

Memorandum

Date: 2 August 2018

Subject: Project Sanitary Sewer Improvements – Alternatives Analysis Memo
Strander Boulevard/Southwest 27th Street Extension - Phase 3
A18.0085.00

From: Marcia Medina, PE and Jon Corkery, PE

To: Steve Carstens, PE, City of Tukwila (City)

Route To: Mark Lampard, PE, King County Wastewater Treatment Division (KCWTD)

INTRODUCTION

The primary objective of the Strander Boulevard/Southwest 27th Street extension is to provide a vital link for freight, transit, passenger vehicle, and non-motorized traffic to move from east to west between the City of Renton and the City of Tukwila.

The entire project is proposed to be constructed in three phases. Phase 1 extended Southwest 27th Street from Oakesdale Avenue SW to Naches Avenue SW and was completed in 2006. Phase 2 created a grade separation undercrossing at the Burlington Northern Santa Fe (BNSF) railroad and extended a two-lane roadway with a single 6-foot sidewalk from the intersection of Naches Avenue SW to the Tukwila Station access road. Phase 2 was completed in 2015. The Strander Boulevard/Southwest 27th Street Extension Phase 3 will complete the east to west connection by constructing a second grade separation undercrossing at the Union Pacific Railroad (UPRR) tracks, constructing a full five-lane roadway and a shared-use path from West Valley Highway to Naches Avenue SW. See Figure 1 for project phasing.

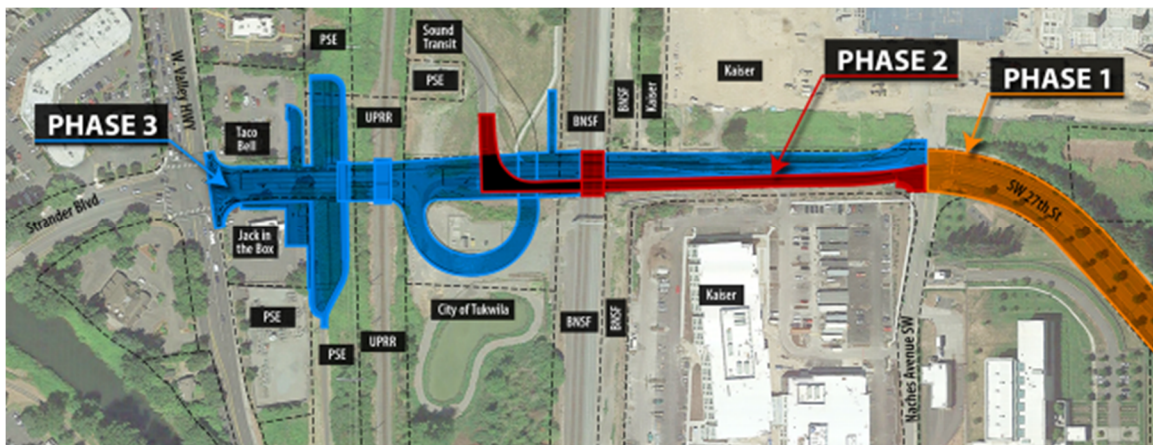


Figure 1 Project Phasing

The roadway corridor extension will begin descending below existing grade just east of the intersection of Strander Boulevard and West Valley Highway to provide a minimum of 16.5 feet of separation from the bottom of the new UPRR bridge and the surface of the new roadway. The new roadway will descend below the high groundwater table in order to achieve the clearance at both the UPRR crossing and the BNSF crossing. Secant pile walls and a concrete bottom seal will be used to create an essentially watertight structure for the portion of roadway located below the high groundwater table. A variety of other wall types will be used to achieve the required separation from existing grade once the roadway is above the regional groundwater table.

The lowered roadway will displace both City and KCWTD sewer mains, British Petroleum (BP) petroleum oil pipelines, communication lines running parallel to UPRR's tracks, the Interurban Trail, and driveway access for Puget Sound Energy (PSE), Jack in the Box, Taco Bell, and Tukwila Station. The relocation of all of these elements will be included in the scope of the Strander Boulevard/Southwest 27th Street Extension Phase 3 project. Driveway access for PSE, Jack in the Box, and Taco Bell will be combined into two single-shared driveways north and south of the lowered road. A looped overpass and new signal will be created to provide access from the Tukwila Station to Strander Boulevard. A new pedestrian bridge with ramped approaches will be constructed over the lowered roadway to continue the north to south connection of the Interurban Trail. See Figure 2 for Phase 3 improvements.

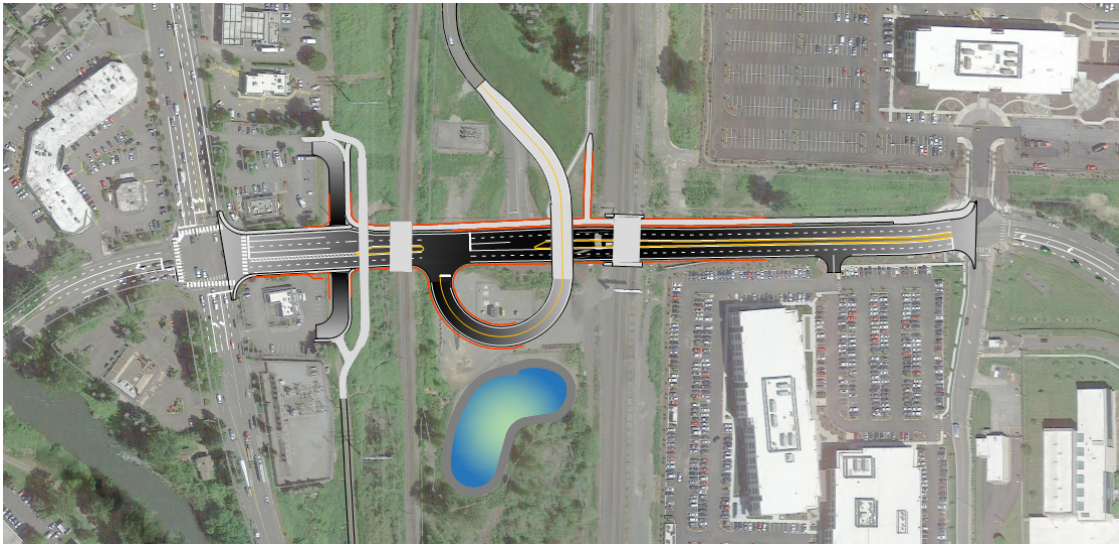


Figure 2 Phase 3 Site Map

SANITARY SEWER MAIN RELOCATION DESIGN ALTERNATIVES

After reviewing the available survey and as-built drawings, BergerABAM met with KCWTD to discuss project constraints. Based on preliminary modeling by KCWTD, the proposed sewer pipe size is shown at 48 inch diameter. KCWTD requested all saddle manholes be a minimum of 96 inches in diameter. KCWTD also requested that all sanitary sewer main relocation options rely on gravity flow only.

The three sewer replacement alternatives developed by BergerABAM, as previously presented to KCWTD, are shown in Appendix A of this memorandum and are briefly summarized below:

- Option 1 – Construct a new sewer alignment around the southern and eastern sides of the lowered portion of Strander Boulevard. The road grades increase to the east such that the sewer alignment can easily be constructed under the new roadway.
- Option 2 – Construct a new sewer alignment though the lowered portion of Strander Boulevard. The new sewer would penetrate wall systems on either side of the new road and would also pass through the groundwater seal beneath the roadway surface.
- Option 3 – Construct a new sewer alignment around the western and northern sides of the lowered portion of Strander Boulevard.

The exhibits for the three options typically show the minimum spacing or maximum achievable spacing between gas pipes and sewer. A detailed description of each alternative alignment is presented below:

Option 1 Alignment Description

Option 1 replacement begins at the existing 36 inch main, approximately 200 feet south of Strander Boulevard on City property. The new sanitary sewer pipe alignment would be built through the north end of the City's stormwater pond parcel and would continue east under the BNSF rail bed. A jack and bore type installation would be required to pass under the BNSF tracks to the Kaiser Permanente (KP) property on its east side. After crossing the rail bed, the alignment would turn north and east through the KP parking area before turning north again and crossing under Strander Boulevard with sufficient cover at a location where the road is no longer below the surrounding grade.

The new pipe will be constructed below the water table and will require a substantial dewatering effort. Based on preliminary recommendations from the geotechnical engineer, Shannon & Wilson, the northwest corner of the KP building could experience 1 to 3 inches of settlement. Settlement mitigation efforts could include staged dewatering, continuous sheet piles along the utility alignment, and/or ground improvement to increase soil strength and reduce seepage.

Option 1 may include a sub-option, Option 1B, of the replaced main in the same alignment as discussed above, but continuing for approximately an additional ¼ mile to the east before connecting to an existing 72" sanitary sewer main in Oakesdale Ave SW. This sub-option would provide the county a significantly greater length of replaced main and additional capacity in the pipe. The county has mentioned that they may favor this longer solution and may potentially provide the funds needed for the additional length of pipe replacement.

KCWTD had initially indicated that Option 1 would be their preferred route.

Option 2 Alignment Description

Option 2 improvements begin at the existing 36 inch main, approximately 200 feet south of Strander Boulevard and inside the PSE right-of-way. A new manhole would be set at the connection point and the alignment would turn generally north inside the PSE right-of-way. PSE's corridor is 100 feet wide and currently accommodates two large diameter BP gas mains along the west side. There is a larger electrical transmission tower in the center and a longer narrow wetland on the east side. The new sewer main is currently routed on the east side of the tower, but could also be placed on the west side, provided there is adequate clearance from the tower's foundation elements and the BP gas mains.

Based on preliminary information provided by PSE regarding the transmission tower foundation, the sewer's nearest trench wall should not be closer than 20 feet from the centerline of the transmission tower's foundation system. The Option 2 configuration provides this required separation. If the main is located on the west side of the transmission tower, a similar 20 foot sanitary sewer pipe clearance from center of tower would result in an approximately 20 foot separation from the existing BP gas pipes.

Once past the transmission tower, the proposed main would continue north to Strander Blvd. KCWTD does not want to route the sanitary sewer under Strander Blvd with a siphon. This option will require pipe penetrations in unreinforced sections of the secant pile walls on either side of the roadway. The pipe will pass through the top of the groundwater seal, requiring additional reinforcing. Once it has exited the roadway section, the pipe would turn east under the UPRR rail bed and connect to the existing sewer pipe on the east side. Work under the UPRR rail bed may be phased with construction of the railroad's shoofly to avoid a jack/bore under the rail bed.

Option 3 Alignment Description

Option 3 improvements begin at the existing 36 inch main, approximately 200 feet south of Strander Boulevard and inside the PSE right-of-way, similar to Option 2. A new manhole would be set at the tie-in and the alignment would turn generally north inside the PSE right-of-way. PSE's corridor is 100 feet wide, and currently accommodates a large diameter BP gas main along the west side, a larger electrical transmission tower in the center, and a longer narrow wetland on the east side. The proposed sewer main is currently shown on the east side of the tower, but could also be placed on the west side, provided there is adequate clearance from the tower foundation elements and the BP gas main.

Based on preliminary information provided by PSE regarding the transmission tower foundation, the sewer's nearest trench wall should not be closer than 20 feet from the centerline of the transmission tower's foundation system. The Option 3 configuration provides this required separation. If the new main is located on the west side of the transmission tower, a similar 20 foot sanitary sewer pipe clearance from center of tower would result in an approximately 20 foot separation from the existing BP gas pipe.

Once past the transmission tower, the main would turn west into the Jack in the Box property, turn north again, then cross Strander Blvd. At this location, the finished grade elevations of Strander Blvd will be high enough to avoid conflict with the sewer and will not require penetrating the groundwater seal or secant walls as in Option 2. The new pipe alignment would continue north through the east side of the Taco Bell parcel before turning east and crossing the PSE easement and UPRR property. Similar to Option 2, work under the UPRR rail

bed may be phased with construction of the railroad's shoofly to avoid a jack/bore under the rail bed.

Option Updates

Subsequent to the development of the initial three options, both KCWTD and BP have indicated that they will consider sharing a trench to reduce costs as long as safety and maintenance concerns are properly addressed. BergerABAM revised the Option 1 and Option 3 concepts slightly based on input from KCWTD and BP. Refer to Appendix B for updated versions of Option 1 and Option 3 exhibits only. Option 2 was not modified and included in Appendix B. Please note that the revised options were not discussed in the alternative descriptions above and are presented to facilitate further discussion only. BP prefers re-routing their gas pipes in the alignment shown in Option 3.

OPTIONS' COSTS

A rough order of magnitude cost estimate that includes all material, labor, and equipment was prepared for the three options using WSDOT unit bid prices. All subcontract prices are reflective of current bid prices. Escalation has not been included. An allowance of 20% for undeveloped design details and 10% for construction contingency has been included in this estimate.

The total costs for each sanitary sewer relocation option are

Option 1A	\$1,141,010
Option 1B	\$2,187,250
Option 2	\$ 952,120
Option 3	\$ 884,260

The detailed rough order of magnitude cost estimate is included in Appendix C.

OPTIONS' PROS AND CONS

The three alternatives have been evaluated for criteria that include: cost, schedule, potential conflicts, sanitary sewer sharing a joint trench with BP gas, and impacts to businesses, rail, power, and wetlands. The three options' pros and cons are summarized in Table 1 below.

	Option 1	Option 2	Option 3
Cost	Con - 1.14M (Option 1A), 2.19M (Option 1B)	Neutral - 952K	Pro - 884K
Schedule	Pro - no known major schedule challenges	Con - Requires close coordination with pile/wall contractor. Short window to complete pile penetration work.	Pro - no known major schedule challenges
Conflicts	BNSF, Kaiser	Wall, groundwater seal, UPRR, PSE	Restaurants, UPRR, PSE
Business Impacts	Con - will impact Kaiser parking area. Settling impact mitigation will be required and may increase costs above numbers listed. It is currently unknown how receptive KP will be to this option or to impacts in general.	Pro - avoids impacts	Neutral - will impact restaurants, but franchisees are supportive of project. May require additional costs for settling mitigation, but will likely be less than KP due to size of restaurants.
Rail Impacts	Con - requires jack and bore under BNSF - BNSF is otherwise not interrupted	Pro - potentially installed as an open cut during shoofly sequencing	Pro - potentially installed as an open cut during shoofly sequencing
Power Impacts	Pro - none	Con - must shore to avoid impacts to transmission tower, maintain distance from conductors	Con - must shore to avoid impacts to transmission tower, maintain distance from conductors
Wetland Impacts	Pro - no wetland impacts	Potential Con - could impact wetlands depending on alignment	Potential Con - could impact wetlands depending on alignment

Table 1 Options' Pros and Cons

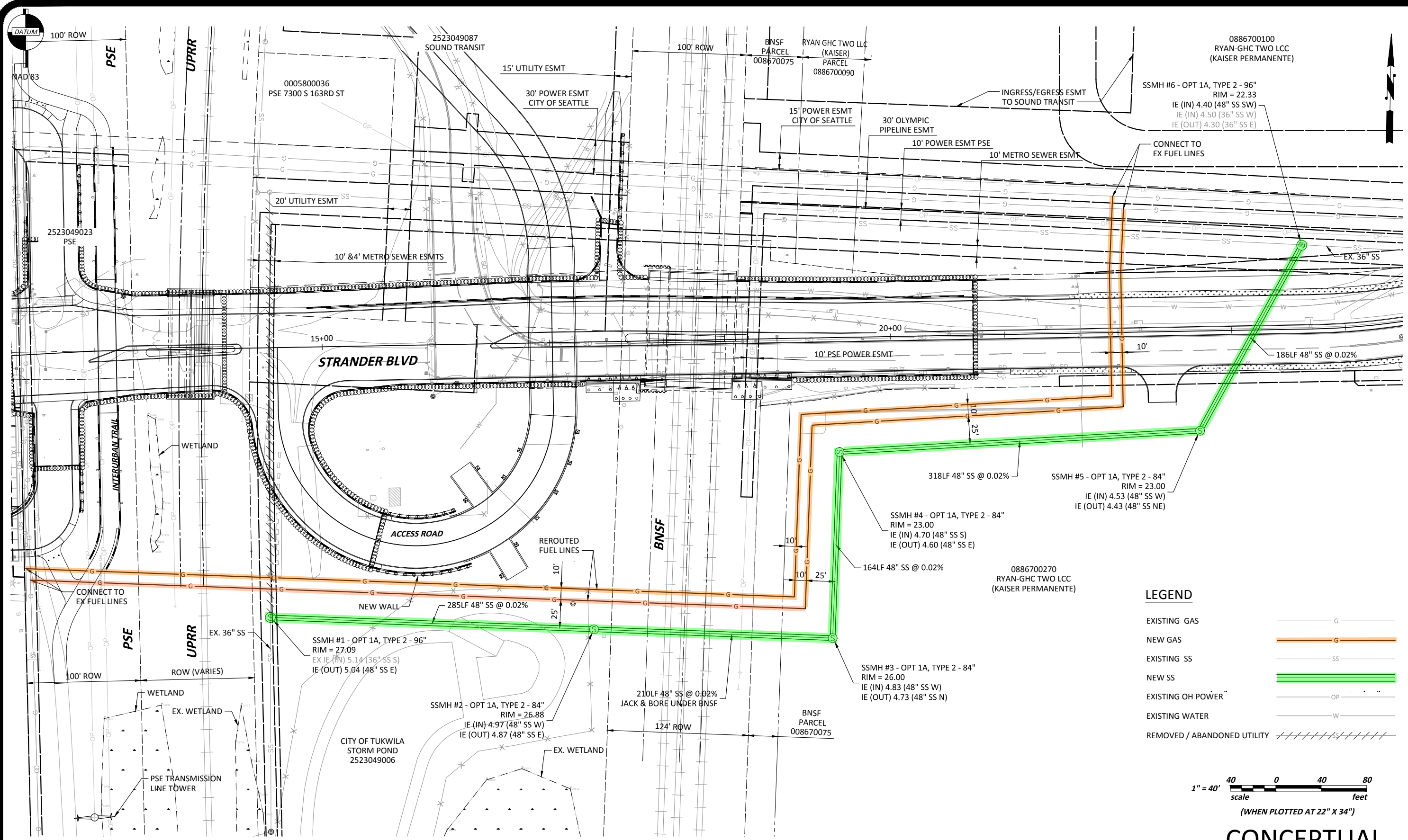
Based on the information provided, the City requests KCWTD recommend their preferred sanitary sewer relocation option.

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Strander Boulevard/Southwest 27th Street Extension - Phase 3
Tukwila, Washington

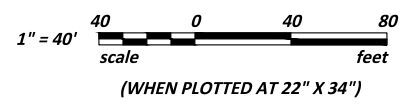
Appendix A

Sanitary Sewer Improvement Exhibits, Options 1-3

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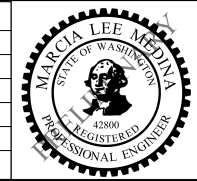
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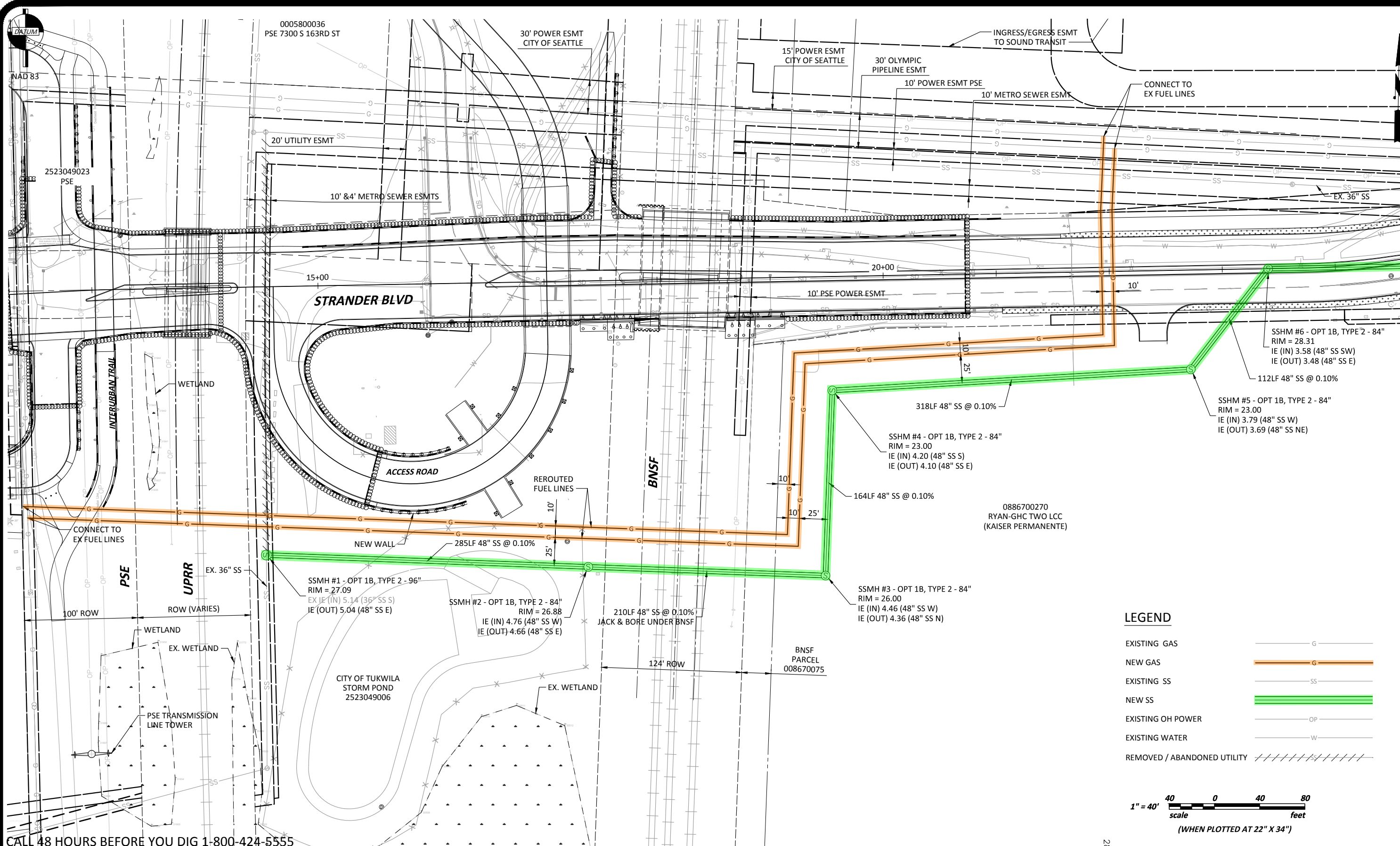
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SANITARY SEWER IMPROVEMENTS EXHIBIT
OPTION 1A

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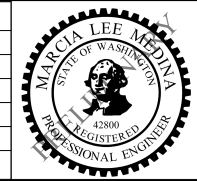
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 OPTION 1B - WEST**

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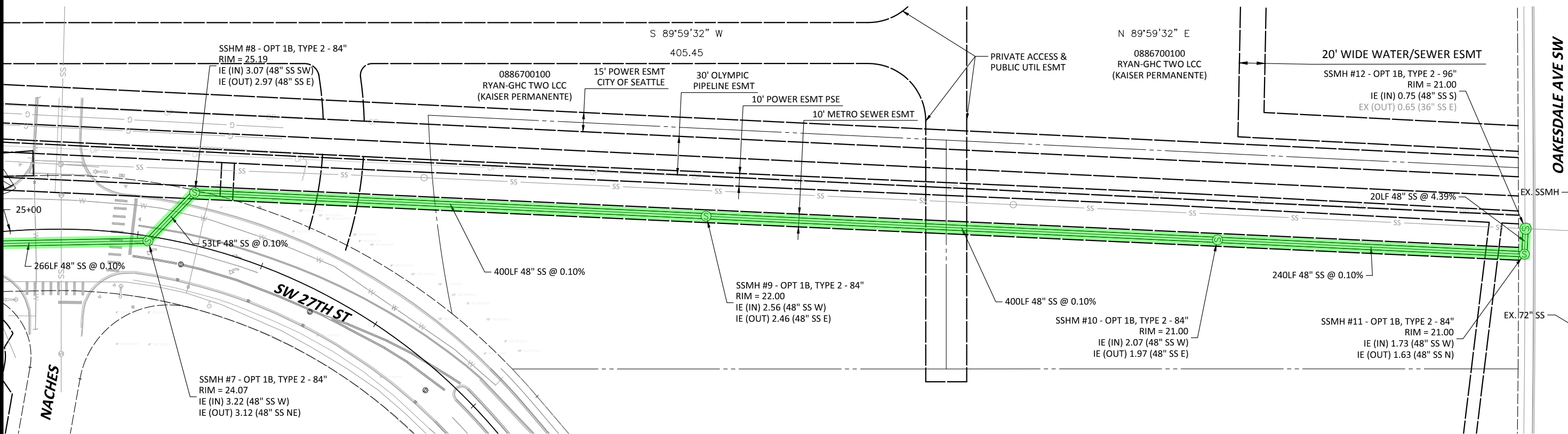
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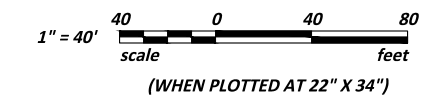


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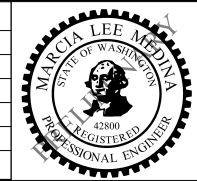


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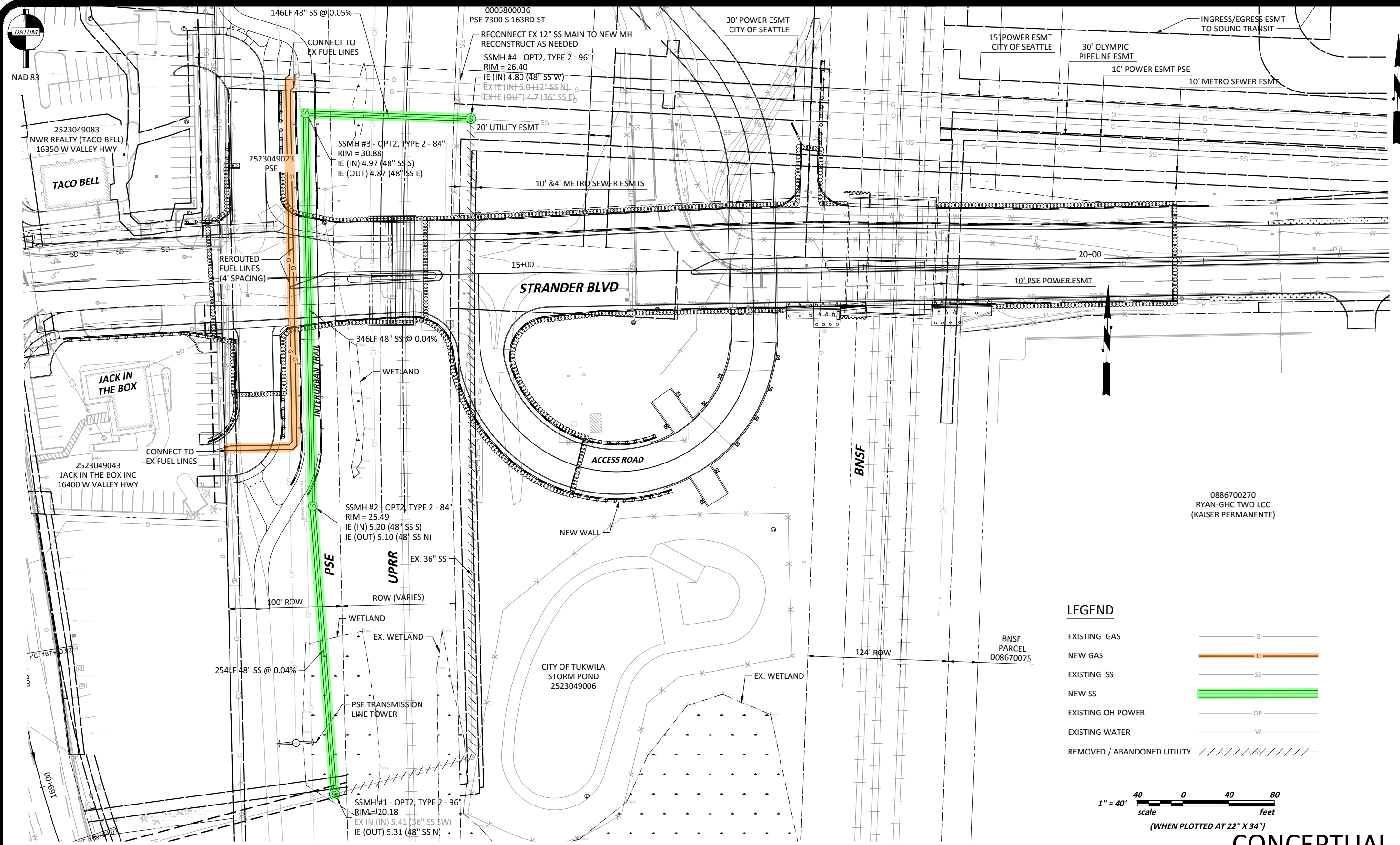
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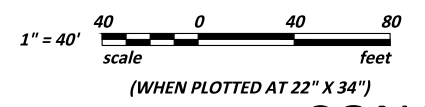
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 OPTION 2**

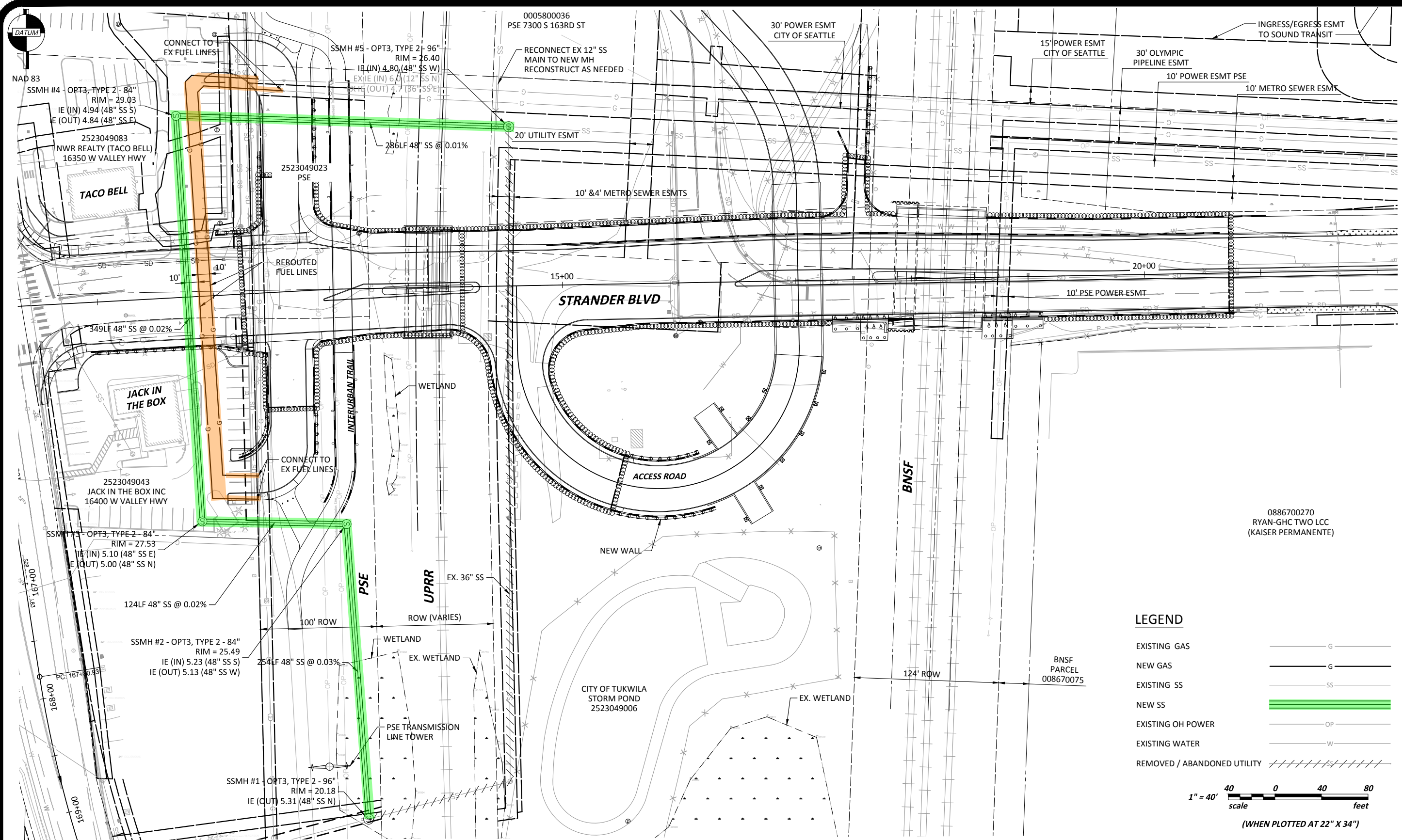
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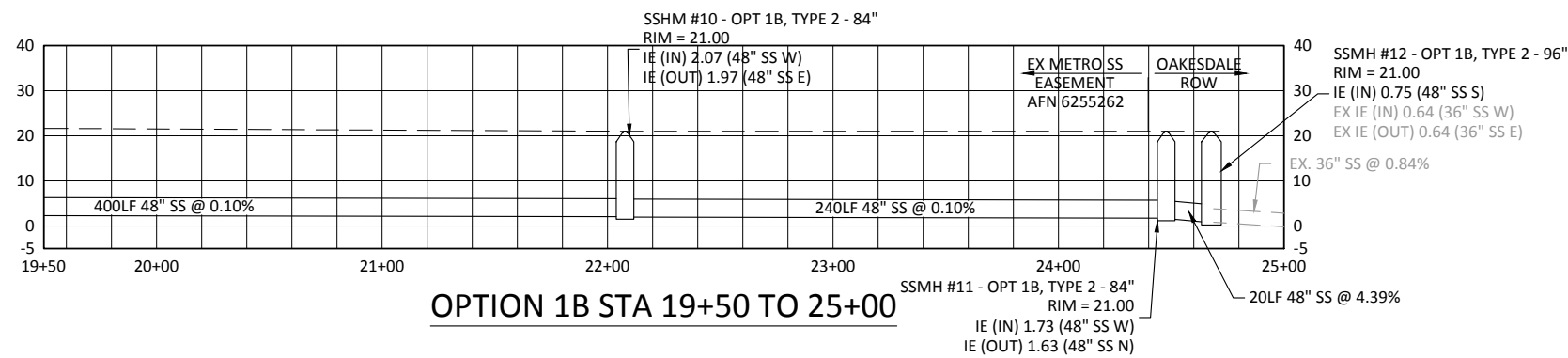
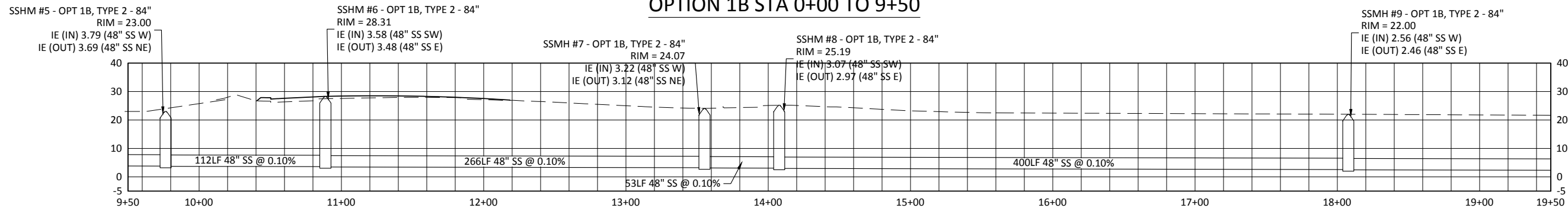
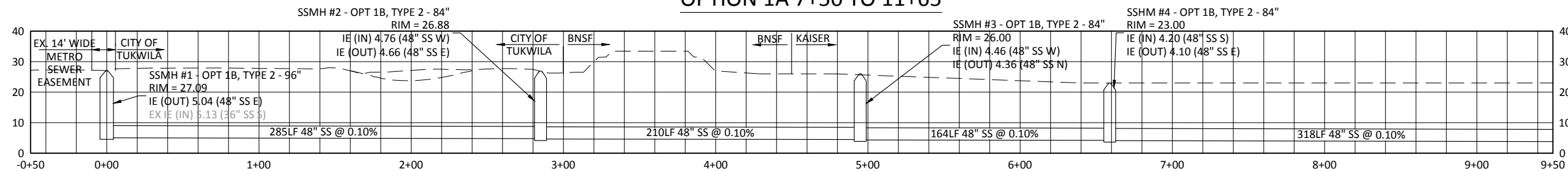
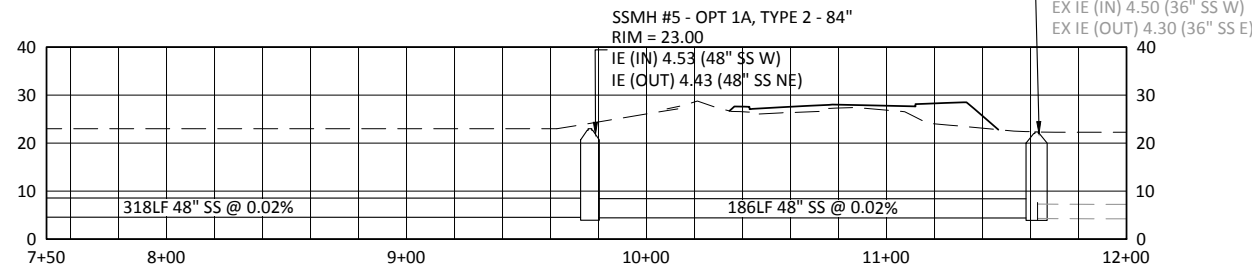
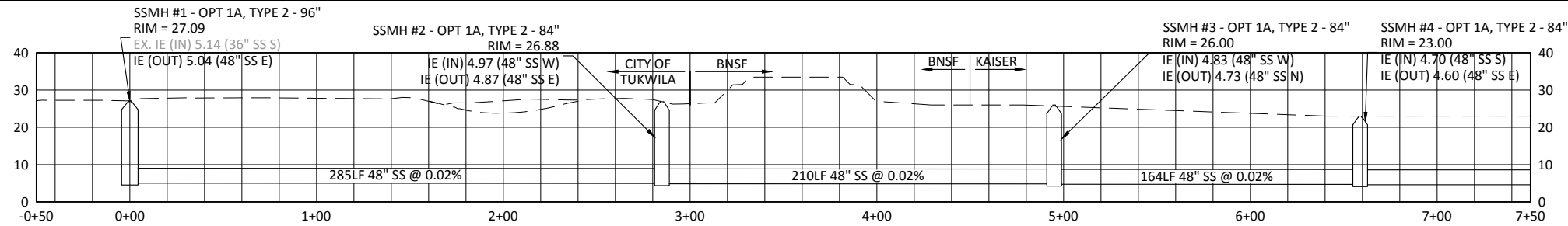
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OPTIONS 1A & 1B PROFILES

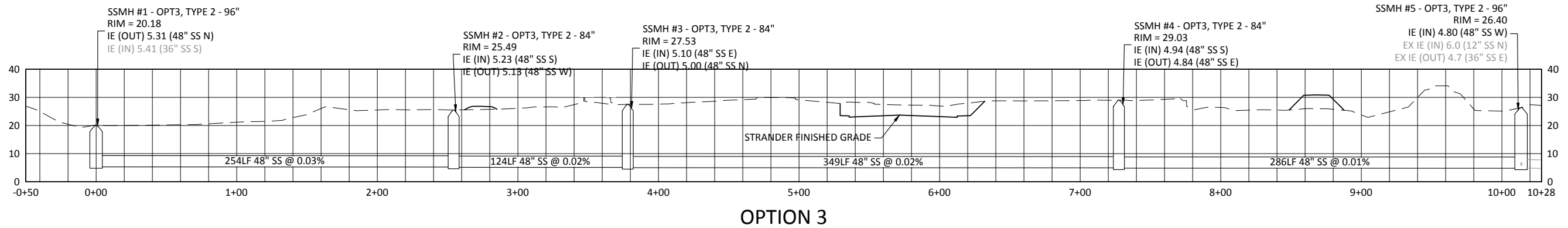
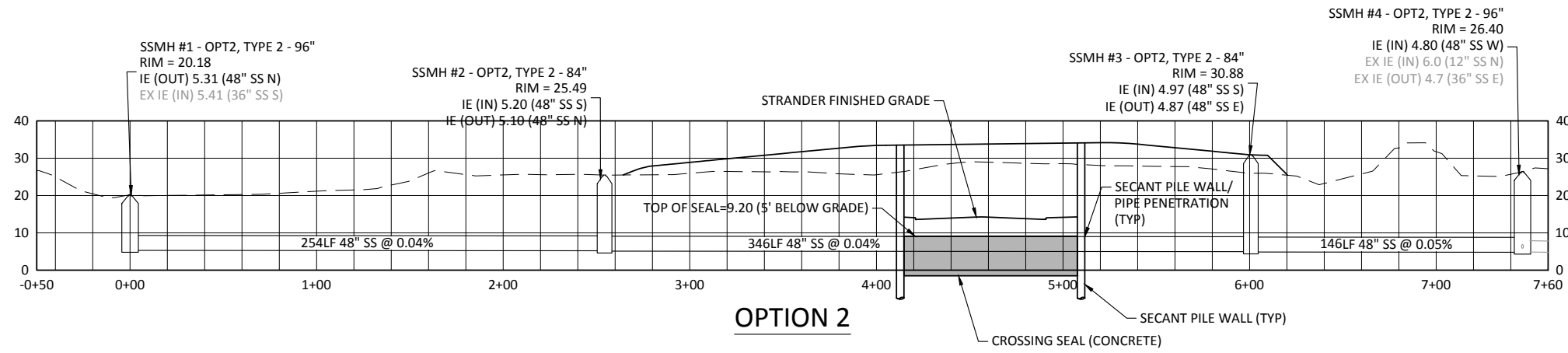
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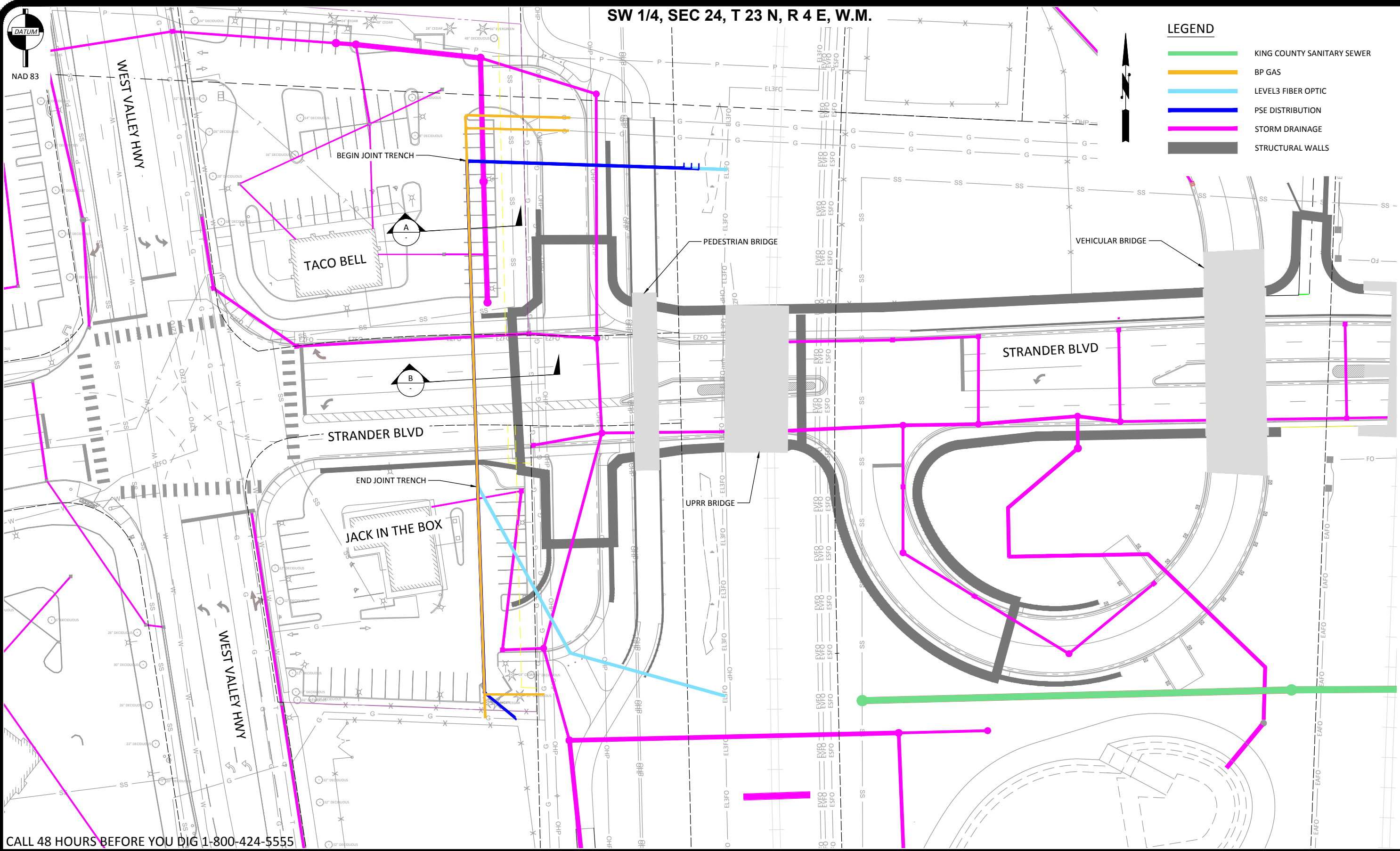
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Strander Boulevard/Southwest 27th Street Extension - Phase 3
Tukwila, Washington

Appendix B

Sanitary Sewer Improvement Exhibits, Options 1 and 3 (Revised)

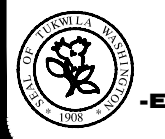
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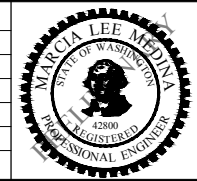
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- KING COUNTY SANITARY SEWER
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 OPTION 1A REVISION**

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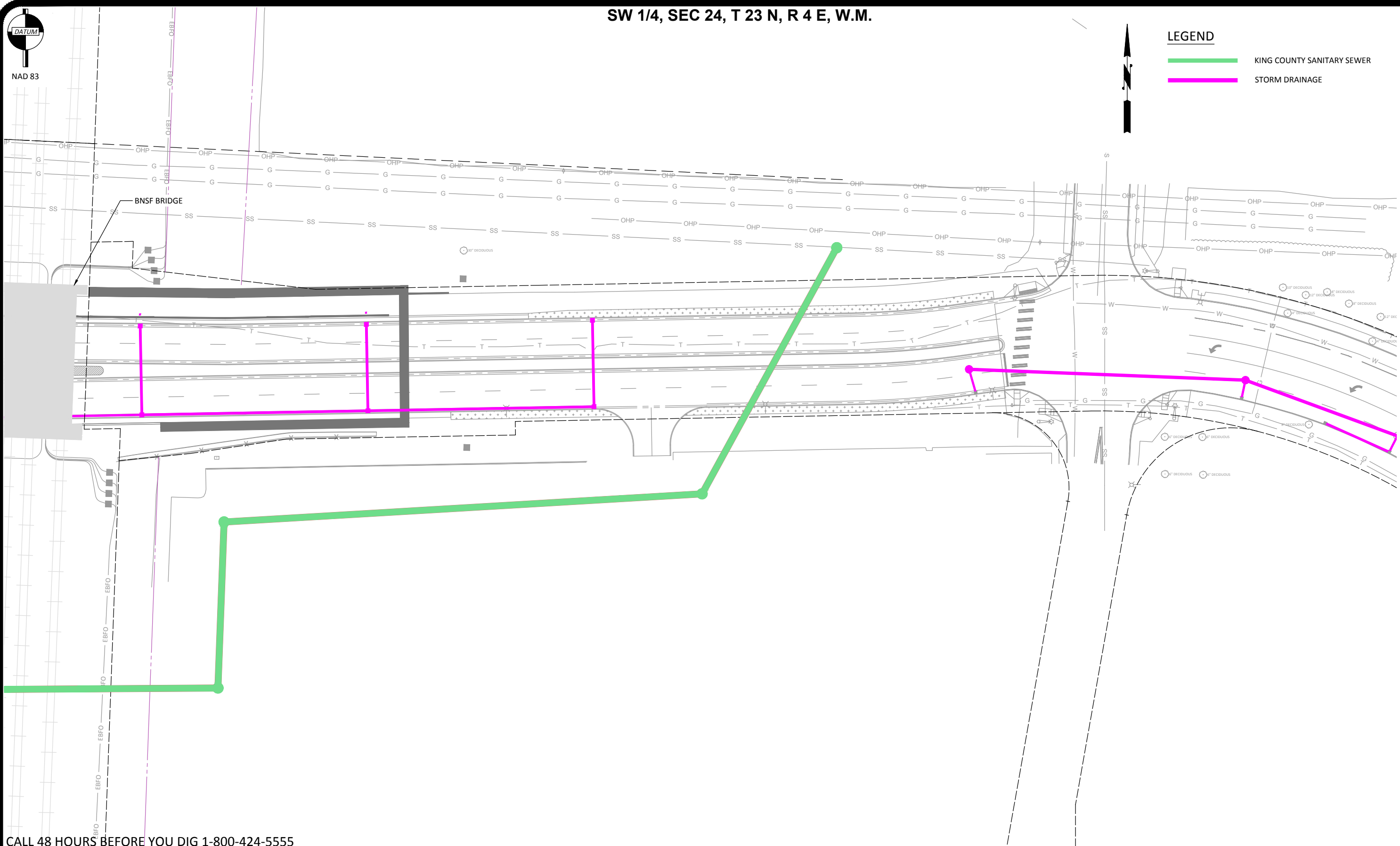
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**STRANDER BOULEVARD EXTENSION
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OPTION 1A REVISION**

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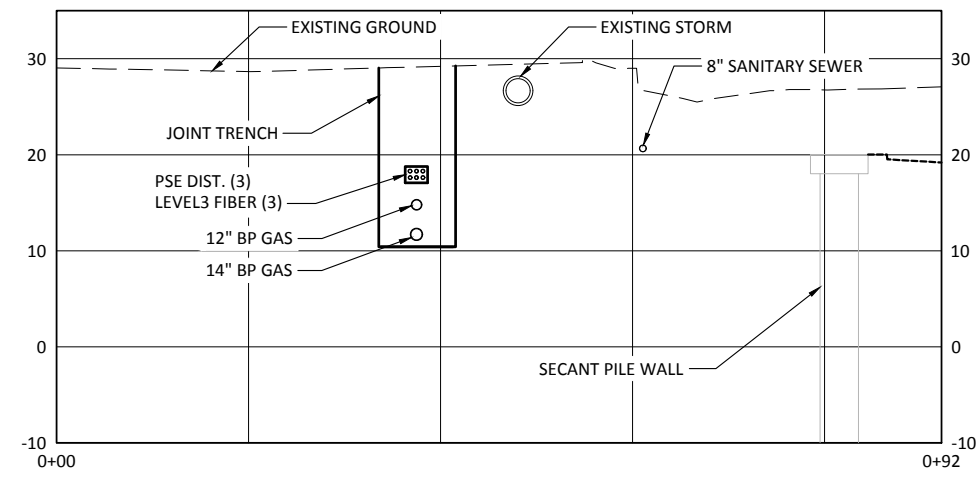
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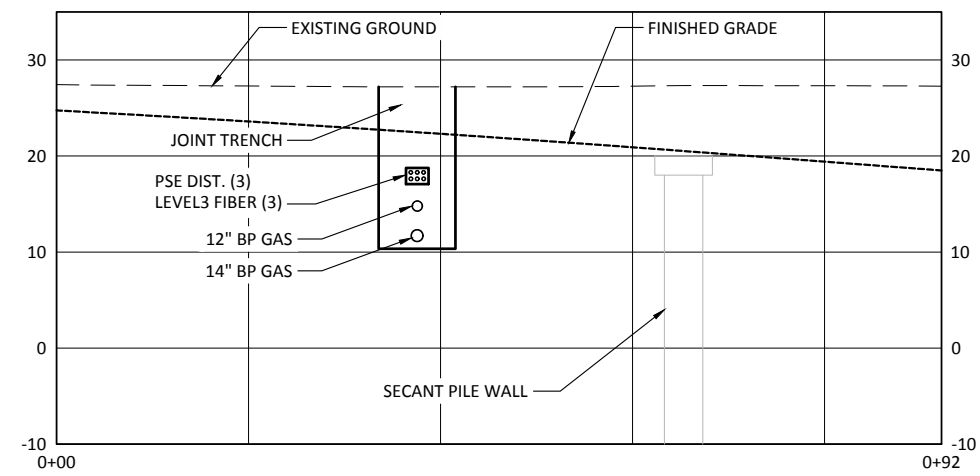
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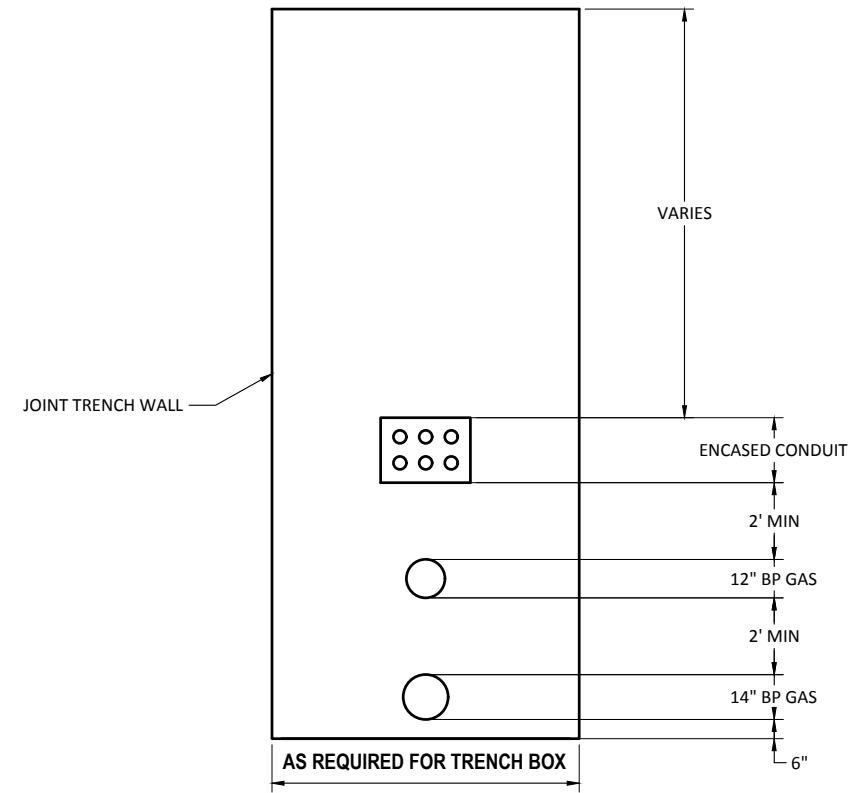
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-ENGINEERING-STREETS-WATER-SEWER-PARKS-BUILDING-

	by	date
designed		
drawn		
checked		
proj eng		
proj dir		
field bk no		



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**STRANDER BOULEVARD EXTENSION
PHASE 3**
**WEST UTILITY ROUTING DETAILS
OPTION 1A REVISION**

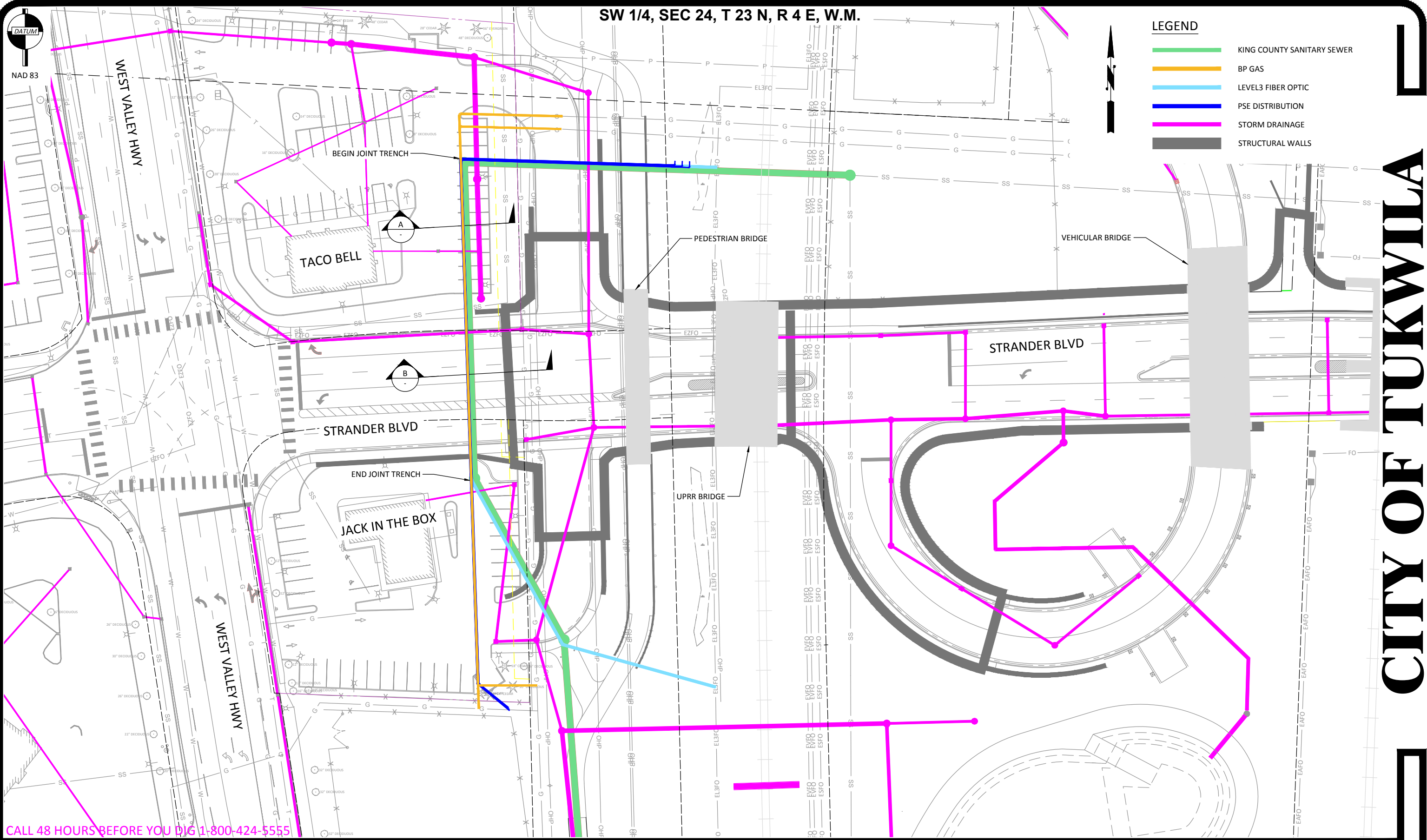
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APPENDIX B
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date _____

CITY OF TUKWILA

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SW 1/4, SEC 24, T 23 N, R 4 E, W.M.



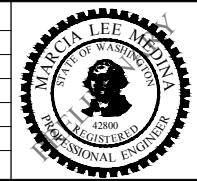
LEGEND

- KING COUNTY SANITARY SEWER
- BP GAS
- LEVEL3 FIBER OPTIC
- PSE DISTRIBUTION
- STORM DRAINAGE
- STRUCTURAL WALLS

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**STRANDER BOULEVARD EXTENSION
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 OPTION 3 REVISION**

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APPENDIX B
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 scale **1"=60'**
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LEGEND

— KING COUNTY SANITARY SEWER

— STORM DRAINAGE

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 OPTION 3 REVISION**

no	date	revisions

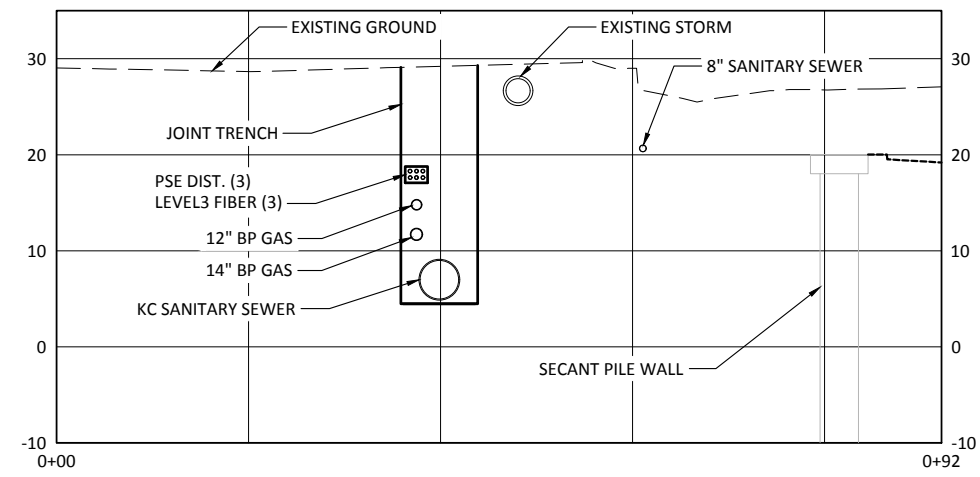
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CITY OF TUKWILA

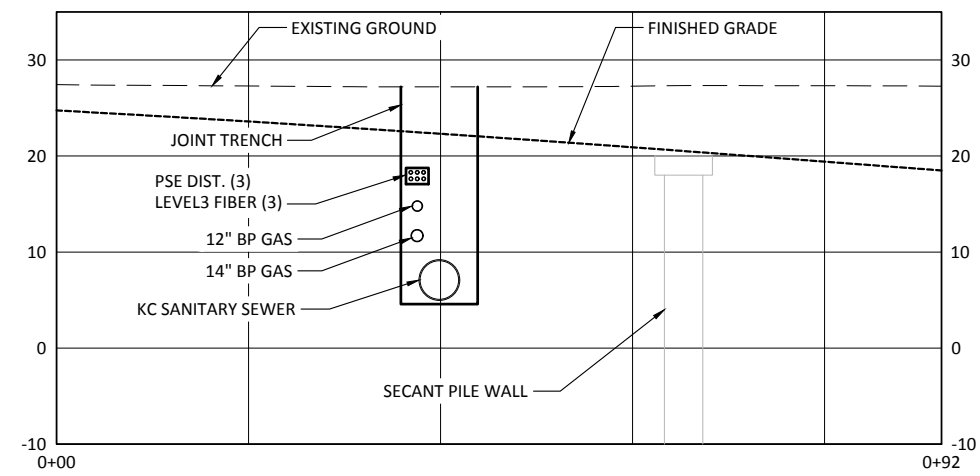
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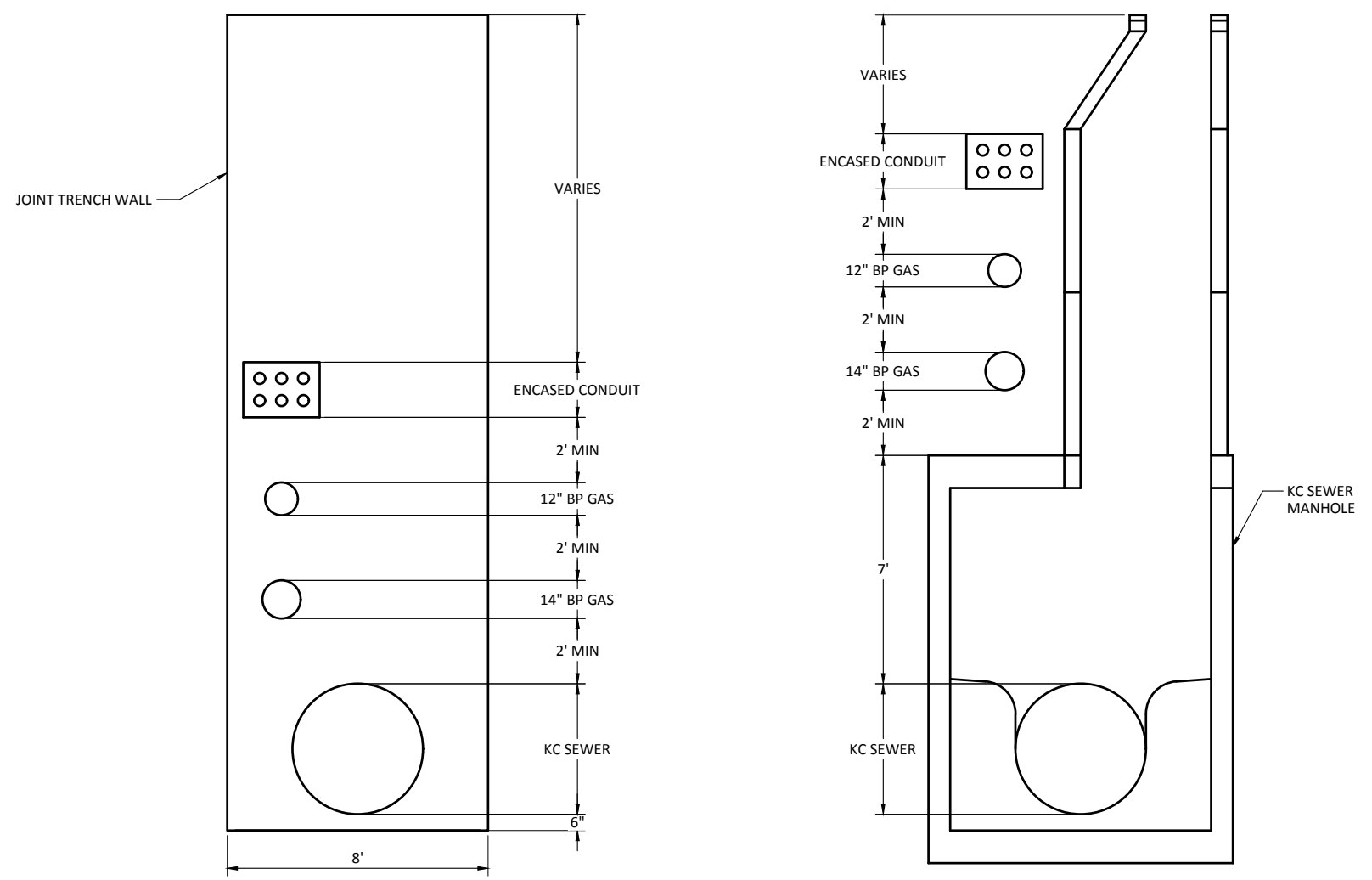
NAD 83



A JOINT TRENCH SECTION
SCALE: NTS



B JOINT TRENCH SECTION
SCALE: NTS



C JOINT TRENCH DIMENSIONS
SCALE: NTS

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**STRANDER BOULEVARD EXTENSION
PHASE 3
WEST UTILITY ROUTING DETAILS
OPTION 3 REVISION**

no	date	revisions

APPENDIX B
file no _____
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date _____

CITY OF TUKWILA

Memorandum
Project Sanitary Sewer Improvements – Alternatives Analysis Memo
Strander Boulevard/Southwest 27th Street Extension - Phase 3
Tukwila, Washington

Appendix C

Cost Estimates, Options 1-3

OPTION 1A

	Quantity	Unit	Unit cost	Total
Connect to existing	2	EA	\$ 5,000	\$ 10,000
SSMH	6	EA	\$ 12,000	\$ 72,000
48" pipe	953	LF	\$ 400	\$ 381,200
Jacking mob	1	LS	\$ 30,000	\$ 30,000
Jack pit	1	EA	\$ 25,000	\$ 25,000
Receiving pit	1	EA	\$ 25,000	\$ 25,000
Jacking/LF	210	LF	\$ 450	\$ 94,500
Shoring	24,000	SF	\$ 5	\$ 120,000
Dewatering	1	LS	\$ 120,000	\$ 120,000
Subtotal				\$ 877,700
Contingency	30%			\$ 263,310

Total

\$ 1,141,010

OPTION 1B

	Quantity	Unit	Unit cost	Total
Connect to existing	2	EA	\$ 5,000	\$ 10,000
SSMH	12	EA	\$ 12,000	\$ 144,000
48" pipe	2258	LF	\$ 400	\$ 903,200
Jacking mob	1	LS	\$ 30,000	\$ 30,000
Jack pit	1	EA	\$ 25,000	\$ 25,000
Receiving pit	1	EA	\$ 25,000	\$ 25,000
Jacking/LF	210	LF	\$ 450	\$ 94,500
Shoring	55,200	SF	\$ 4	\$ 220,800
Dewatering	1	LS	\$ 230,000	\$ 230,000
Subtotal				\$ 1,682,500
Contingency	30%			\$ 504,750

Total

\$ 2,187,250

OPTION 2

	Quantity	Unit	Unit cost	Total
Connect to existing	2	EA	\$ 5,000	\$ 10,000
SSMH	4	EA	\$ 12,000	\$ 48,000
48" pipe	746	LF	\$ 400	\$ 298,400
Wall Penetration & Groundwater Seal	1	LS	\$ 200,000	\$ 200,000
Shoring	19200	SF	\$ 5	\$ 96,000
Dewatering	1	LS	\$ 80,000	\$ 80,000
Subtotal				\$ 732,400
Contingency	30%			\$ 219,720

Total

\$ 952,120

OPTION 3

	Quantity	Unit	Unit cost	Total
Connect to existing	2	EA	\$ 5,000	\$ 10,000
SSMH	5	EA	\$ 12,000	\$ 60,000
48" pipe	1013	LF	\$ 400	\$ 405,200
Shoring	24000	SF	\$ 5	\$ 120,000
Dewatering	1	LS	\$ 85,000	\$ 85,000
Subtotal				\$ 680,200
Contingency	30%			\$ 204,060

Total

\$ 884,260

Note:

These cost estimates only include anticipated construction costs, no property acquisition or easement costs are included.