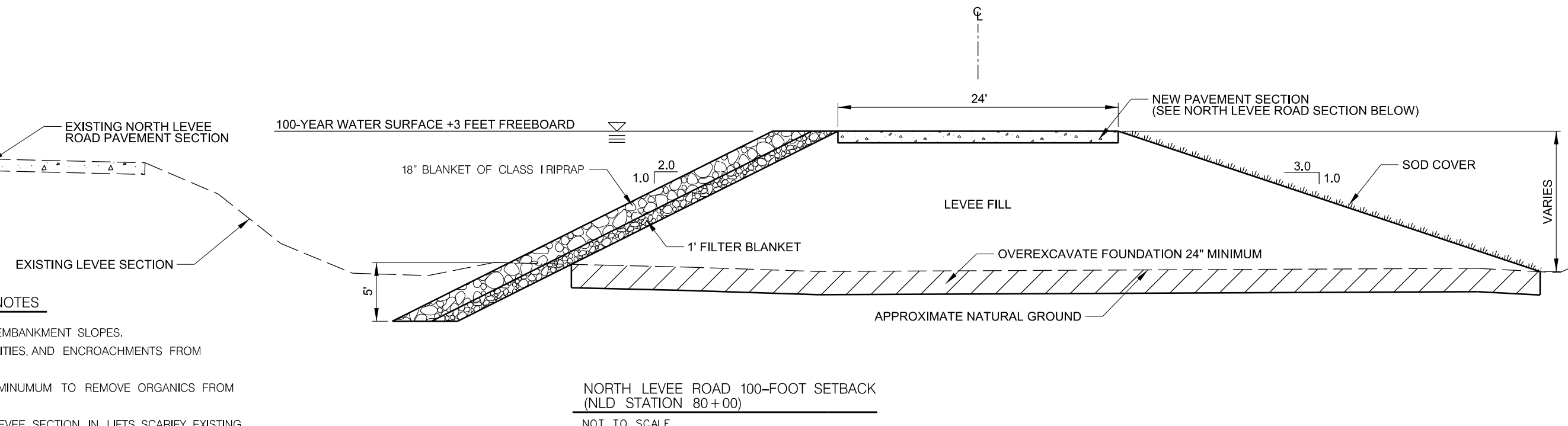
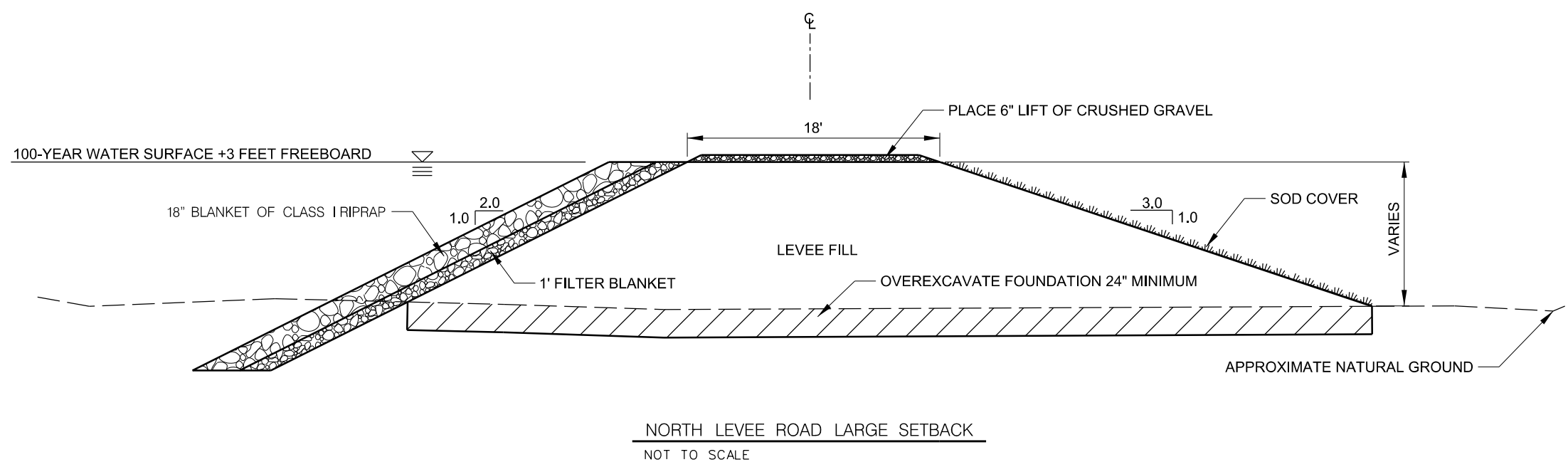
1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. OVEREXCAVATE 24" MINIMUM TO REMOVE ORGANICS FROM FOUNDATION.
4. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY EXISTING EMBANKMENT TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND.
5. ADD BASE COURSE, TOP COURSE, AND ASPHALT TO RE-ESTABLISH NORTH LEVEE ROAD SECTION WHERE REQUIRED.
6. REPLACE GUARDRAIL.

Description	Symbol	Appr.	Date

Designed by:	M. GONIA	Date:	12 DEC 2013
Drawn by:	M. GONIA	File #	
Checked by:	M. MICHALSEN	Rev.	

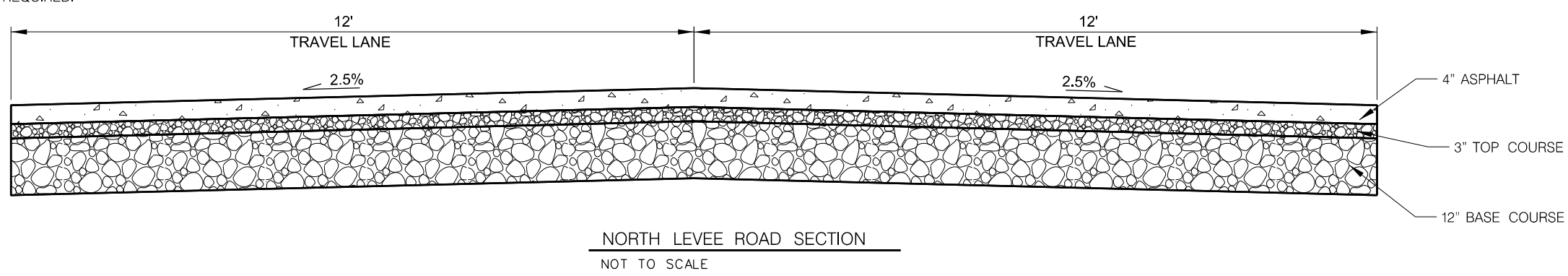
U.S. ARMY ENGINEER DISTRICT SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON
Prepared by: CENWS-EN-GB-SS/GONIA

PUYALLUP GENERAL INVESTIGATION
CONCEPTUAL LEVEE DESIGNS
NORTH LEVEE ROAD
TYPICAL SECTION
PIERCE COUNTY
WA

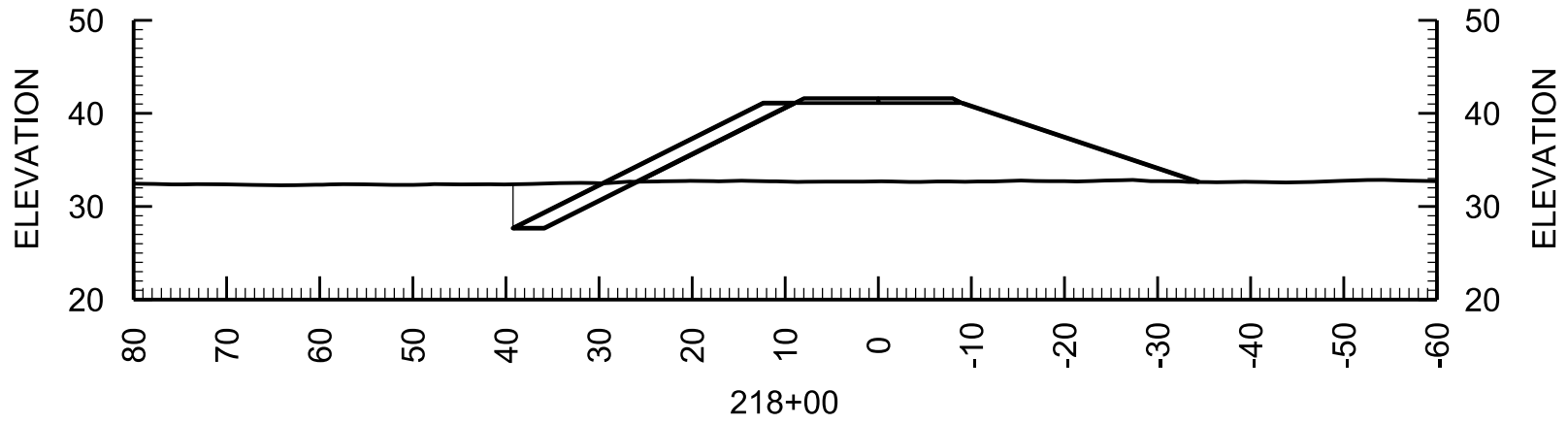


CONSTRUCTION NOTES

1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. OVEREXCAVATE 24" MINIMUM TO REMOVE ORGANICS FROM FOUNDATION.
4. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY EXISTING EMBANKMENT TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND.
5. ADD BASE COURSE, TOP COURSE, AND ASPHALT TO RE-ESTABLISH NORTH LEVEE ROAD SECTION WHERE REQUIRED.
6. REPLACE GUARDRAIL.



North Levee Road Setback
InRoads Generated Section



Puyallup River General Investigation

TSP Quantities - Lower Puyallup Left Bank

Material

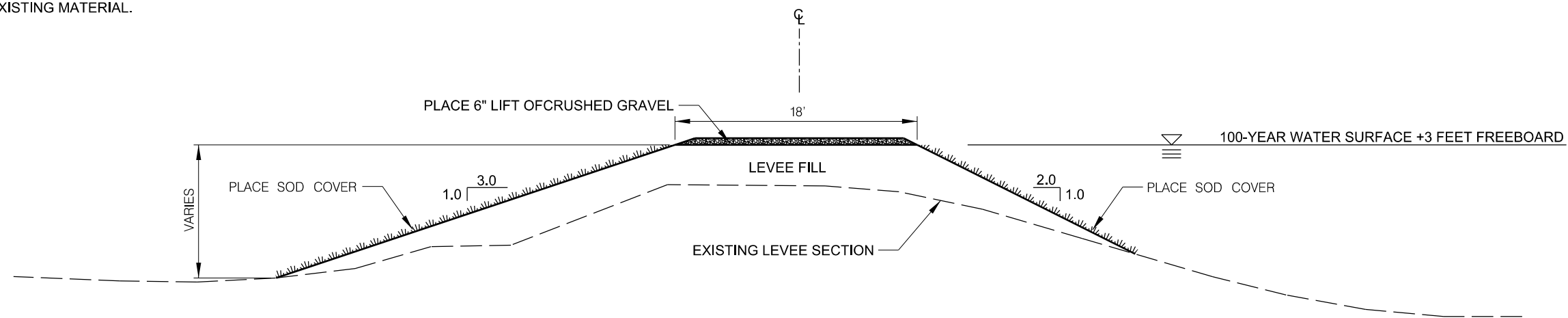
	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut (spalls and buried toe excavation)	13,684	15,737
Fill (levee fill to raise existing levee in place)	125,534	144,364
<i>Rock</i>	<u>Quantity (CY)</u>	
Riprap (buried toe + reinforce slope protection)	17,007	
Spalls (filter)	11,338	
Wearing (top of levee surface course)	3,494	

Material Notes

1. Levee Fill: Silty sand (SM) preferably with 10-20% passing the #200 sieve.
2. Quarry Spalls: 2" – 4" rock
3. Wearing: 1.25" CSBC or similar
4. See typical section for rip rap size.

CONSTRUCTION NOTES

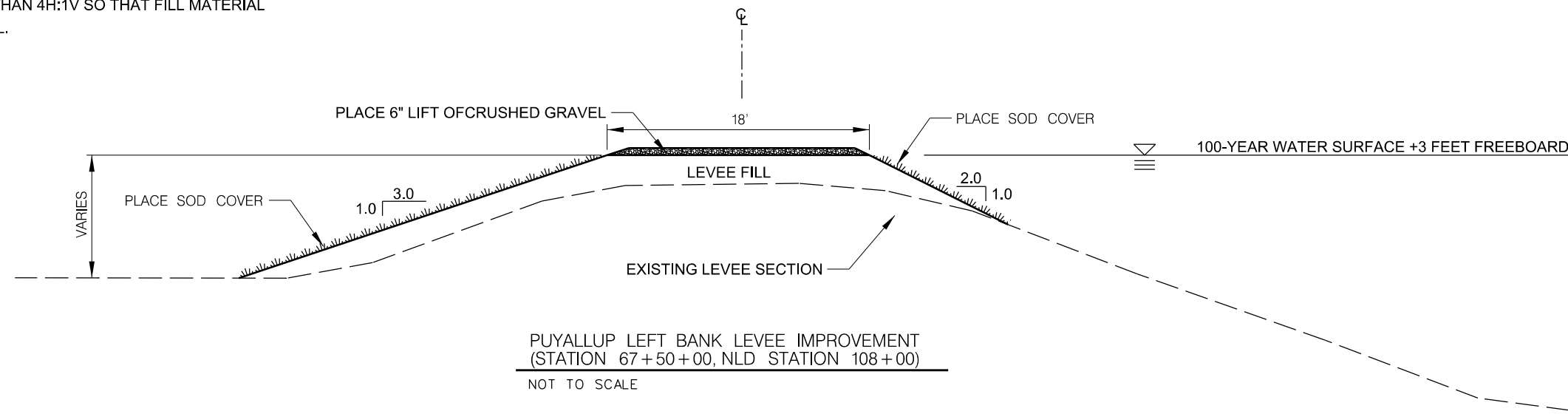
1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY EXISTING EMBANKMENT TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND WITH THE EXISTING MATERIAL.



PUYALLUP LEFT BANK LEVEE IMPROVEMENT
(STATION 19+00, NLD STATION 60+00)
NOT TO SCALE

CONSTRUCTION NOTES

1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY EXISTING EMBANKMENT TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND WITH THE EXISTING MATERIAL.



PUYALLUP LEFT BANK LEVEE IMPROVEMENT
(STATION 67+50+00, NLD STATION 108+00)
NOT TO SCALE

Description	Date	Appr.	Symbol

Designed by:	M. GONIA	Date:	12 DEC 2013
Drawn by:	M. GONIA	File #	
Checked by:	M. MICHALSEN	Rev.	
Prepared by:	CENWS-EN-GB-SS/GONIA		

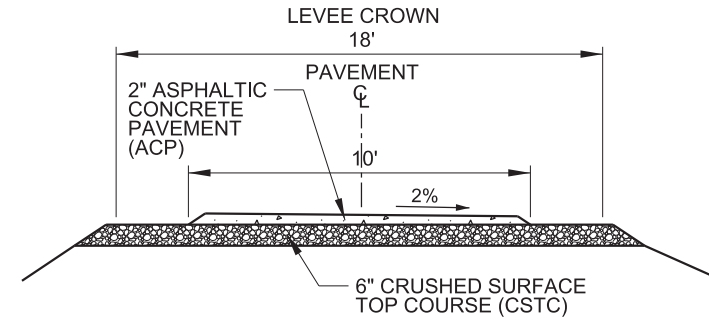
U.S. ARMY ENGINEER DISTRICT SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON
WA
PIERCES COUNTY
PUYALLUP LEFT BANK
CONCEPTUAL LEVEE DESIGNS
TYPICAL SECTION

Plate number:
C-101
Sheet 1 of 1

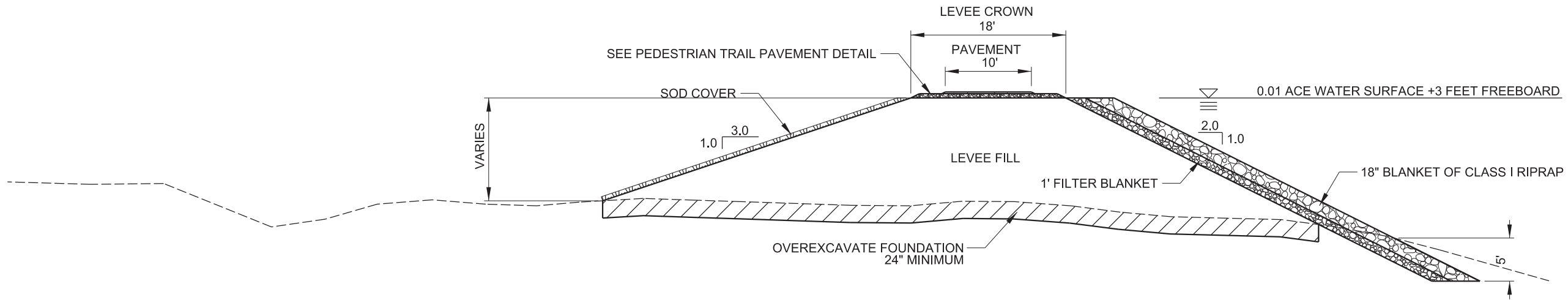


CONSTRUCTION NOTES

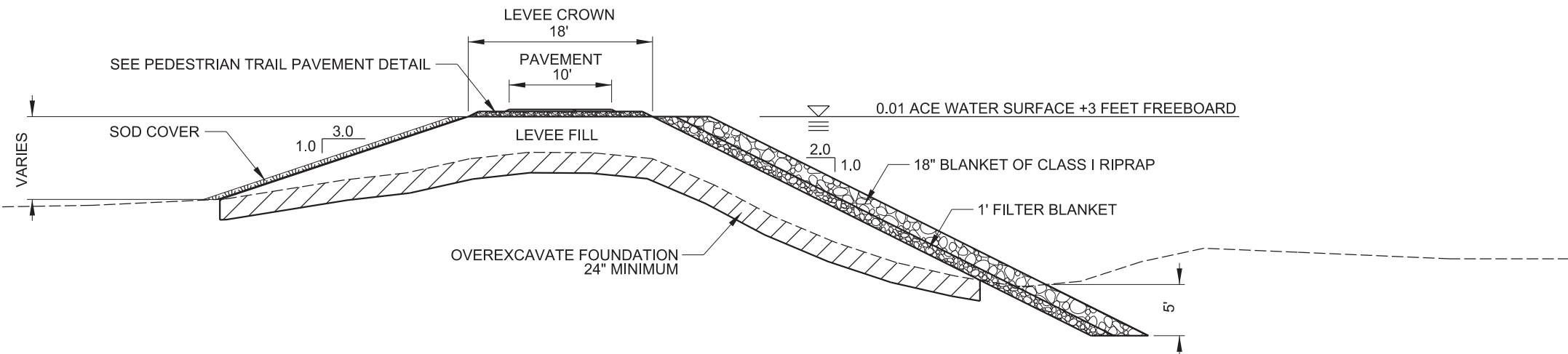
1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. STRIP EXISTING PEDESTRIAN TRAIL PAVEMENT.
4. OVEREXCAVATE 24" MINIMUM TO REMOVE ORGANICS FROM FOUNDATION.
5. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY EXISTING EMBANKMENT TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND WITH THE EXISTING MATERIAL.
6. REPLACE PEDESTRIAN TRAIL ACCORDING TO SPECIFICATIONS. SEE DETAIL.



PEDESTRIAN TRAIL PAVEMENT SECTION
NOT TO SCALE



LOWER PUYALLUP EXTENSION LEVEE
(STATION 0+00 TO STATION 28+00 &
STATION 49+00 TO STATION 71+39)
NOT TO SCALE

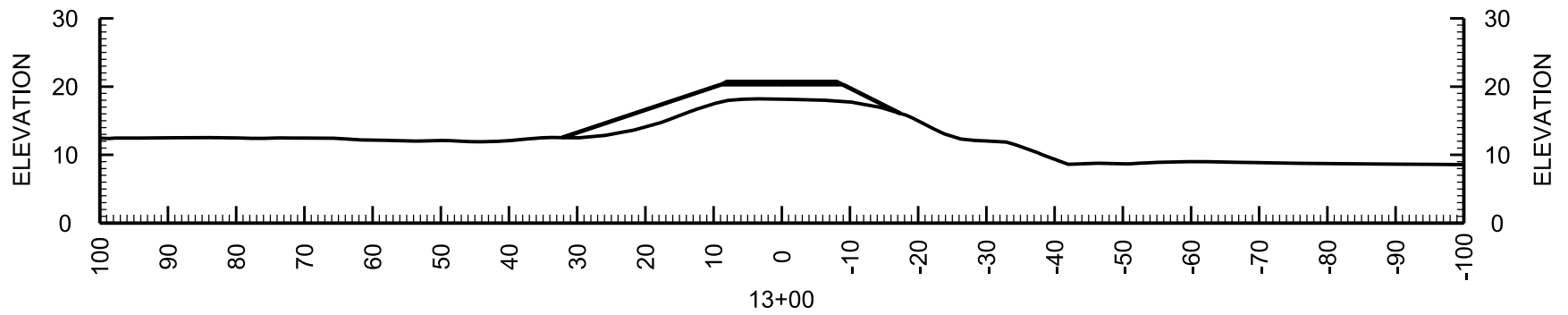


LOWER PUYALLUP EXTENSION LEVEE
(STATION 28+00 TO STATION 49+00)
NOT TO SCALE

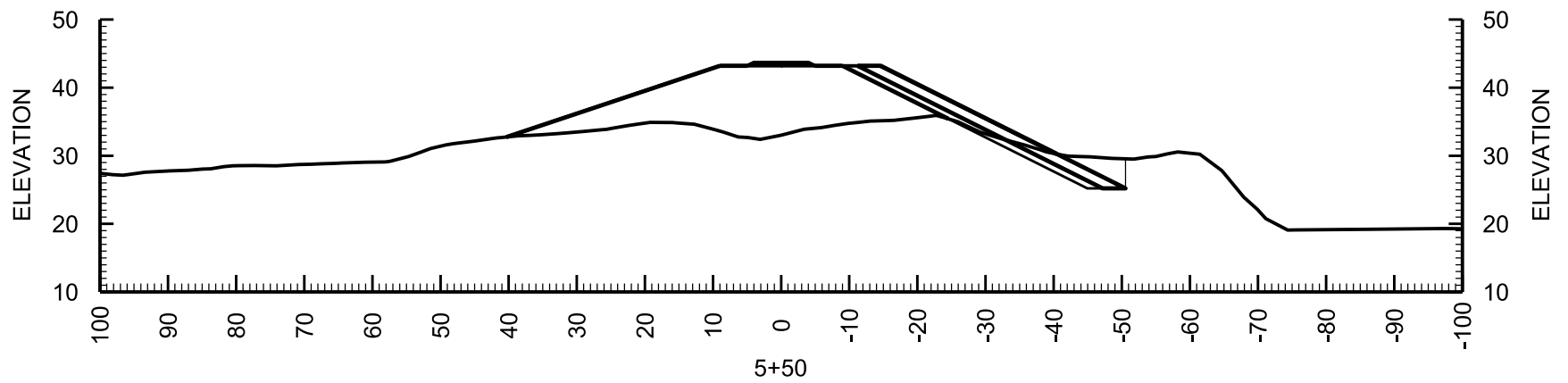
Designed by:	M. GONIA	Date:	05 JAN 2016
Drawn by:	M. GONIA	File #:	
Checked by:	K. OHSIEK	Rev.:	
U.S. ARMY ENGINEER DISTRICT SEATTLE CORPS OF ENGINEERS SEATTLE, WASHINGTON		Prepared by: CENWS-EN-GB-SS/GONIA	

PUYALLUP GENERAL INVESTIGATION
CONCEPTUAL LEVEE DESIGNS
RIVER ROAD EXTENSION
TYPICAL SECTION
PIERCE COUNTY WA

Lower Puyallup Left Bank InRoads Generated Section



River Road Extension Inroads Genrated Section



Puyallup River General Investigation

TSP Quantities - Lower White

Material



	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut (spalls and buried toe excavation)	43,580	50,117
Fill (levee fill to raise existing levee in place)	79,978	91,975
<i>Rock</i>	<u>Quantity (CY)</u>	
Riprap (buried toe + reinforce slope protection)	44,889	
Filter (Quarry Spalls)	15,449	
Wearing (top of levee surface course)	3,691	

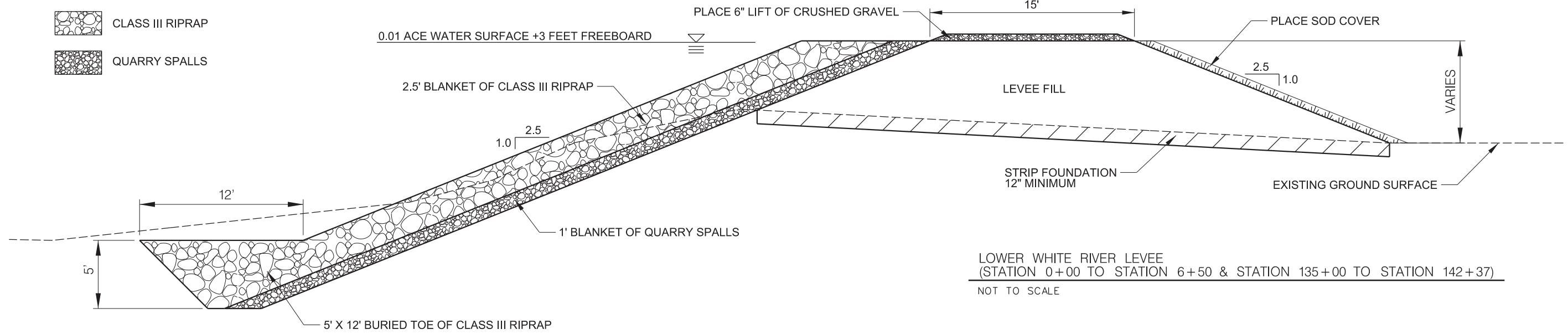
Material Notes

1. Levee Fill: Silty sand (SM) preferrably with 10-20% passing the #200 sieve.
2. Filter: 2" – 4" rock
3. Wearing: 1.25" crushed surfacing basecourse (CSBC) or similar
4. See typical section for rip rap size.

CONSTRUCTION NOTES

1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY SOIL TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND.
4. REGRADE SLOPE. PLACE RIPRAP BLANKET AND BURIED TOE TO THE DIMENSIONS SHOWN.



-  CLASS III RIPRAP
-  QUARRY SPALLS

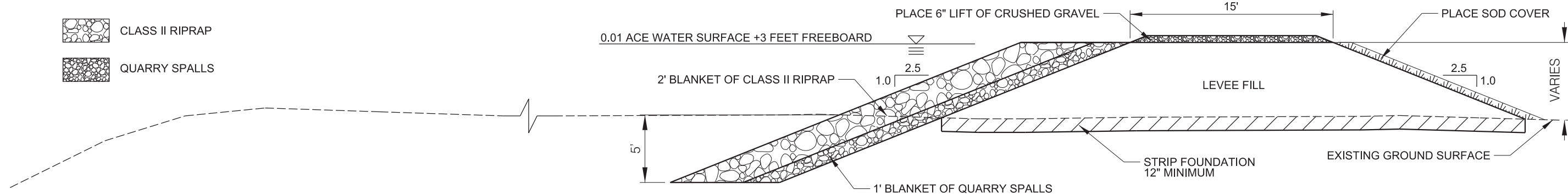


LOWER WHITE RIVER LEVEE
(STATION 0+00 TO STATION 6+50 & STATION 135+00 TO STATION 142+37)
NOT TO SCALE

CONSTRUCTION NOTES

1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY SOIL TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND.
4. REGRADE SLOPE. PLACE RIPRAP BLANKET AND BURIED TOE TO THE DIMENSIONS SHOWN.

-  CLASS II RIPRAP
-  QUARRY SPALLS



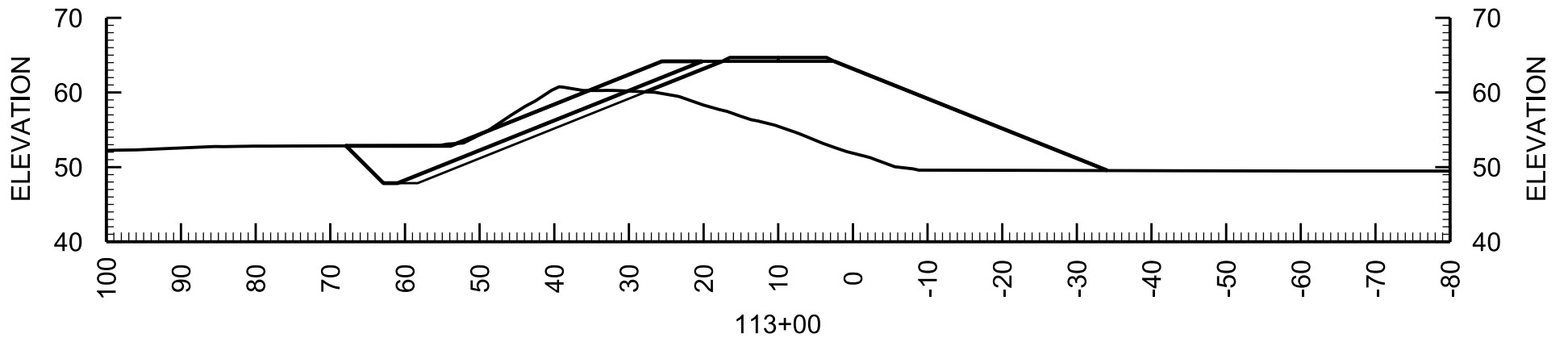
LOWER WHITE RIVER LEVEE
(STATION 6+50 TO STATION 135+00)
NOT TO SCALE

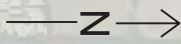
Designed by:	M. GONIA	Date:	05 JAN 2016
Drawn by:	M. GONIA	File #:	
Checked by:	K. OHSIEK	Rev.:	

U.S. ARMY ENGINEER DISTRICT/SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON
Prepared by:
CENWS-EN-GB-SS/GONIA

PUYALLUP GENERAL INVESTIGATION
CONCEPTUAL LEVEE DESIGNS
LOWER WHITE RIVER
TYPICAL SECTION
PIERCE COUNTY WA

Lower White InRoads Generated Section





140TH AVE E

142ND AVE E

16TH ST E

TACOMA AVE

LOWER WHITE
LEVEE ALIGNMENT

Puyallup River General Investigation

TSP Quantities - Pacific Park and Butte Avenue

Material

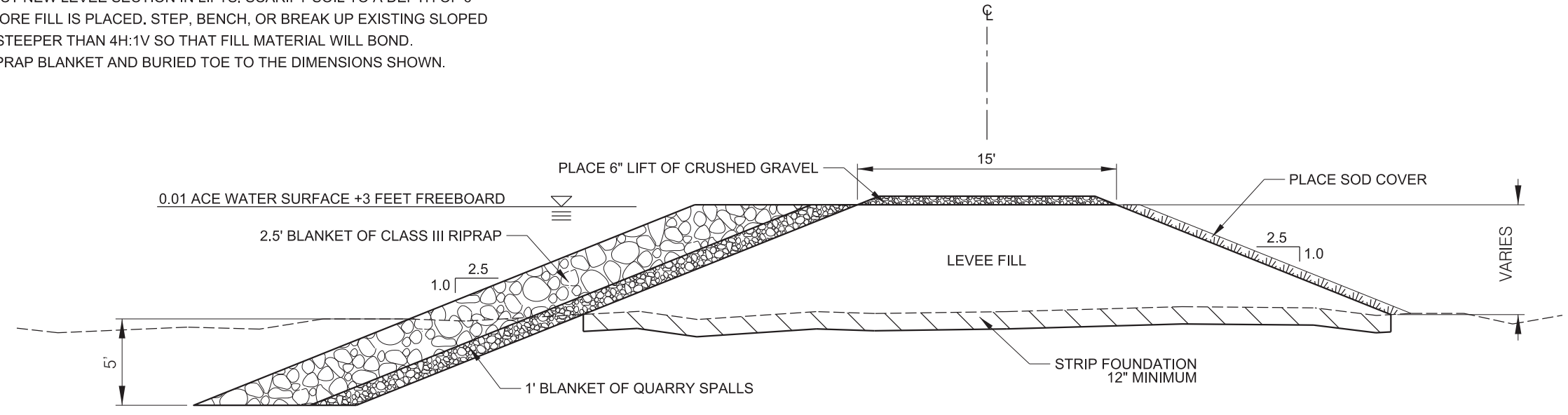
	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut (spalls and buried toe excavation)	22,071	25,382
Fill (levee fill to raise existing levee in place)	59,463	68,382
<i>Rock</i>	<u>Quantity (CY)</u>	
Riprap (buried toe + reinforce slope protection)	20,108	
Filter (Quarry Spalls)	8,120	
Wearing (top of levee surface course)	2,294	

Material Notes

1. Levee Fill: Silty sand (SM) preferably with 10-20% passing the #200 sieve
2. Filter: 2" – 4" rock
3. Wearing: 1.25" crushed surfacing basecourse (CSBC) or similar
4. See typical section for rip rap size

CONSTRUCTION NOTES

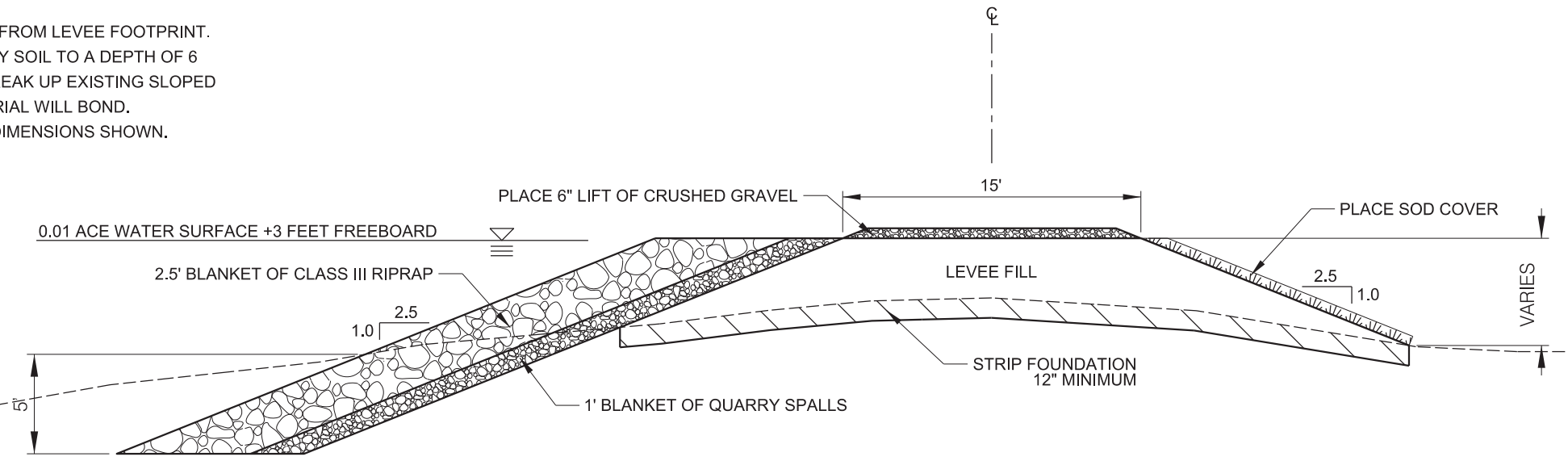
1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY SOIL TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND.
4. PLACE RIPRAP BLANKET AND BURIED TOE TO THE DIMENSIONS SHOWN.



PACIFIC PARK LEVEE
TYPICAL SECTION
NOT TO SCALE

CONSTRUCTION NOTES

1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. CONSTRUCT NEW LEVEE SECTION IN LIFTS. SCARIFY SOIL TO A DEPTH OF 6 INCHES BEFORE FILL IS PLACED. STEP, BENCH, OR BREAK UP EXISTING SLOPED SURFACES STEEPER THAN 4H:1V SO THAT FILL MATERIAL WILL BOND.
4. PLACE RIPRAP BLANKET AND BURIED TOE TO THE DIMENSIONS SHOWN.



BUTEE AVE. LEVEE
TYPICAL SECTION
NOT TO SCALE

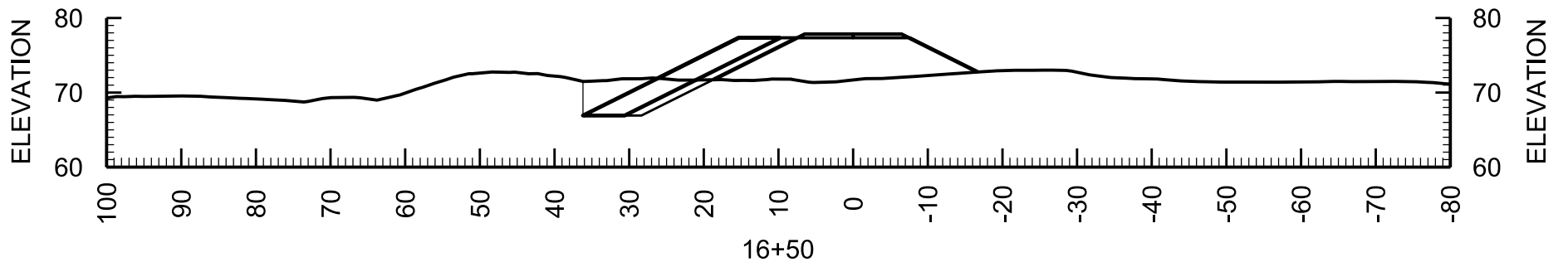
Description	Symbol	Appr.	Date

Designed by:	M. GONIA	Date:	05 JAN 2016
Drawn by:	M. GONIA	File #:	
Checked by:	K. OHSIEK	Rev.:	
U.S. ARMY ENGINEER DISTRICT/SEATTLE CORPS OF ENGINEERS SEATTLE, WASHINGTON	Prepared by:	CENWS-EN-GB-SS/GONIA	

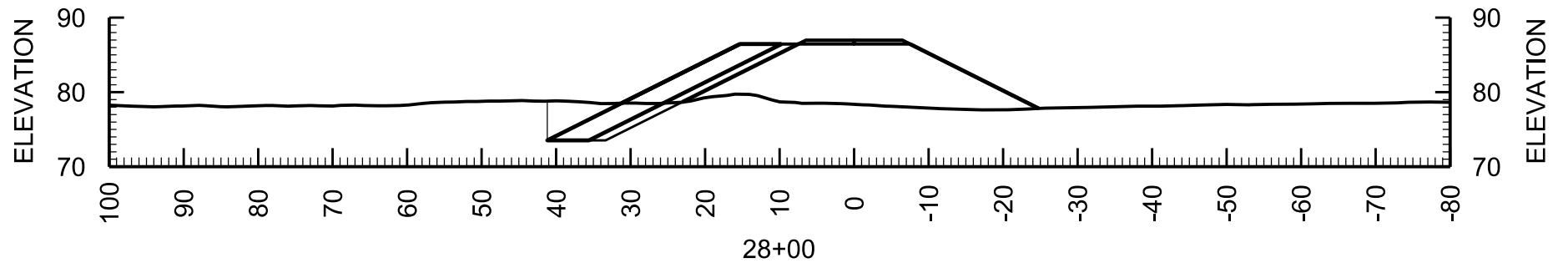
PUYALLUP GENERAL INVESTIGATION
CONCEPTUAL LEVEE DESIGNS
BUTTE AVE. & PACIFIC PARK
TYPICAL SECTION
PIERCE COUNTY WA

Plate number:
EXHIBIT
Sheet 1 of 1

Pacific Park InRoads Generated Section



Butte Avenue InRoads Generated Section



3RD AVE SE

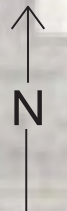
PACIFIC PARK LEVEE

BUTTE AVE

DIVISION STREET

GOVERNMENT DITCH

BUTTE AVENUE LEVEE



SCALE 1" = 275'

8TH ST E

STEWART ROAD SE



Puyallup River General Investigation

TSP Quantities - SR410

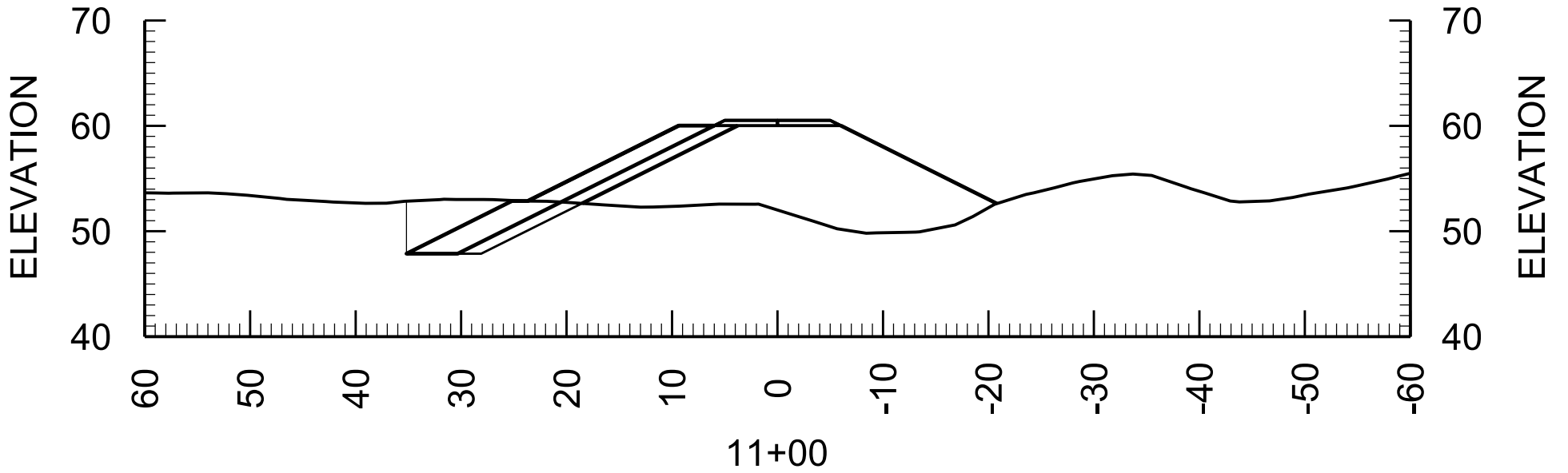
Material

	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut (spalls and buried toe excavation)	3,921	4,509
Fill (levee fill to raise existing levee in place)	10,209	11,740
<i>Rock</i>	<u>Quantity (CY)</u>	
Riprap (buried toe + slope protection)	2,872	
Filter (Quarry Spalls)	1,621	
Wearing (top of levee surface course)	353	

Material Notes

1. Levee Fill: Silty sand (SM) preferably with 10-20% passing the #200 sieve.
2. Filter: 2" – 4" rock
3. Wearing: 1.25" crushed surfacing basecourse (CSBC) or similar
4. See typical section for rip rap size.

SR 410 InRoads Generated Section



E MAIN AVE

SR410 LEVEE ALIGNMENT

HWY SR410

RIVER GROVE FLOOD WALL ALIGNMENT

E PIONEER AVE



Puyallup River General Investigation

TSP Quantities - Jones Raise in Place

Material

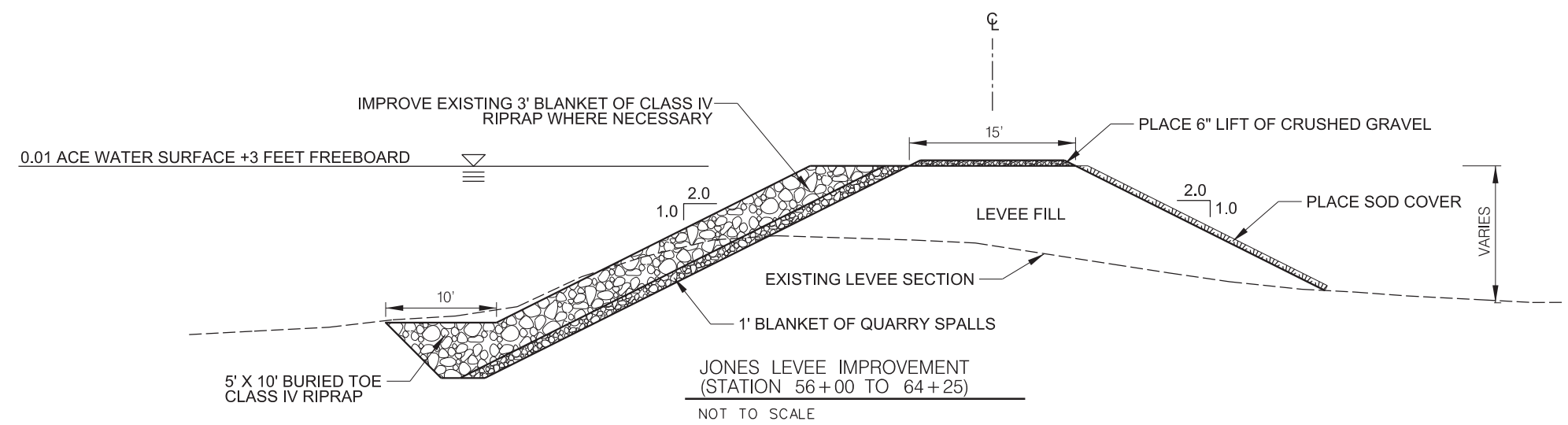
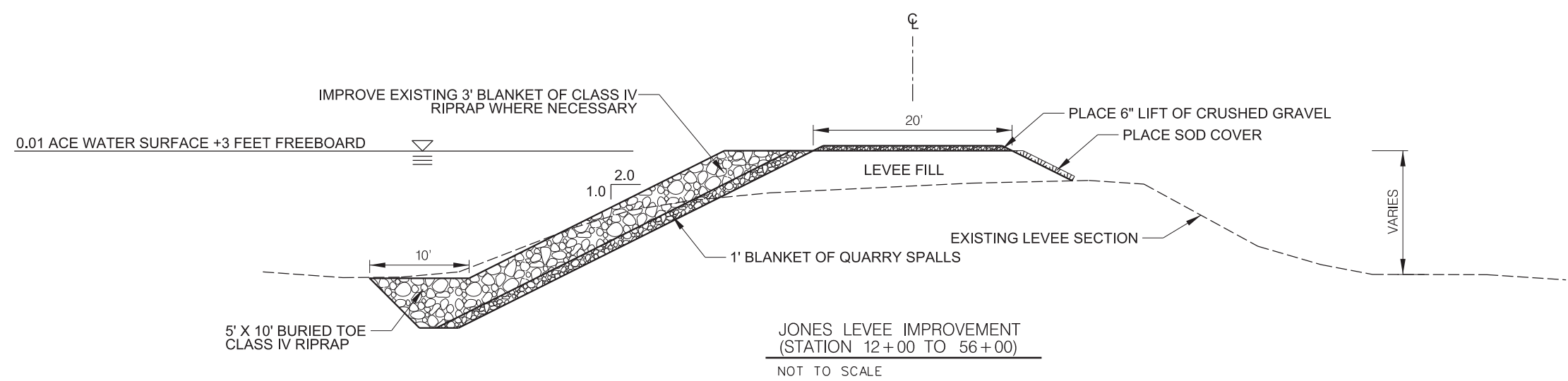
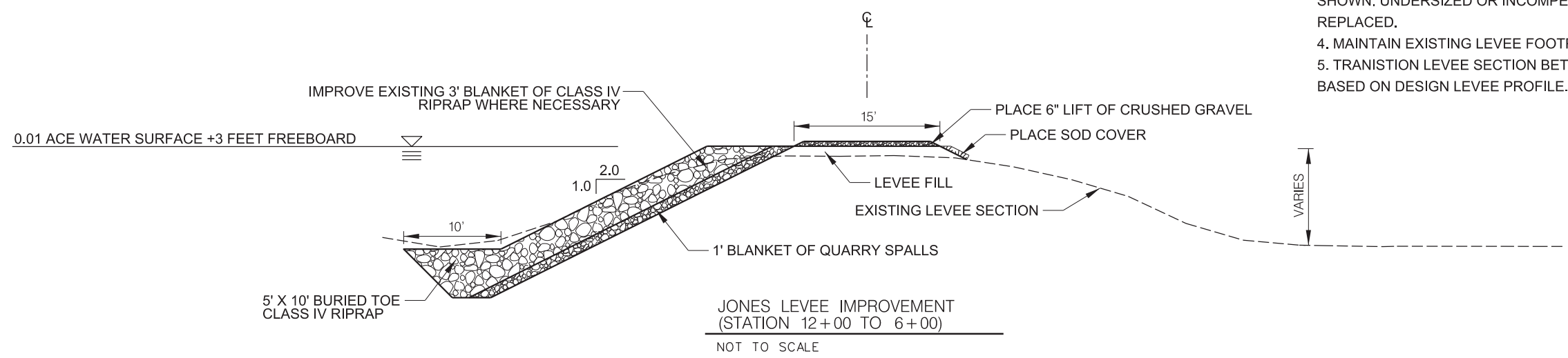
	<u>Bank Quantity (CY)</u>	<u>Loose Quantity (CY)</u>
<i>Earthwork Totals</i>		Swell factor of 1.15 used
Cut (spalls and buried toe excavation)	22,653	26,051
Fill (levee fill to raise existing levee in place)	34,032	39,137
<i>Rock</i>	<u>Quantity (CY)</u>	
Riprap (buried toe + reinforce slope protection)	27,627	
Spalls	8,219	
Wearing (top of levee surface course)	2,100	

Material Notes

1. Levee Fill: Silty sand (SM) preferably with 10-20% passing the #200 sieve.
2. Quarry Spalls: 2" – 4" rock
3. Wearing: 1.25" CSBC or similar
4. See typical section for rip rap size.

CONSTRUCTION NOTES

1. CLEAR AND GRUB EMBANKMENT SLOPES.
2. REMOVE TREES, UTILITIES, AND ENCROACHMENTS FROM LEVEE FOOTPRINT.
3. IMPROVE EXISTING RIPRAP BLANKET AND BURIED TOE TO THE DIMENSIONS SHOWN. UNDERSIZED OR INCOMPETENT ROCK SHALL BE REMOVED AND REPLACED.
4. MAINTAIN EXISTING LEVEE FOOTPRINT WHERE POSSIBLE.
5. TRANSITION LEVEE SECTION BETWEEN STATION 6+00 TO STATION 12+00 BASED ON DESIGN LEVEE PROFILE.



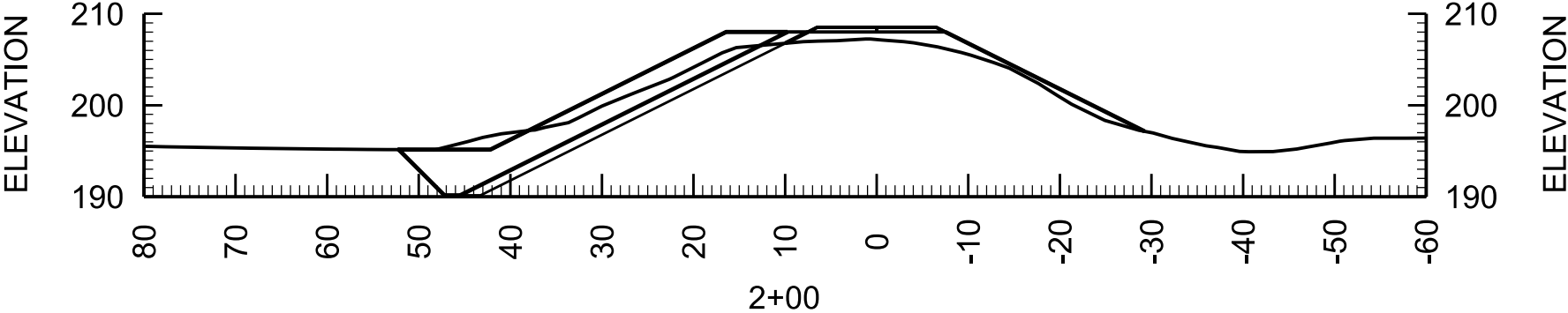
Description	Symbol	Appr.	Date

Designed by:	M. GONIA	Date:	05 JAN 2016
Drawn by:	M. GONIA	File #	
Checked by:	K. OHSIEK	Rev.	
U.S. ARMY ENGINEER DISTRICT SEATTLE CORPS OF ENGINEERS SEATTLE, WASHINGTON	Prepared by:	CENWS-EN-GB-SS/GONIA	

PUYALLUP GENERAL INVESTIGATION
CONCEPTUAL LEVEE DESIGNS
JONES LEVEE
TYPICAL SECTION
PIERCE COUNTY WA

IF SHEET MEASURES LESS THAN 22" X 34" IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

Jones Levee InRoads Genereated Section



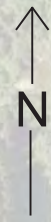


ORTING/ KAPOWSIN HWY E

JONES LEVEE ALIGNMENT

HWY 162

ALBERT BELL RD E



Puyallup River Flood Risk Reduction GI Utility Impacts for Levee Alternative

Italicized text = required utility work.

Lower Puyallup Right Bank

The setback of N. Levee Road has a significant impact to existing utilities:

1. Power:

Overhead power present along entire length of proposed setback (Google Earth). Assume no relocation required for raise in place area of levee at far downstream end of alignment.

Demolish/Relocate 30,000LF of overhead power

2. Water/ Sanitary Sewer

Assume water (12") and sanitary sewer (10" with SSMH every 300') in existing N. Levee road between two areas of large setback (9,500LF). No water/SS in downstream large setback (per Art Gregg City of Fife), Assume no water/SS in area up upstream large setback. SS known from far upstream end of alignment to the large setback (3,300LF City of Puyallup Map). One SS pump station is known to require relocation. Assume need to relocate/reroute 500 LF of 8" force main associated with pump station. Assume 12" water main present parallel to known SS.

Demolish/Relocate 12,800LF of 12" PVC Water main and appurtenances

Demolish/Relocate 12,800LF of 10" PVC SS main

Demolish/Relocate 43 SS manholes (48")

Demolish/Relocate 3 SS cleanouts

Demolish/Relocate 1 SS Pump Station and 500LF of 8" force main

3. Storm Drainage

Assume no SD mains/catch basins at far downstream end of project where the intent is to raise N Levee Road in place. No SD/Outfalls in downstream setback area (per Art Greg with Summit Water District). Assume no SD/Outfalls in upstream set back area. Assume no SD in existing N. Levee road between two areas of large setback (9,500LF). No catch basins observed in Google earth and large residential development looks to drain to a central wetland/pond. SD mains known from far upstream end of alignment to the large setback (City of Puyallup Map). The number and type of catch basins are assumed. Some existing outfalls known from levee inspections. 3 additional 36" outfalls are assumed. Outfall pipe is assumed to be 250LF long.

Demolish/Relocate 2,800LF of 24" PVC SD Pipe

Demolish/Relocate 475LF of 48" PVC SD Pipe

Demolish/Relocate 10 Type 1 Catch Basins

Demolish/Relocate 8 Type 2 Catch Basins

Reuse/Relocate 250LF 10' diameter culvert (Shadx Restoration)

Demolish/Replace 250LF 72" CMP with 72" RCP (Wapato Creek)

Demolish/Replace 3 250LF 36" CMP with 36" RCP

Lower Puyallup Left Bank

1. Power:

Overhead power present at downstream extent of levee alignment and within the Clear Creek setback (Google Earth). There is also overhead power that crosses the river but poles are on landward side of River Road E.

Demolish/Relocate 5,000LF of overhead power

2. Water/ Sanitary Sewer

There are PVC water mains present in the Clear Creek Setback Area (Lora Scott Summit Water District). Assume no impact other than to sleeve one main that runs under proposed levee. Assume additional cover over 1000LF of existing PVC water main under proposed Clear Creek levee alignment is OK.

Adjustment of elevations of valves and other appurtenances will be necessary. No SS in Clear Creek setback area (Summit Water). SS/Water will not be impacted on left bank since it's not set back and a flood wall on riverward side of River Road E.

Excavate and sleeve 200LF 12" PVC with 14" Ductile Iron Pipe

Adjust WA valves/appearances for 2000LF

3. Storm Drainage

Assume no SD mains/catch basins at far downstream end of project where the intent is to existing levee in place. No SD main impact along River Road E due to proposed flood wall not impacting the road prism. All outfalls along left bank alignment will be impacted and need to be replaced or reused where already RCP. Some existing outfalls known from levee inspections. 3 additional 36" CMP outfalls are assumed that need to be replaced. Outfall pipe is assumed to be 250LF long.

Demolish/Replace 250LF 72"x84" diameter RC box culvert

Demolish/Reuse 250LF 72" RCP (Clear Creek)

Demolish/Reuse 250LF 18" RCP (Clear Creek)

Demolish/Replace 250LF 18" Iron 18" RCP (Clear Creek)

Demolish/Replace 250LF 48" Steel with 48" RCP (Cleveland Way Pump Station)

Demolish/Replace 250LF 24" Steel with 24" RCP (Cleveland Way Pump Station)

Demolish/Replace 250LF 12" PVC with 12" RCP (Cleveland Way Pump Station)

Demolish/Replace 250LF 4" Steel with 6" RCP (Cleveland Way Pump Station)

Demolish/Reuse two (2) 250LF 12" RCP

Demolish/Replace 250LF 12" CMP with 12" RCP

Demolish/Replace 250LF 24" CMP with 24" RCP

Demolish/Replace 250LF 12" Steel with 12" RCP

Demolish/Replace 250LF 36" CMP with 36" RCP

Demolish/Replace 250LF 18" PVC with 18" RCP

Demolish/Replace 250LF 14" PVC with 14" RCP

Demolish/Replace 250LF 14" PVC with 14" RCP

Demolish/Replace 250LF 24" Steel with 24" RCP

Demolish/Replace 250LF 72" unknown with 72" RCP

Demolish/Replace 250LF six (3) 36" CMP with 36" RCP

Puyallup River Flood Risk Reduction GI Utility Impacts for Levee Alternative

The remaining levee reaches are either not set back or will be raise-in-place existing levees that are not set back from the river. Therefore, it is assumed that the impact to existing utilities is limited to storm drainage outfalls/culverts. A cost contingency will be required to be carried forward until that assumption can be confirmed.

Italicized text = required utility work.

SR 410 Floodwall/Levee

1. Storm Drainage

One existing 8" outfall/culvert known from levee inspections. 3 additional 24" outfalls are assumed.

Outfall pipe is assumed to be 250LF long.

Demolish/Replace 250LF 8" CMP with 8" RCP

Demolish/Replace three (3) 250LF 24" CMP with 24" RCP

Lower White

1. Storm Drainage

Outfalls/culverts are assumed. Outfall pipe is assumed to be 250LF long.

Demolish/Replace six (6) 250LF 36" CMP with 36" RCP

Orting System

1. Storm Drainage

Some existing outfalls known from levee inspections. 3 additional outfalls/culverts are assumed. Outfall pipe is assumed to be 250LF long.

Reuse/Relocate two (2) 250LF 30" RCP (Orting treatment plant)

Demolish/Replace 250LF 24" CMP with 24" RCP (Orting)

Reuse/Relocate two (2) 250LF 36" RCP (Riddell)

Reuse/Relocate 250LF 18" RCP (Riddell)

Demolish/Replace three (3) 250LF 36" CMP with 36" RCP

Pacific System

1. Storm Drainage

Outfalls/culverts are assumed. Outfall pipe is assumed to be 250LF long.

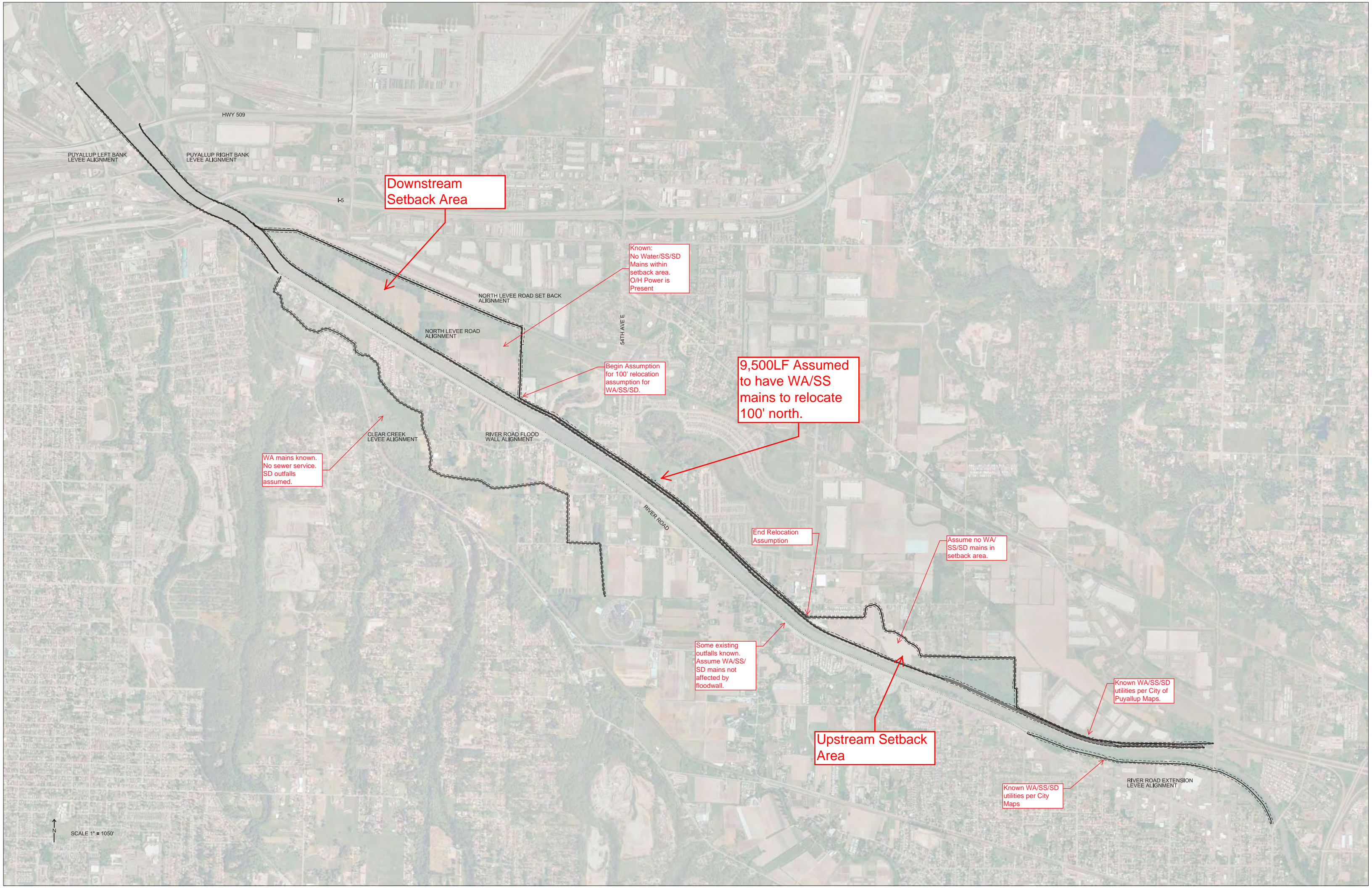
Demolish/Replace six (6) 250LF 36" CMP with 36" RCP

Jones

1. Storm Drainage

Outfalls/culverts are assumed. Outfall pipe is assumed to be 250LF long.

Demolish/Replace six (3) 250LF 24" CMP with 24" RCP



PUYALLUP LEFT BANK LEVEE ALIGNMENT

HWY 509

PUYALLUP RIGHT BANK LEVEE ALIGNMENT

I-5

Downstream Setback Area

Known: No Water/SS/SD Mains within setback area. O/H Power is Present

NORTH LEVEE ROAD SET BACK ALIGNMENT

NORTH LEVEE ROAD ALIGNMENT

Begin Assumption for 100' relocation assumption for WA/SS/SD.

9,500LF Assumed to have WA/SS mains to relocate 100' north.

64TH AVE

CLEAR CREEK LEVEE ALIGNMENT

RIVER ROAD FLOOD WALL ALIGNMENT

WA mains known. No sewer service. SD outfalls assumed.

RIVER ROAD

End Relocation Assumption

Assume no WA/SS/SD mains in setback area.

Some existing outfalls known. Assume WA/SS/SD mains not affected by floodwall.

Known WA/SS/SD utilities per City of Puyallup Maps.

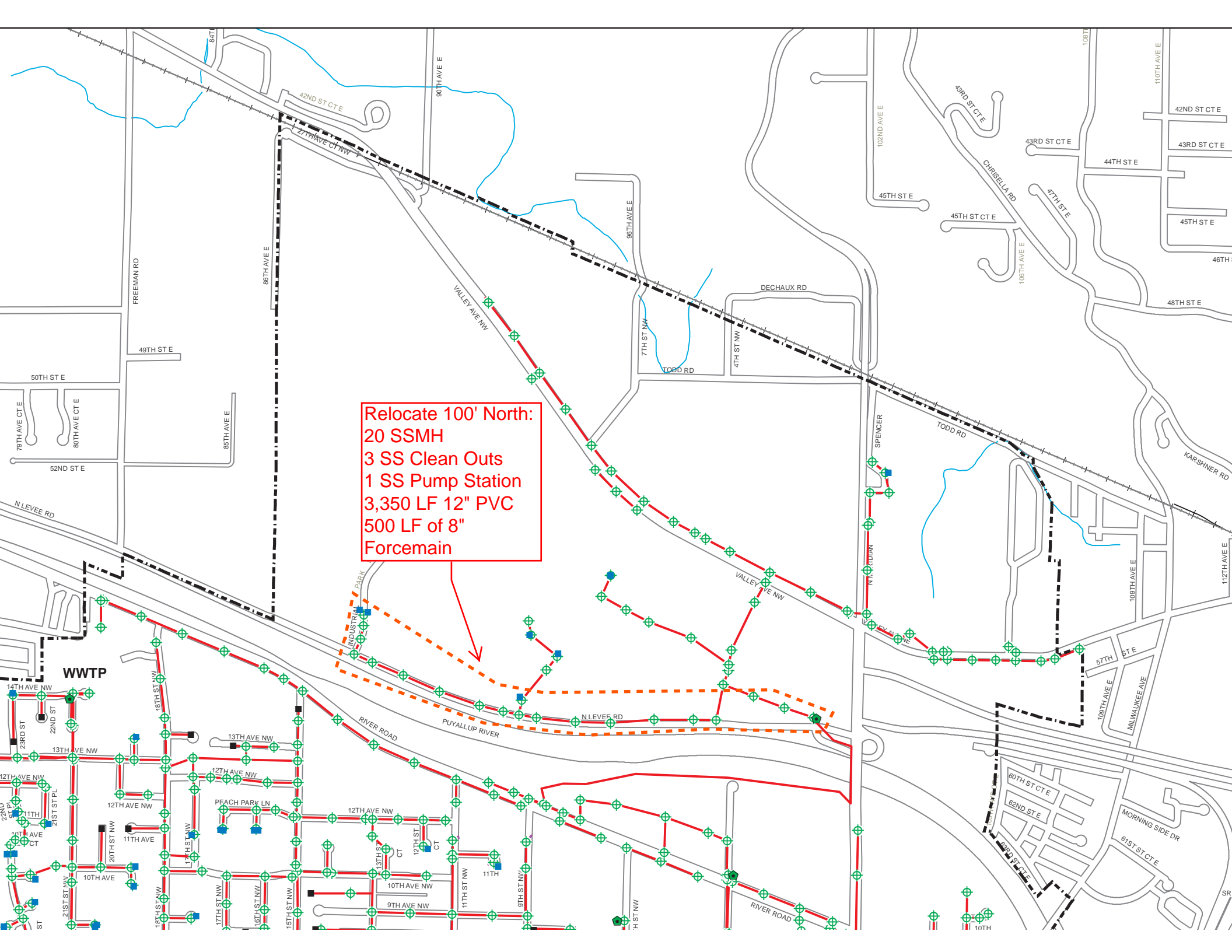
Upstream Setback Area

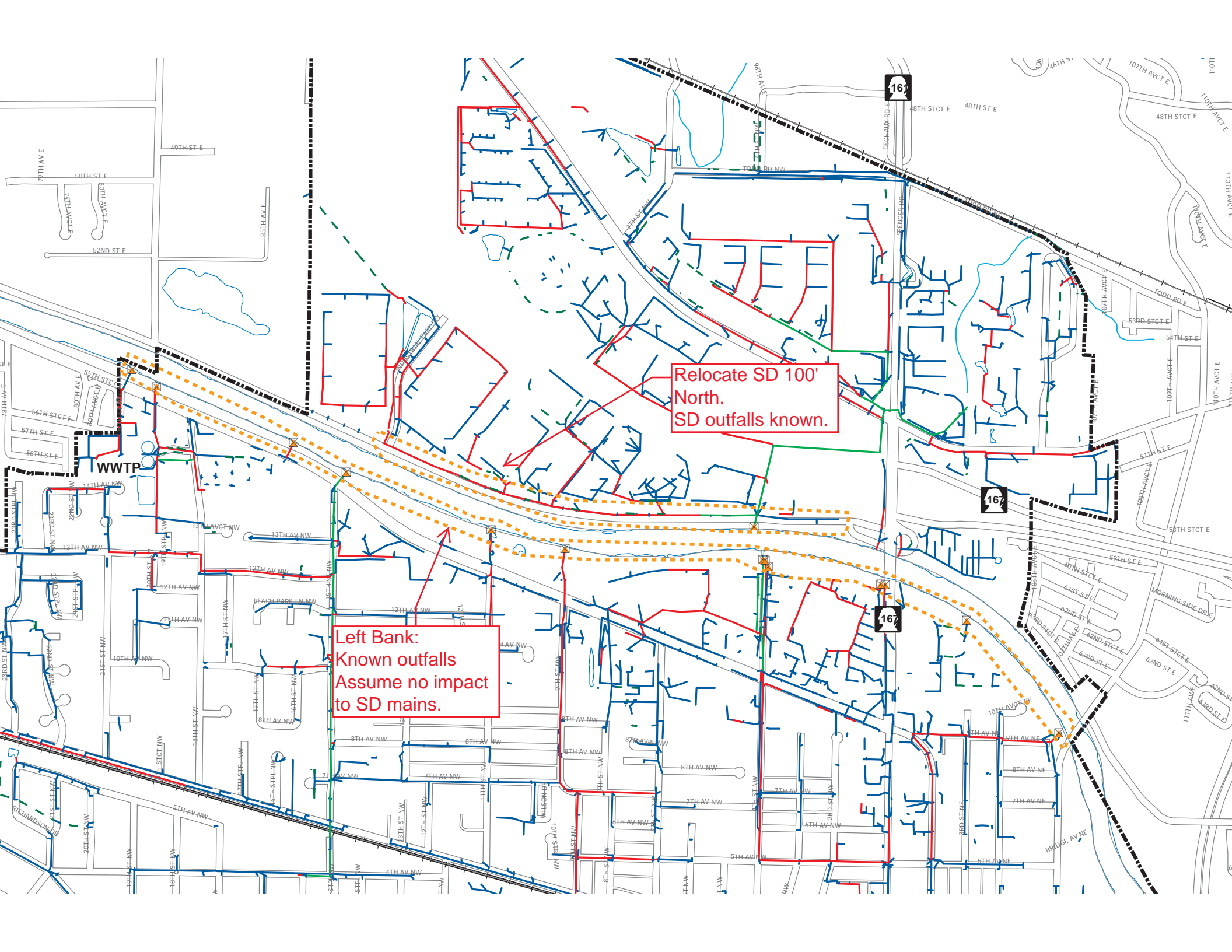
Known WA/SS/SD utilities per City Maps

RIVER ROAD EXTENSION LEVEE ALIGNMENT

SCALE 1" = 1050'

Relocate 100' North:
20 SSMH
3 SS Clean Outs
1 SS Pump Station
3,350 LF 12" PVC
500 LF of 8"
Forcemain





Relocate SD 100'
North.
SD outfalls known.

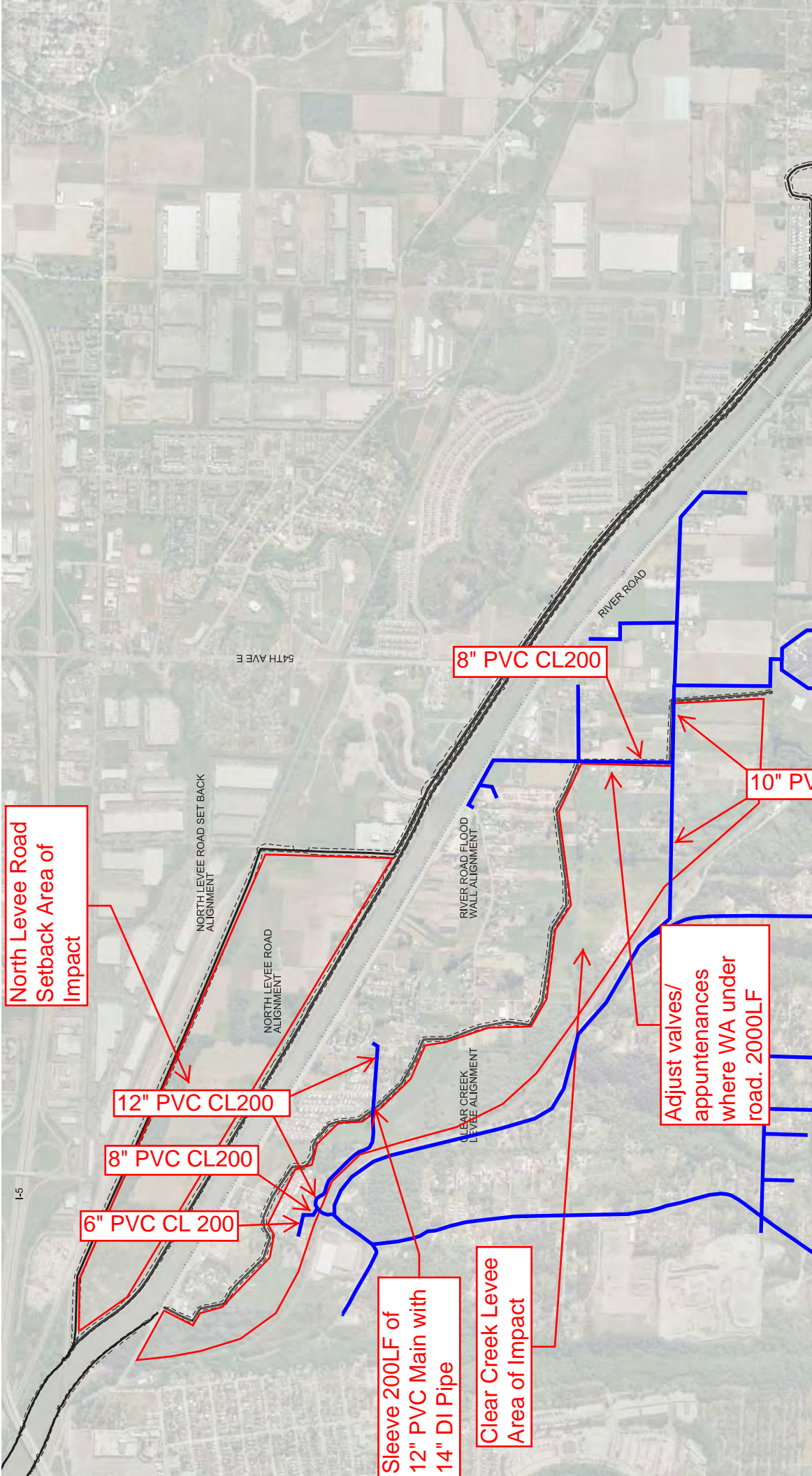
Left Bank:
Known outfalls
Assume no impact
to SD mains.

WWTP

162

162

162



Levee	Station	Size	Material Type
River Road	1+00	72" x 84"	Concrete
River Road	47+50	12"	CMP
River Road	110+00	12"	Concrete
River Road	187+50	24"	CMP
River Road	208+00	12"	Steel
River Road	210+00	36"	HDPE
River Road	211+50	18"	PVC
River Road	225+00	14"	PVC
River Road	229+00	? / 8"	Concrete / PVC
River Road	229+00	72"	Concrete
River Road	244+00	18" / 8"	Concrete / Iron
North Levee Road	260+00	72"	Corrugated Steel
North Levee Road	70+00	120"	Concrete
Orting Treatment Plant	46+00	30"	Concrete
Orting Treatment Plant	23+00	30"	Concrete
Orting Treatment Plant	1+00	?	?
Riddell	74+00	18"	Concrete
River Grove	?	8"	?
Puyallup LB	75+00	12"	PVC
Puyallup LB	75+00	48"	Steel
Puyallup LB	75+00	24"	Steel
Puyallup LB	75+00	4"	Steel
Puyallup LB	75+00	24"	Steel
Puyallup LB	75+00	24"	Steel
Puyallup LB	81+00	72"	?

Jones

1. Storm Drainage

Outfalls/culverts are assumed. Outfall pipe is assumed to be 250LF long.

Demolish/Replace six (3) 250LF 24" CMP with 24" RCP

Utility quality level	A professional opinion of the quality and reliability of utility information. Such reliability is determined by the means and methods of the professional. Each of the four existing utility data quality levels is established by different methods of data collection and interpretation.
Utility quality level A	Precise horizontal and vertical location of utilities obtained by the actual exposure (or verification of previously exposed and surveyed utilities) and subsequent measurement of subsurface utilities, usually at a specific point. Minimally intrusive excavation equipment is typically used to minimize the potential for utility damage. A precise horizontal and vertical location, as well as other utility attributes, is shown on plan documents. Accuracy is typically set to 15-mm vertical and to applicable horizontal survey and mapping accuracy as defined or expected by the project owner.
Utility quality level B	Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. Quality level B data should be reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances defined by the project and reduced onto plan documents.
Utility quality level C	Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to quality level D information.
Utility quality level D	Information derived from existing records or oral recollections.
Utility relocation policy	A policy (typically of the project owner or utility owner) for the relocation of utility facilities required by the project. This policy includes, but is not limited to, establishing provisions for compensating utility owners; for removing and reinstalling utility facilities; for acquiring or permitting necessary rights-of-way at the new location; for moving, rearranging, or changing the type of existing facilities; and for taking necessary protective measures.
Utility search	The search for a specific or unknown utility or utilities using a level of effort in accordance with the specified quality level, within a defined area.
Utility trace	The process of using surface geophysical methods to image and track a particular utility.

