GILLETTE MADISON PIPELINE PROJECT (GMPP)
TECHNICAL MEMORANDUM #14

Draft 04/28/2011

TO:	Mike Cole, P.E., City of Gillette
FROM:	Dan Korinek, P.E., BMcD Clint Madsen, P.E., BMcD Casey Hanson, P.E., MMI
DATE:	April 28, 2011
JOB NO.:	BMcD #54432, MMI #4776.001,
RE:	18-inch Blending Waterline Alternative Alignment Evaluation
CC:	Darin Brickman, P.E., BMcD Carl Anderson, P.E., MMI Jamie Tarver, P.E., Tarver Consulting Bryan Clerkin, P.E., WWD
ATTACHMENTS:	10% Design Drawings – Figure 1 through 14, 10% Opinion of Probable Construction Cost, Matrix Tables Table 1-1 through 1-3

☐ **Urgent** ☒ **For Review** ☒ **Please Comment** ☐ **Please Reply** ☐ **For Your Use**

INTRODUCTION AND BACKGROUND

This 18-inch Blending Waterline Alternative Alignment Evaluation Technical Memorandum provides a brief overview of the 10% pipeline alignment and easements. The Blending Waterline will be an connection to the existing soft water main that originates from Pump Station #1. The new blending waterline will tie into the Gillette Madison Transmission Pipeline at the proposed blending point near WYODAK and Highway 51. The proposed alignments are approximately between 5 and 6.3 miles long depending on the chosen alignment. The modeling efforts performed in Technical Memorandum (TM) #7 – Hydraulic Modeling of the Pre Design

Report on the Gillette Madison Pipeline Project dated November 22, 2010 sized the Blending Waterline.

BLENDING WATERLINE 10% ALIGNMENT EVALUATION

The following section provides specific information regarding the proposed alignment alternatives for the Blending Waterline. As seen in Figure 1 there are two proposed connection points for the transmission line to the existing system one near US Highway 14/16 and Butler-Spaeth Road (Segment #1) and the second connection point located at N. Gurley Avenue and E. Warlow Drive (Segment #2). Either of the proposed segment alignments will connect to Segment #3 at State Highway 51 and the extension of Badger Avenue where the final segment will continue to the proposed blending point.

Segment #1

The general alignment for Segment #1 is shown in Figures 1 through 3 as a solid blue line. The alignment begins at Highway 14/16 and Butler-Spaeth Road. The alignment would head east along Highway 14/16 crossing Interstate 90 as 3 separate bores and then follows Highway 51 to the connection point with Segment #3.

Segment #1 would consist of approximately 2.0 miles of 18-inch waterline and 850 feet of 30-inch casing for the bores at Interstate 90. It is anticipated that all of the alignment will be within or adjacent to Wyoming Department of Transportation (WYDOT) right-of-way (ROW). Currently there are two WYDOT construction projects located along the alignment of Segment #1. Both projects are depicted on Figure 1. Project “A” - a pathway improvement project is to be under construction in 2011. Project “B” - a pathway improvement project is to be under construction in 2014.

Segment #2

The general alignment for Segment #2 is shown in Figures 1, 3, and 4 through 5 as a solid orange line. The alignment begins at N. Gurley Avenue and E. Warlow Drive. The alignment would head east along Warlow Drive to Garner Lake Road, then north to an existing well line easement, then east along the existing well easement to the east edge of the property, then the alignment would head south following the property line. There the alignment would need to be bored under Interstate 90, after the interstate the alignment would again follow a property line until the alignment could be aligned along Badger Avenue. The alignment would follow Badger Road to the south until the alignment would need to cross a parcel owned by Campbell County south of University Road and then a bore under Burlington Northern Santa Fe Railroad and Highway 51 to the connection point with Segment #3.

Segment #2 would consist of approximately 3.4 miles of 18-inch waterline and 390 feet of 30-inch casing for the bores at Interstate 90, railroad, and Highway 51. It is anticipated that the majority of the alignment would be in the City of Gillette’s ROW however portions of the alignment will need permanent easements. Currently there is one WYDOT construction project located along the alignment of Segment #2. The project is depicted on Figure 1. Project “B” - a pathway improvement project is to be under construction in 2014.

Segment #3

The general alignment for Segment #3 is shown in Figures 1 and 6 through 7 as a solid green line. The alignment begins at the connection point. The alignment would head east along

Highway 51 crossing two creeks (unnamed and Donkey) as 2 separate bores as the alignment heads east to the location of the Blending Point.

Segment #3 would consist of approximately 2.9 miles of 18-inch waterline and 480 feet of 30-inch casing for the bores at the creek crossing. It is anticipated that all of the alignment will be within or adjacent to WYDOT right-of-way. Currently there are two WYDOT construction projects located along the alignment of Segment #3. Both projects are depicted on Figure 1. Project "B" - a pathway improvement project and Project "C" - widen and resurface project are both to be under construction in 2014.

The property lines and ownership information shown on Figures 2 through 7 has been obtained from the City of Gillette and the Campbell County website. The property lines shown are approximate and will be verified by the field survey. The property ownership information including Landowner Name and Parcel Identification Number will also be verified by the project team.

BLENDING WATERLINE LAYOUT CRITERIA

The following design criteria were used to develop the Blending Waterline Alignment.

1. Utilize existing public ROW, property, or easement where possible.
2. Minimize the number of affected properties and affected landowners.
3. Minimize the amount of disturbed area:
    a. Avoid trees, escarpments, monuments, etc.
4. Stay away from environmentally sensitive areas:
    a. Avoid wetlands, habitats, ponds, streams, and rivers;
        i. Bores may be required to cross rivers and streams, and
        ii. Named creeks and streams are likely waters of the United States and extra protection and bores may be required.
5. Minimize the number of road crossings which would require expensive bores or elaborate traffic control measures.
6. Attempt to maintain reasonable access to the pipeline without additional construction.
7. Minimize the number of railroad crossings.
8. Minimize the length of pipe within railroad property.
9. Avoid any parallel installation within railroad property.
10. Minimize conflicts with proposed WYDOT planned construction projects.
11. Secure a minimum of a 60-foot wide permanent easement:
    a. Provide and additional 40-feet of temporary construction easement.
12. Maintain at least 100-feet from high voltage power lines with any parallel metallic piping.

The following table presents a general narrative of the location of Blending Waterline, important alignment considerations, and the proposed alignment location.

Table 1a – 10% Blending Waterline Alignment, Segment #1			
Drawing Number	Pipeline Area	Other Alignment Factors	Proposed Alignment Location
Figure 2 through Figure 3	Intersection of Hwy 14/16 and Butler-Spaeth Road to the connection point near Hwy 51 across from Badger Ave.	• Additional easement would be required if ROW doesn't exist or if there are utility conflicts within the ROW. • Is open cut construction acceptable across: El Camino Rd, Stetson Dr, Axels Rd, and/or Garner Lake Rd? • I-90 would need to be bored in 3 separate locations.	• Proposed Blending Waterline would be located south of the shoulder of Highway 14/16 and 51, but remain in the ROW.

Table 1b – 10% Blending Waterline Alignment, Segment #2			
Drawing Number	Pipeline Area	Other Alignment Factors	Proposed Alignment Location
Figure 4 through Figure 5	Intersection of N. Gurley Ave and E. Warlow Dr. to the intersection of Garner Lake Road and E. Warlow Dr.	• It is assumed that enough ROW would be available for the blending waterline so that it would not need to be located in the street. • Is open cut construction acceptable across: S. Enterprise Ave, Limestone Ave., and/or Garner Lake Rd?	• Proposed Blending Waterline would be located south of the shoulder of E. Warlow Drive but remain in the ROW.
Figure 5	Intersection of Garner Lake Road and E. Warlow Drive to the easement for well line Soft 22.	• It is assumed that enough ROW would be available for the blending waterline so that it would not need to be located in the street.	• Proposed Blending Waterline would be located on the east or west sides behind the shoulder of Garner Lake Road but remain in the ROW.
Figure 5	Easement of well line Soft 22.	• It is assumed that enough easement would be available for the blending waterline so that additional easement would not be required.	• Proposed Blending Waterline would be located in the easement for well line Soft 22.
Figure 5	Sprigler Properties	• Easement would need to be acquired for these two Sprigler properties. • I-90 would need to be bored.	• Proposed Blending Waterline would be located along the easterly property boundaries.
Figure 5	Intersection of Badger Ave. and Highline Rd to the intersection of Badger Ave. and University Rd.	• It is assumed that enough ROW would not be available for the blending waterline so that it would need to be located in the street.	• Proposed Blending Waterline would be located within the Badger Ave. ROW..

Table 1b – 10% Blending Waterline Alignment, Segment #2			
Drawing Number	Pipeline Area	Other Alignment Factors	Proposed Alignment Location
Figure 5	Campbell County Public Land Board Property	• Easement would need to be acquired the property.	• Proposed Blending Waterline would cut through the westerly portion of the property.
Figure 5	Railroad and Highway 51	• License agreement would need to be acquired the property. • This section would need to be bored.	• N/A

Table 1c – 10% Blending Waterline Alignment, Segment #3			
Drawing Number	Pipeline Area	Other Alignment Factors	Proposed Alignment Location
Figure 6 through Figure 7	The connection point near Hwy 51 across from Badger Ave to the Proposed Blending Point.	• Additional easement would be required if ROW doesn't exist or if there are utility conflicts within the ROW. • Is open cut construction acceptable across: Fox Park Avenue? • The two creeks would need to be bored.	• Proposed Blending Waterline would be located south of the shoulder of Highway 51, but remain in the ROW.

EASEMENTS

The following section provides preliminary information regarding the property owners from whom permanent easements, blanket easements, license agreements, and crossing agreements may be required for the Blending Waterline of the Gillette Madison Pipeline project. The permanent easements will be required since the pipeline will need to be placed through private property or outside of the right-of-way limits. The blanket easements will be required where the Wyoming Department of Transportation and/or Campbell County may not have clear title to the area indicated as right-of-way. There will also be temporary construction easements required for this project, but they will not be indicated until the actual survey and ownership information is available. It should be noted that for all information obtained for this 10 percent evaluation that the property owner name and parcel identification numbers were obtained from the county assessor's website between April 4 and April 5, 2011. In some cases, the assessor's website did not include property lines or ownership information for the railroad or for road right of way. The counties assessor's website may not provide the most current information available. For example, if a recent land transaction or new boundary survey has taken place. Table 2a, 2b, and 2c indicates the location of the easements, property owner, parcel number and type of easement expected for each of the proposed segments at this phase of the project:

Table 2a –10% Blending Waterline Easements, Segment #1			
Drawing Number	Property Owner	Parcel Number	Type of Easement
Figure 2	State of Wyoming		License Agreement for Highway 14/16
Figure 2	State of Wyoming		License Agreement for Interstate 90
Figure 3	State of Wyoming		License Agreement for Highway 51

Table 2b – 10% Blending Waterline Easements, Segment #2			
Drawing Number	Property Owner	Parcel Number	Type of Easement
Figure 4 & 5	City of Gillette, East Warlow Drive		N/A
Figure 5	Sprigler Leo F & Iola M Revocable Trust	17507100001053	Permanent
Figure 5	State of Wyoming		License Agreement for Interstate 90
Figure 5	Sprigler Iola M, Leo F & Linda R	17507100001055	Permanent
Figure 5	City of Gillette, Badger Ave.		N/A
Figure 5	Campbell County Public Land Board	17507130102001	Permanent
Figure 5	BNSF Railroad		Crossing Agreement
Figure 5	State of Wyoming		License Agreement for Highway 51

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Table 2c – 10% Blending Waterline Easements, Segment #3			
Drawing Number	Property Owner	Parcel Number	Type of Easement
Figures 6 & 7	State of Wyoming		License Agreement for Highway 51

BLENDING WATERLINE – ALTERNATE ALIGNMENT

An alternate alignment has been shown on the 10% design figures for Segment #2 as a dashed line. This alignment through the Sprigler property would decrease the alignment distance for Segment #2 by 740 feet. The alignment would be decreased by turning south at Garner Lake Road and then paralleling Interstate 90. As an easement agreement with the Springler's and/or WYDOT would be required with the original alignment no additional easements would be required, but easement alignment would be for the revised route.

The alternate alignment is indicated on Figure 5.

HYDRAULIC MODEL

MMI adjusted the system hydraulic model indicated in TM #7 to estimate the hydraulic grade line at the beginning of Segments #1 and #2 and at the end of Segment #3. As part of the

model they adjusted the pump discharge from Pump Station #1 to overcome the flow condition at the blending point when all the flow and pressure of the Gillette Madison Pipeline passing through the blending point. This should be a worst case scenario for Pump Station #1. The results of that model run are given below:

Table 3 – 10% Blending Waterline System Pressure per the Hydraulic Model

Location	Hydraulic Grade Elevation	Ground Surface Elevation	Estimated Line Pressure
Segment #1 (beginning)	4844.3	4518	141 PSI
Segment #2 (beginning)	4852.2	4540	135 PSI
Segment #3 (ending)	4822.7	4430	170 PSI

The increase in system pressure may require that some of the laterals off of the existing soft water main may need to be isolated or have a PRV installed at the connection points for proper system operations. With the increase output of the existing Pump Station #1 the Blending Waterline will be able to overcome the elevation changes along the proposed alignments without any difficulties. Figures 8 through 14 include a preliminary profile for each segment and indicate possible locations for air vacs and blow off not knowing locations and depths of existing utilities.

The ability of the existing soft water main to handle the increase line pressures was brought up as a concern. In discussions between MMI and the City of Gillette it was found that the existing pipe material will carry the additional pressure without any issues.

BLENDING WATERLINE – ALLOWABLE MATERIALS

At the 10% design phase, it is important to begin consideration of the pipe material for the Blending Waterline. Careful selection of the appropriate material will play an important role in the design, performance, and cost of the pipeline. In TM #10 – Pipeline Material Evaluation and Recommendations section allowed the following pipe material into the specifications; Steel, Ductile Iron, and PVC – Only as pressures allow, with DIP bond coated fittings.

Currently the Engineer's Opinion of Probable Construction Cost for this project was estimated using PVC. This pipe material should be suitable with the current pipe size and pressure. However, it is recommended that the pipe material be reevaluated after the hydraulic analysis for the chosen alignment is finalized.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

A preliminary Engineer's Opinion of Probable Construction Cost is included as part of this Technical Memorandum to aid in the evaluation of cost impacts between Segment 1 and 2 portions of the alignments. The pipe material used for the opinion of probable cost evaluation was PVC. The Final Engineer's Opinion of Probable Construction Cost will be presented with the final plans. Costs associated with this estimate may vary significantly depending on the chosen alignment, selected pipe material and pressure class, and the required number of easements.

The opinions of probable construction cost for the different alignments are indicated in the following table:

Table 4 – 10% Blending Waterline Segments 1 and 2 Cost Evaluation			
Segment Number	Segment Cost	Segment #3 Cost	Total Cost
Segment #1	$4,122,700.00	$4,844,900.00	$ 8,967,600.00
Segment #2	$5,458,700.00	$4,844,900.00	$10,303,600.00

Alternative Alignment Evaluation Matrix

An alignment evaluation matrix has been developed to rate Segment 1 and Segment 2 pipeline alignments according to the established criteria. The order of importance of the criteria was determined by the design team. The criteria are listed in order of importance on Table 1- 1 "Alignment Weighting Matrix Table" from A to L. "A", Availability of existing ROW/Easement has the highest importance of all the criteria.

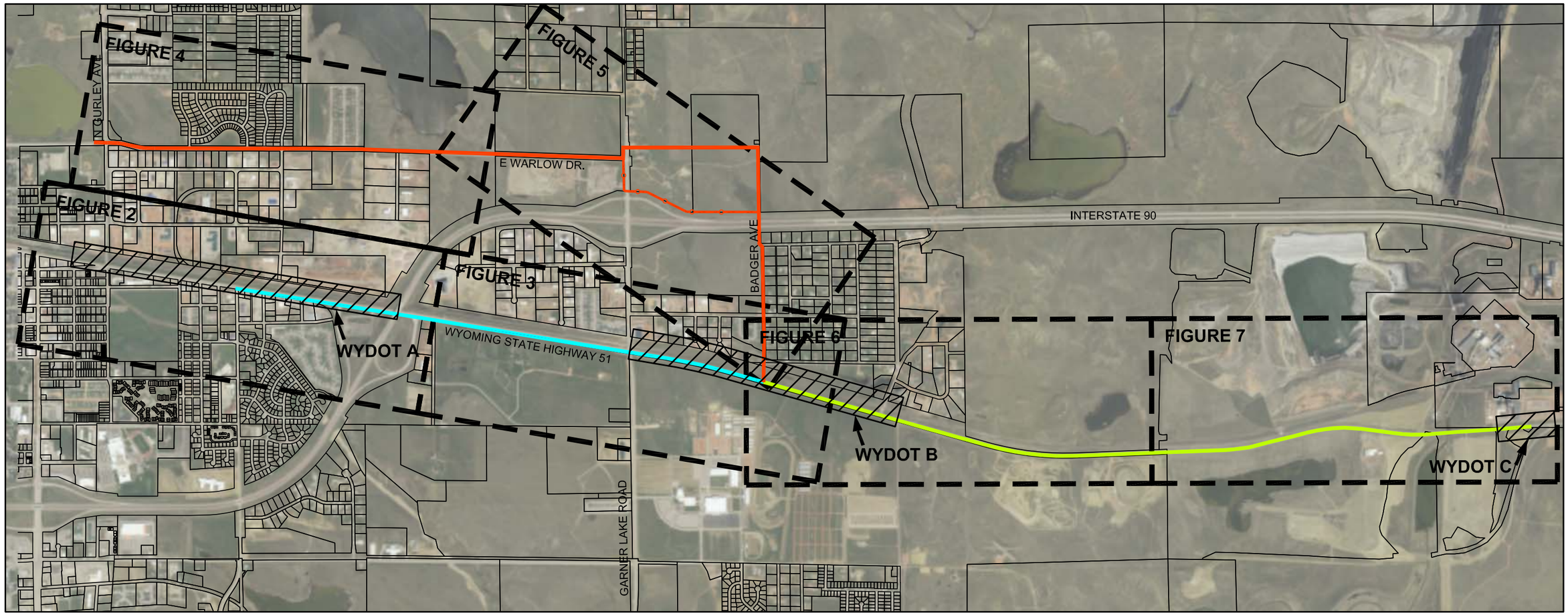
The "Alignment Weighting Matrix Table" Table 1-1 compares each criteria against each of the other criteria and assigns a relative importance number of 0 to 3 with 0 being equal and 3 being 3 times as important. The relative importance numbers for a single criteria are added to determine a total weight of importance for that criteria. For example "A", Availability of Existing ROW/Easement is compared to criteria "B" through criteria "L". The table indicates that when "A" is compared to "B" the relative importance is 2 but when "A" is compared to "C" the relative importance is 0. When the relative importance numbers are added for "A" the total weight is 11.

The "Alignment Ratings Matrix Table" Table 1-2 rates each of the proposed alignments for each of the criteria on a scale of 1 though 10 with 10 being the best and 1 being the worst.

The "Alignment Scoring Matrix Table" Table 1-3 scores each of the criteria for each of the alignments by multiplying the weight from the "Alignment Weighting Matrix Table" by the rating from the "Rating Matrix Table". The scores are then added for each alignment to come out with a total score. The higher the score the better the proposed alignment. The "Alignment Scoring Matrix Table" indicates that Segment 2 is the best alignment based on the criteria.

Recommended Alignment Alternative

As indicated by the results of the alternative alignment evaluation matrix, Segment 2 was selected as the preferred alignment of the Blending Waterline. This is the alignment that runs along Warlow Drive. Therefore the full Blending Waterline recommended alignment would be the combination of Segments #2 and #3.



LEGEND

SEGMENT	LINETYPE	LENGTH
1		10,600 FEET
2		18,000 FEET
2 ALT		3,400 FEET
3		15,500 FEET

WYDOT PROJECTS

	PROJECT#	LENGTH	TYPE	CONSTRUCTION TIME
A	P6210013	1.3 MI	PATHWAY	2011
B	0303019	1.0 MI	PATHWAY	2014
C	0303018	5.0 MI	WIDEN RESURFACE	2014

N

0 2000' 4000'

SCALE IN FEET

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date APRIL 2011

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TECHNICAL MEMORANDUM 14
18" BLENDING WATERLINE STUDY
PROPOSED ALIGNMENT / KEY MAP

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FIGURE 1

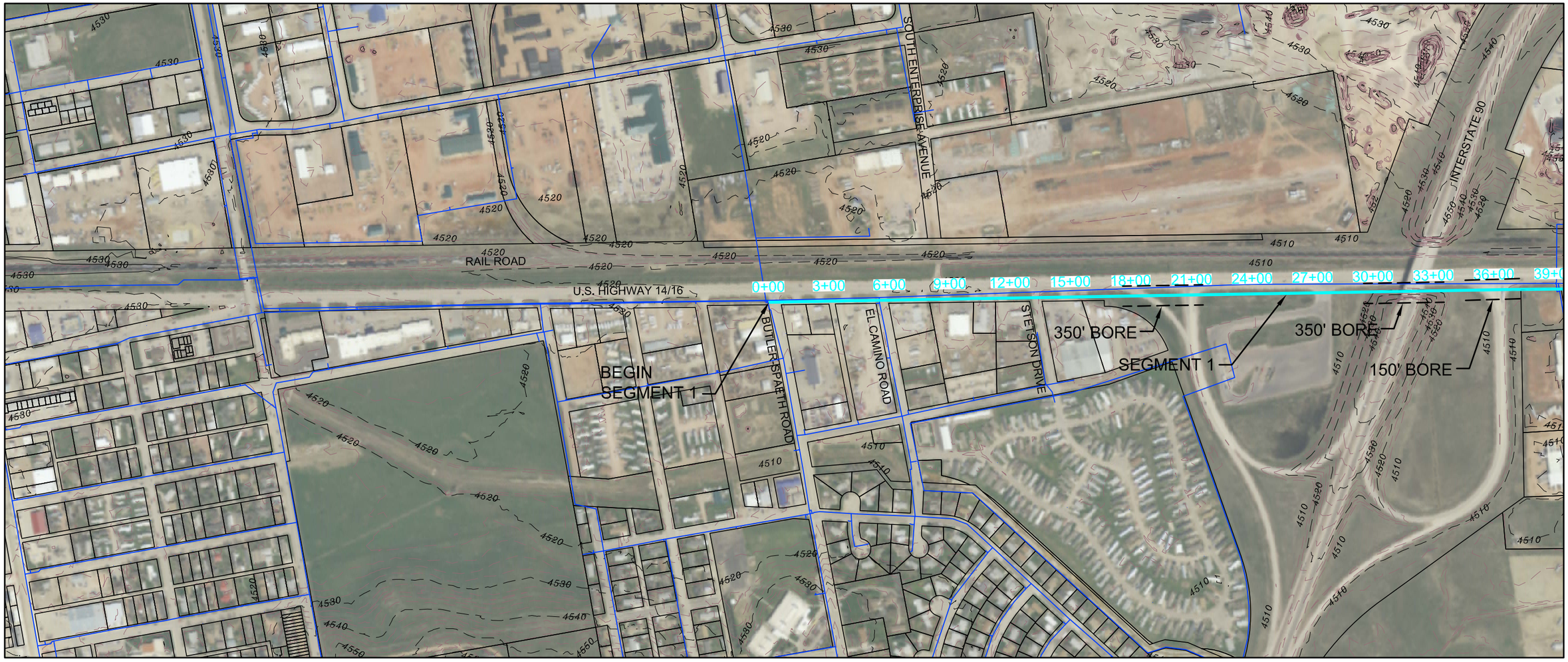

FIGURE 3

LEGEND

- SEGMENT 1
- WATERLINE
- PROPERTY LINE
- INDEX CONTOURS — 4510 —
- INTERMEDIATE CONTOURS - 2'

N

0 500' 1000'

SCALE IN FEET

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TECHNICAL MEMORANDUM 14
18" BLENDING WATERLINE
ALIGNMENT SITE PLAN - SEGMENT 1A

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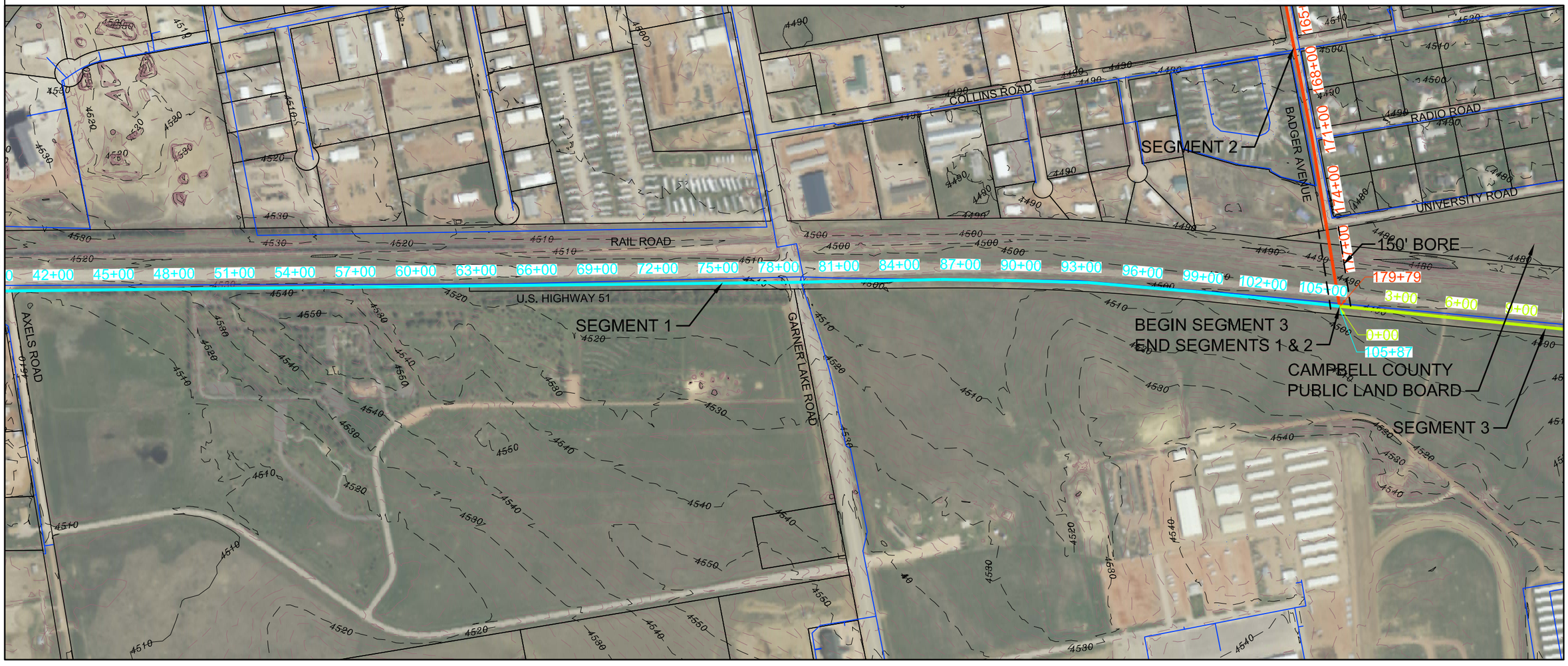
FIGURE 2

FIGURE 5

FIGURE 2

FIGURE 6



LEGEND

- SEGMENT 1
- SEGMENT 2
- SEGMENT 3
- WATERLINE
- PROPERTY LINE
- INDEX CONTOURS — 4510 —
- INTERMEDIATE CONTOURS - 2'

N

0 500' 1000'

SCALE IN FEET

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18" BLENDING WATERLINE
ALIGNMENT SEGMENT 1B -SITE PLAN

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FIGURE 3

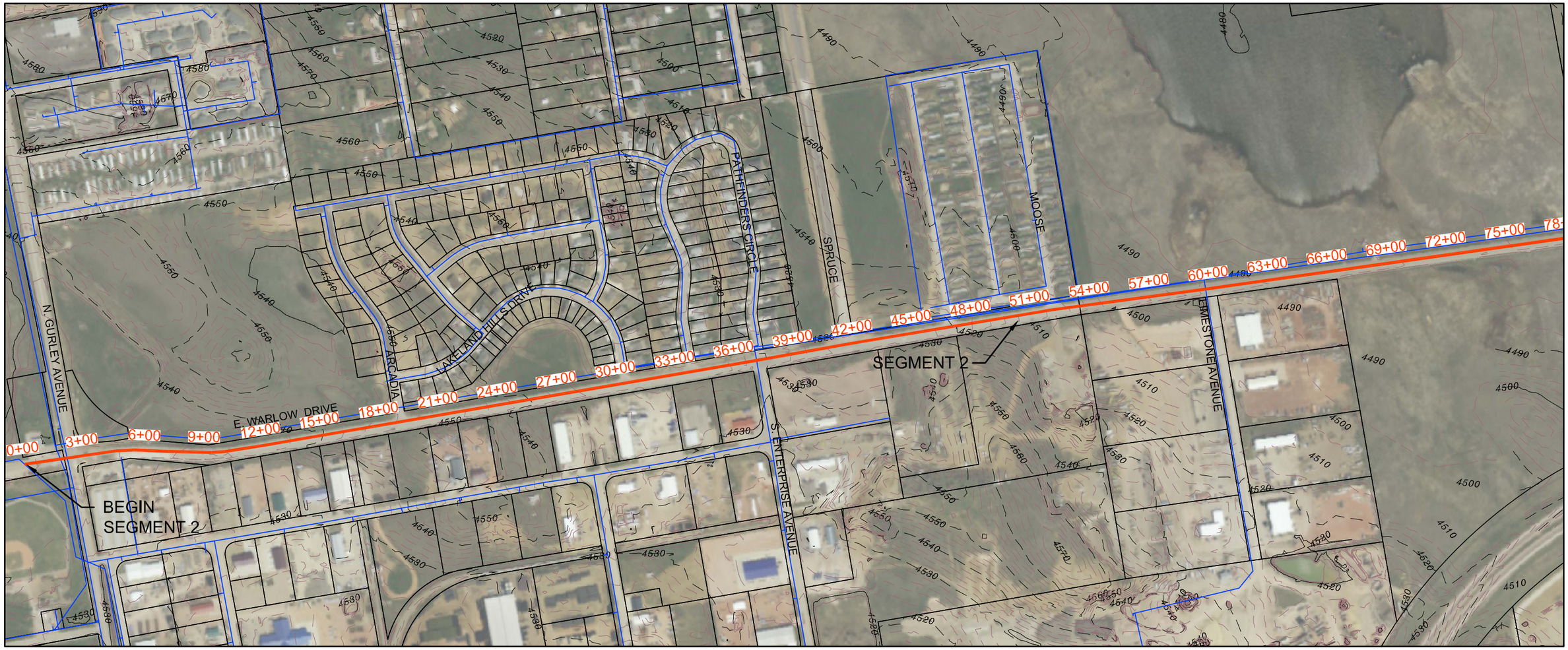

FIGURE 5

LEGEND

- SEGMENT 2
- WATERLINE
- PROPERTY LINE
- INDEX CONTOURS — 4510 —
- INTERMEDIATE CONTOURS - 2'

N

0 500' 1000'

SCALE IN FEET

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18" BLENDING WATERLINE STUDY
ALIGNMENT SEGMENT 2A - SITE PLAN

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FIGURE 4

LEGEND

SEGMENT 1	
SEGMENT 2	
ALT SEGMENT 2	
SEGMENT 3	
WATERLINE	
PROPERTY LINE	
INDEX CONTOURS	4510
INTERMEDIATE CONTOURS - 2'	

N

0 500' 1000'
SCALE IN FEET

PROPERTY OWNER KEYMAP

1 SPRIGLER LEO F & IOLA M REVOCABLE TRUST

2 SPRIGLER LEO F & IOLA M & LINDA R

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18" BLENDING WATERLINE STUDY
ALIGNMENT SEGMENT 2B - SITE PLAN

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FIGURE 5

FIGURE 5

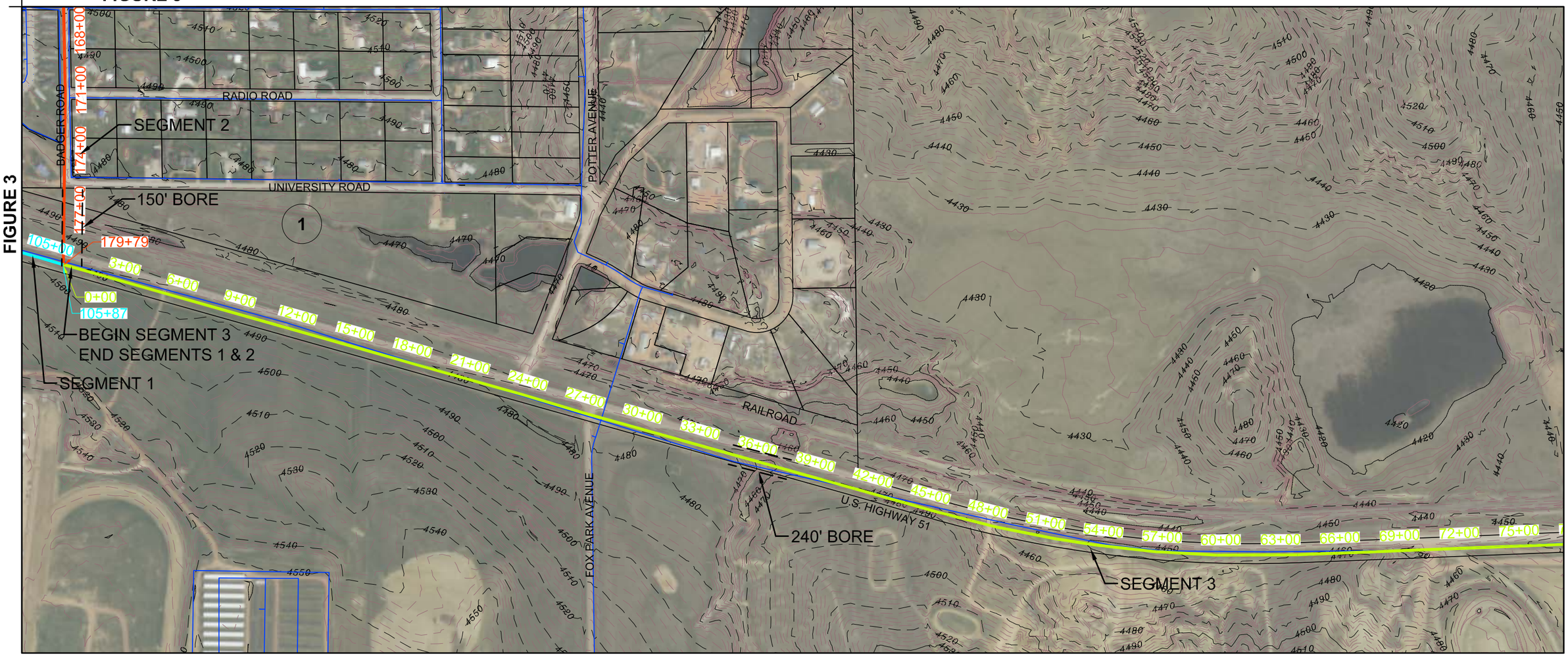

FIGURE 3

FIGURE 7

LEGEND

- SEGMENT 1
- SEGMENT 2
- SEGMENT 3
- WATERLINE
- PROPERTY LINE
- INDEX CONTOURS (4510)
- INTERMEDIATE CONTOURS - 2'

N

0 500' 1000'

SCALE IN FEET

PROPERTY OWNER KEYMAP

1 CAMPBELL COUNTY PUBLIC LAND BOARD

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TECHNICAL MEMORANDUM 14
18" BLENDING WATERLINE STUDY
ALIGNMENT SEGMENT 3A - SITE PLAN

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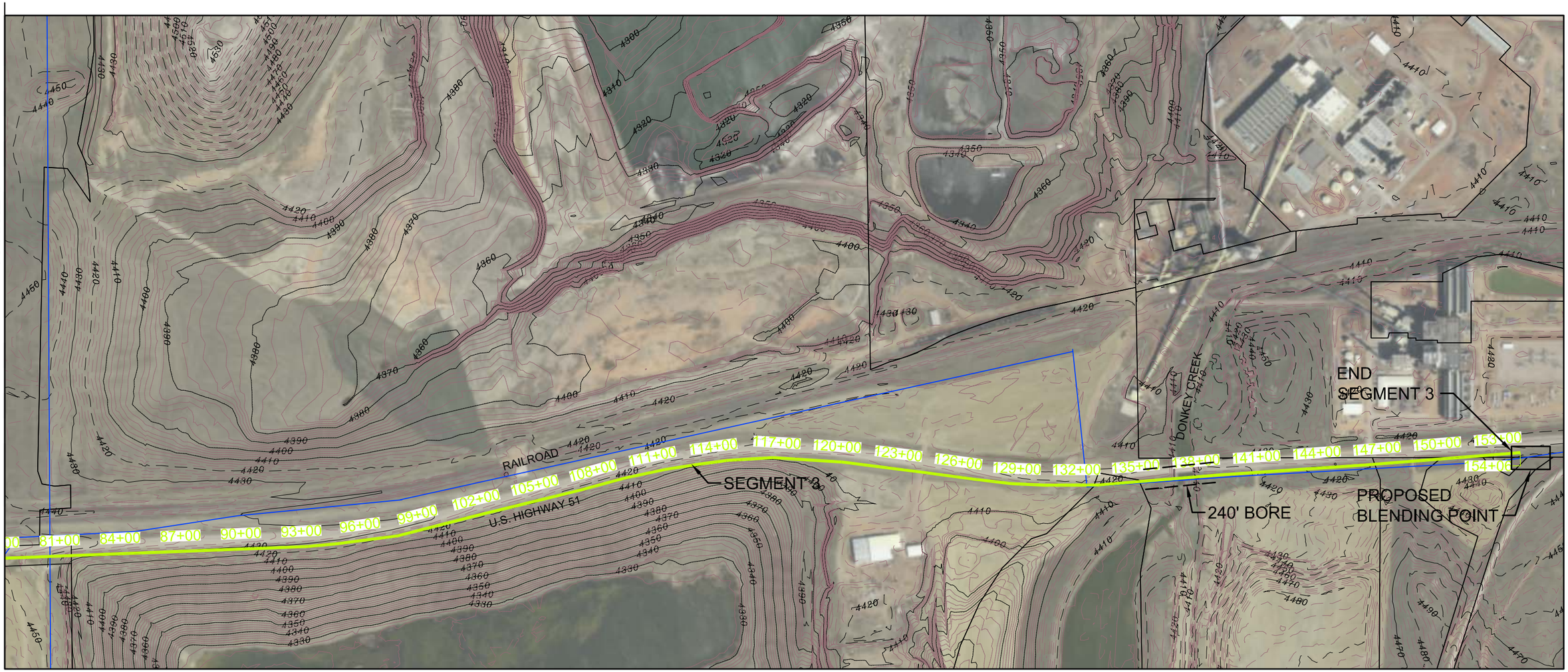
FIGURE 6

FIGURE 6



LEGEND

- SEGMENT 3
- WATERLINE
- PROPERTY LINE
- INDEX CONTOURS — 4510 —
- INTERMEDIATE CONTOURS - 2'

N

0 500' 1000'

SCALE IN FEET

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18" BLENDING WATERLINE STUDY

ALIGNMENT SEGMENT 3B - SITE PLAN

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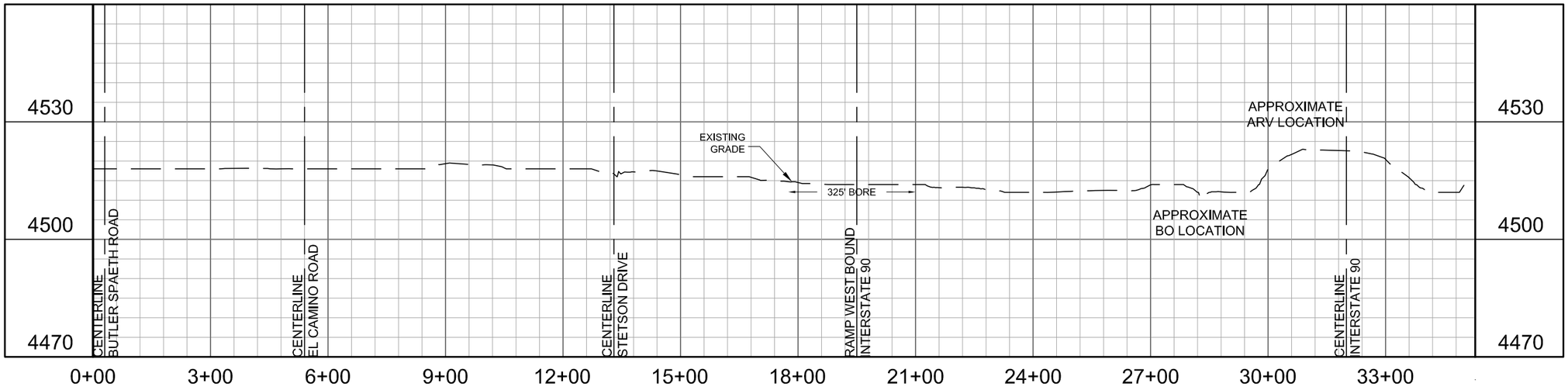
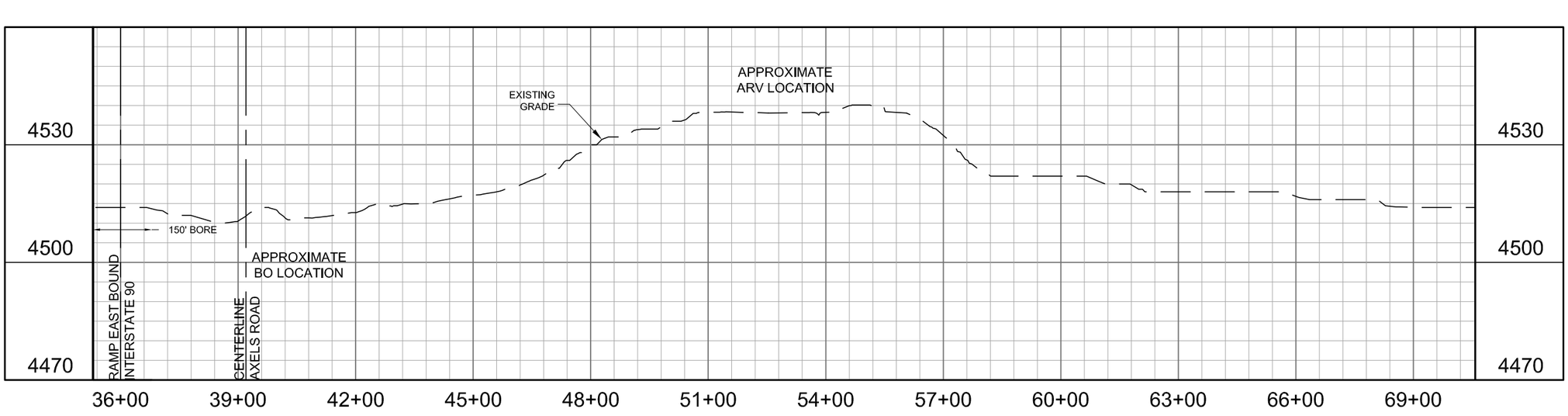
FIGURE 7





VERTICAL 0 30' 60'
SCALE IN FEET

HORIZONTAL 0 300' 600'
SCALE IN FEET

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TECHNICAL MEMORANDUM 14
SEGMENT 1 PROFILES

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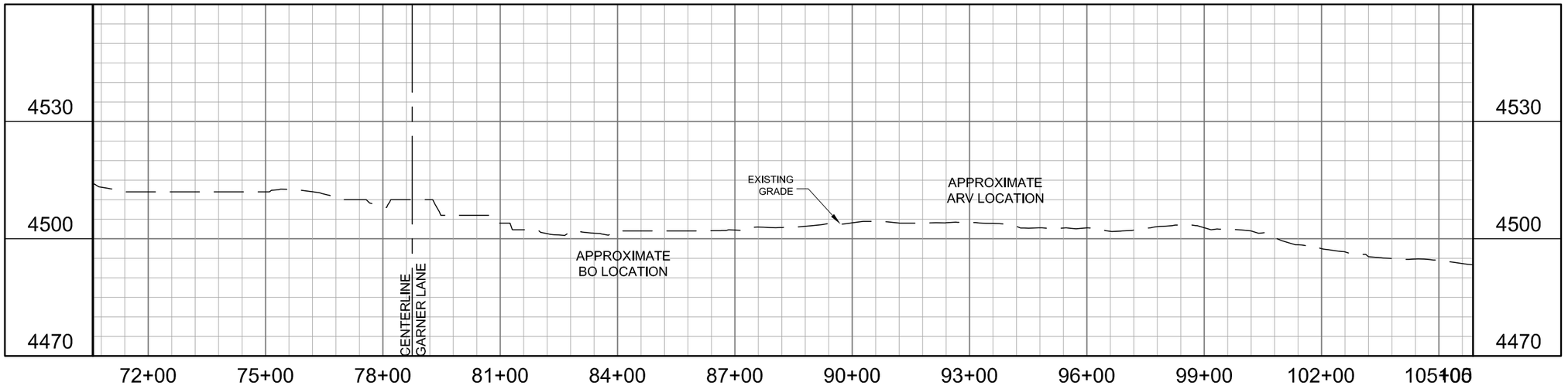
FIGURE 8



VERTICAL 0 30' 60'
SCALE IN FEET

HORIZONTAL 0 300' 600'
SCALE IN FEET

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SEGMENT 1 PROFILES

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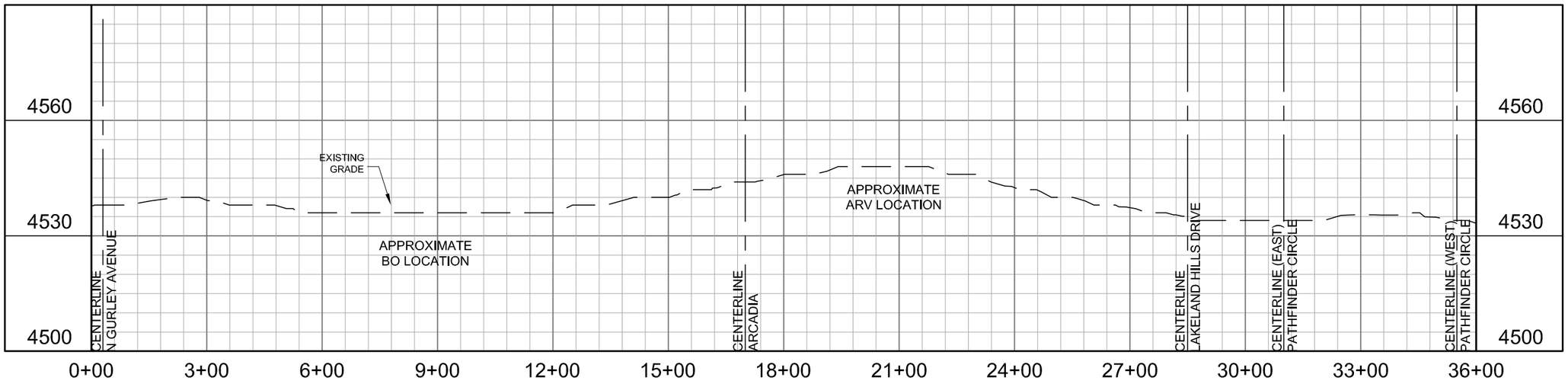
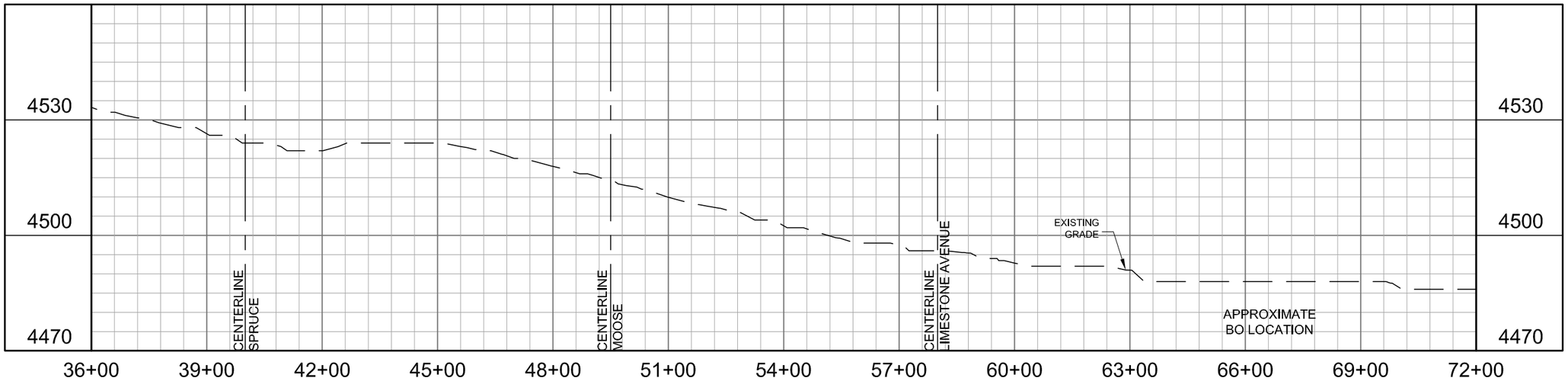
FIGURE 9





VERTICAL 0 30' 60'
SCALE IN FEET

HORIZONTAL 0 300' 600'
SCALE IN FEET

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GILLETTE-MADISON PIPELINE
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SEGMENT 2 PROFILES

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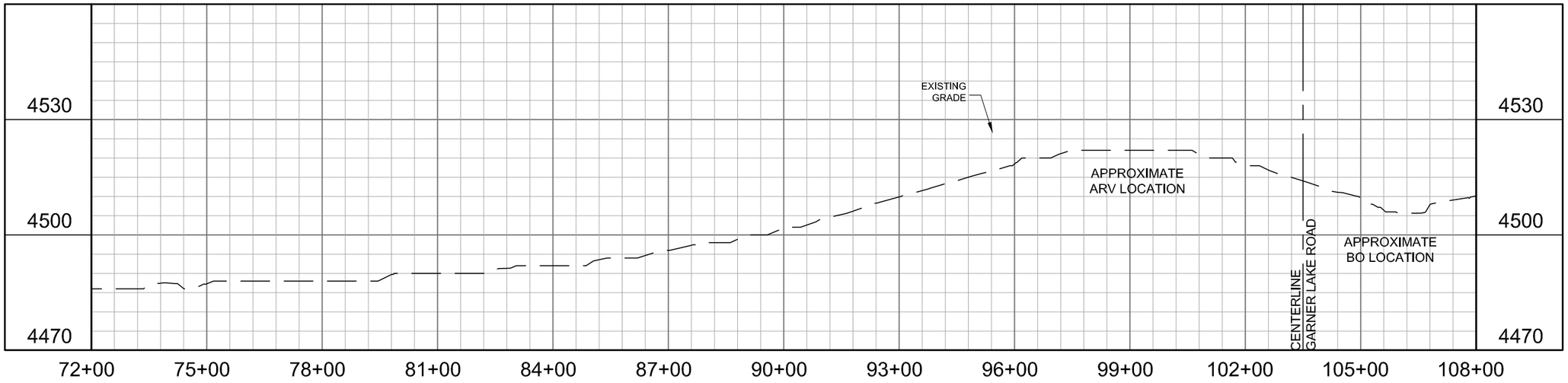
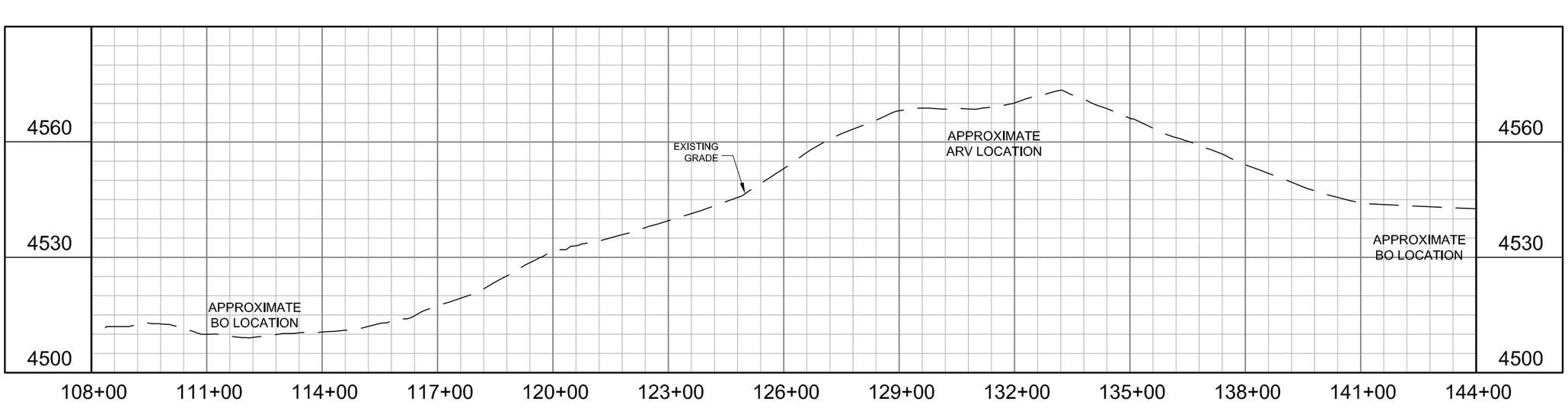
FIGURE 10





VERTICAL 0 30' 60' SCALE IN FEET

HORIZONTAL 0 300' 600' SCALE IN FEET

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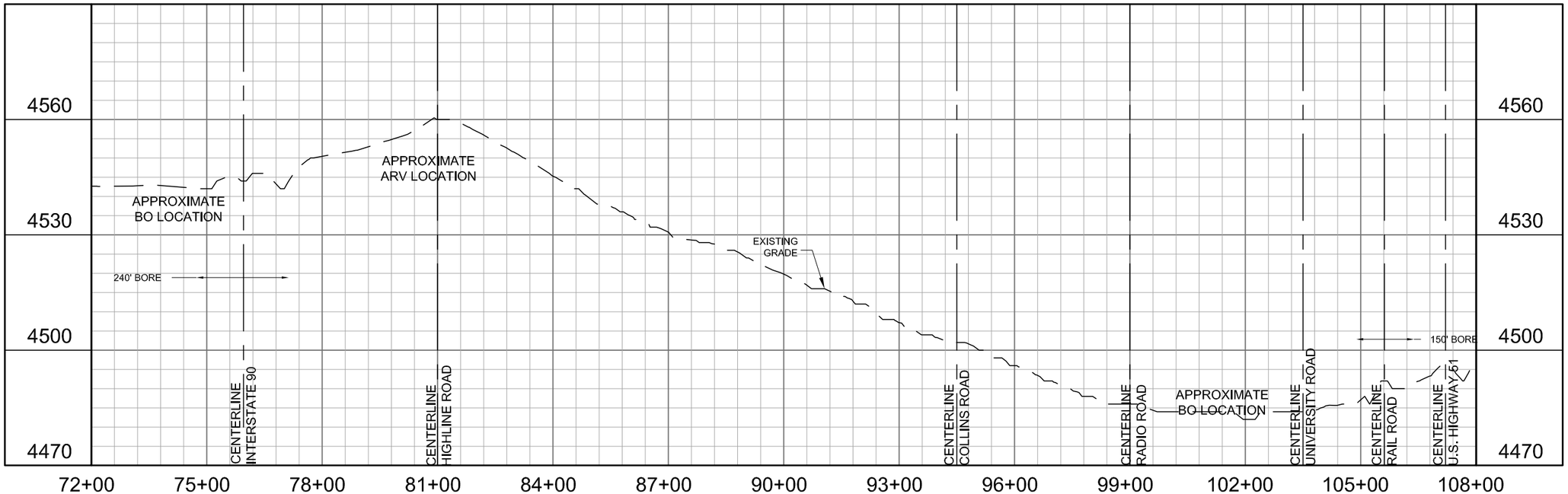
FIGURE 11



VERTICAL 0 30' 60'
SCALE IN FEET

HORIZONTAL 0 300' 600'
SCALE IN FEET

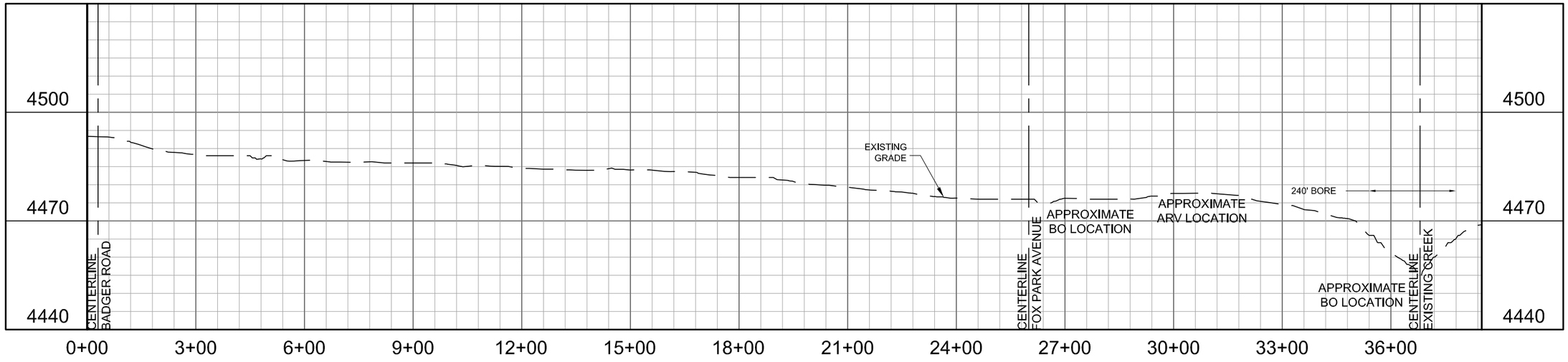
Burns & McDonnell SINCE 1898

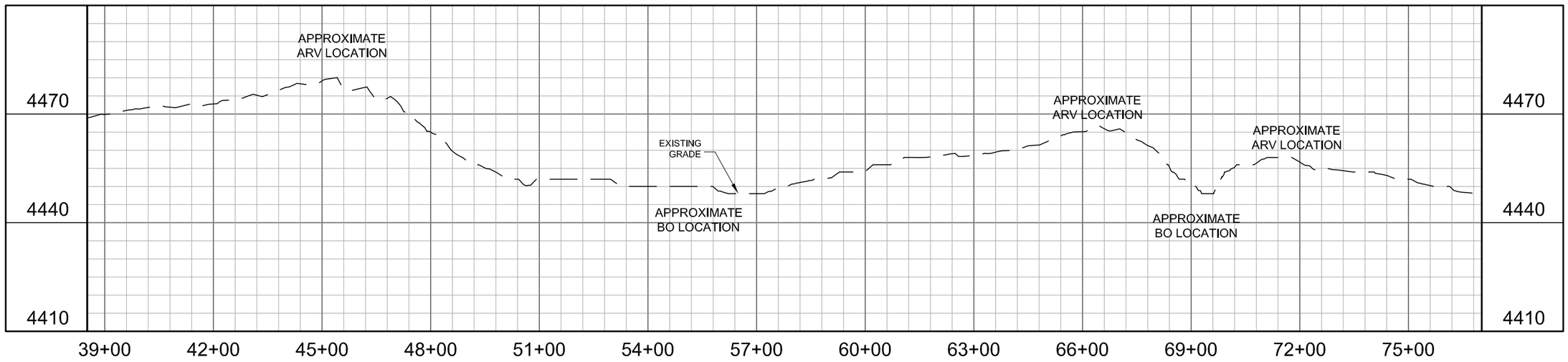
date APRIL 2011
designed C. MADSEN

CITY OF GILLETTE
GILLETTE-MADISON PIPELINE
TECHNICAL MEMORANDUM 14
SEGMENT 2 PROFILES

project 54432
contract

FIGURE 12





VERTICAL 0 30' 60'
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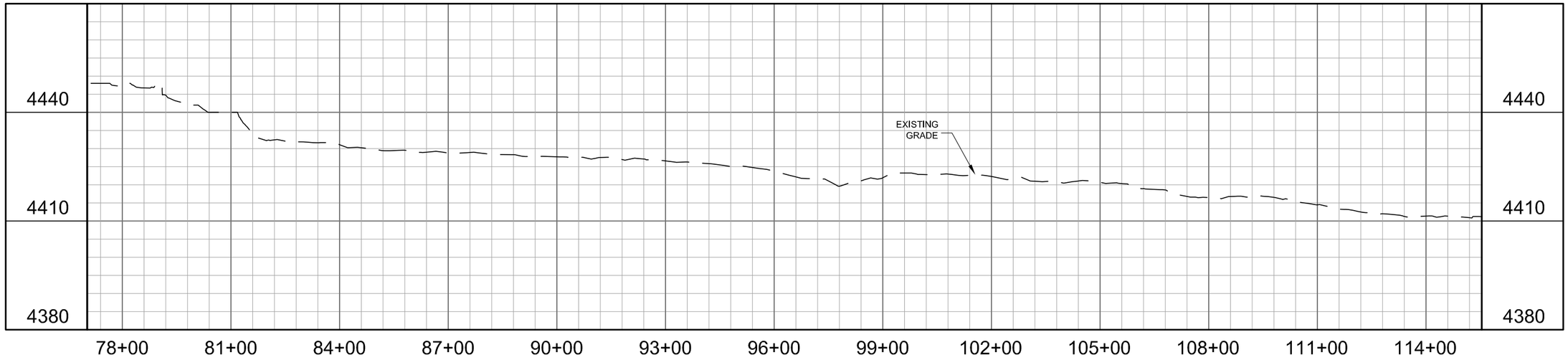
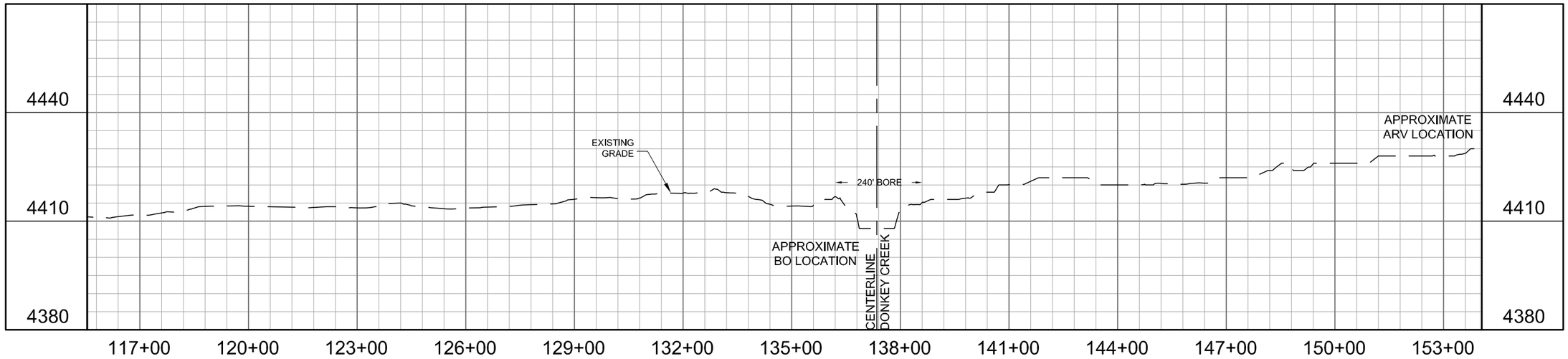
FIGURE 13





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CITY OF GILLETTE
GILLETTE-MADISON PIPELINE
TECHNICAL MEMORANDUM 14
SEGMENT 3 PROFILES

project 54432
contract

FIGURE 14

10 PERCENT OPINION OF PROBABLE CONSTRUCTION COST
Gillette Madison Pipeline Project - 18" Blending Waterline, Segment #1
City of Gillette

Description	Unit	Quantity	Unit Cost	Total Cost
DIVISION 1				
General Requirements				
Mobilization [1]	LS	1	$65,181.50	$65,182.00
Traffic Control [2]	LS	1	$52,145.20	$52,145.00
Conformance with Sediment and Erosion Control [3]	LS	1	$91,254.10	$91,254.00
Dewatering [4]	LS	1	$52,145.20	$52,145.00
Subtotal Division 1				**$260,726.00**
DIVISION 2				
Trenching and Backfilling for Utilities				
Cut Off Walls [5]	EA	22	$500.00	$11,000.00
Trench Stabilization Material [6]	TON	3,742	$50.00	$187,110.00
Utility Casings				
30-inch Bored Casing	LF	850	$900.00	$765,000.00
Pressure Pipe				
18-inch Restrained Raw Water Pipe and Appurtenances [7]	LF	4,240	$120.00	$508,800.00
18-inch Unrestrained Raw Water Pipe and Appurtenances	LF	6,360	$100.00	$636,000.00
Utility Valves and Accessories				
18-inch Butterfly Valve in Vault [8]	EA	11	$28,000.00	$308,000.00
Connection to Existing Waterline [9]	EA	1	$28,000.00	$28,000.00
Air Relief and Vacuum Valve [10]	EA	3	$13,000.00	$39,000.00
Blow Off Valve and Manhole [11]	EA	4	$16,000.00	$64,000.00
Cathodic Protection System [12]	LS	1	$2,650.00	$2,650.00
Surface Restoration				
R & R AC Pavement (9-inch depth) [13]	TON	200	$145.00	$29,000.00
R&R Dirt Pavement [14]	LF	114	$50.00	$5,700.00
Seeding and surface restoration [15]	Acre	23	$1,000.00	$23,000.00
Subtotal Division 2				**$2,607,260.00**
Subtotal				$2,867,986.00
Contractor Overhead and Profit (15%)				$430,198.00
Subtotal				$3,298,180.00
Contingency (25%)				$824,550.00
Estimated Capital Cost				**$4,122,700.00**
Notes				

(1) Mobilization has been estimated at 2.5% of the Division 2 Subtotal.

(2) Traffic Control will be required for Highway 51 at the crossing intersections and driveways. Traffic control is estimated at 2% of the Divison 2 items.

(3) Conformance with Sediment and Erosion Control has been estimated at 4.0% of the Division 2 Subtotal.

(4) Actual dewatering will depend on soils report as well as seasonal conditions during construction. Dewatering is based on 2% of the Division 2 items.

(5) One cutoff wall has been estimated for every 500 feet of pipe. with additional cutoff wall for areas adjacent to a water crossing.

(6) Trench Stabilization Material is based installing 6-inches of rock for 1/2 of the total project footage for a 10 foot (average) trench. Actual stabilization will depend on field conditions.

(7) Assumes 40% of total pressure pipe footage will require restraint. Total length of 18 inch pipe is based on the estimated length for Segment #1.

(8) Butterfly Valve in Vaults are estimated at a spacing of 1,000 feet.

(9) Connection to existing waterline consist of a stub and 18-inch butterfly valve in a vault followed by a blind flange.

(10) Air Relief and Vacuum Valve locations were estimated based on Figures 8 and 9. The actual number will be dictated by the final profiles.

(11) Blow Off Valve and Manhole locations were estimated based on Figures 8 and 9. The actual number will be dictated by the final profiles.

(12) Cathodic protection was estimated for protection of the 18" Blending Waterline was estimated at $0.25/LF of alignment.

(13) Removal and replacement of pavement is based on a 10 foot wide trench that crosses intersecting roadways and driveways.

(14) Removal and replacement of dirt pavement is based on a 10 foot wide trench that crosses intersecting roadways and driveways.

(15) Seeding is estimated to be 100 feet in width (60' permanent + 40' temporary for construction).

10 PERCENT OPINION OF PROBABLE CONSTRUCTION COST
Gillette Madison Pipeline Project - 18" Blending Waterline, Segment #2
City of Gillette

Description	Unit	Quantity	Unit Cost	Total Cost
DIVISION 1				
General Requirements				
Mobilization [1]	LS	1	$86,303.50	$86,304.00
Traffic Control [2]	LS	1	$69,042.80	$69,043.00
Conformance with Sediment and Erosion Control [3]	LS	1	$120,824.90	$120,825.00
Dewatering [4]	LS	1	$69,042.80	$69,043.00
Subtotal Division 1				**$345,215.00**
DIVISION 2				
Trenching and Backfilling for Utilities				
Cut Off Walls [5]	EA	36	$500.00	$18,000.00
Trench Stabilization Material [6]	TON	6,355	$50.00	$317,740.00
Utility Casings				
30-inch Bored Casing	LF	390	$900.00	$351,000.00
Pressure Pipe				
18-inch Restrained Raw Water Pipe and Appurtenances [7]	LF	7,200	$120.00	$864,000.00
18-inch Unrestrained Raw Water Pipe and Appurtenances	LF	10,800	$100.00	$1,080,000.00
Utility Valves and Accessories				
18-inch Butterfly Valve in Vault [8]	EA	18	$28,000.00	$504,000.00
Connection to Existing Waterline [9]	EA	1	$28,000.00	$28,000.00
Air Relief and Vacuum Valve [10]	EA	4	$13,000.00	$52,000.00
Blow Off Valve and Manhole [11]	EA	5	$16,000.00	$80,000.00
Cathodic Protection System [12]	LS	1	$4,500.00	$4,500.00
Surface Restoration				
R & R AC Pavement (9-inch depth) [13]	TON	770	$145.00	$111,650.00
R&R Dirt Pavement [14]	LF	25	$50.00	$1,250.00
Seeding and surface restoration [15]	Acre	40	$1,000.00	$40,000.00
Subtotal Division 2				**$3,452,140.00**
Subtotal				$3,797,355.00
Contractor Overhead and Profit (15%)				$569,603.00
Subtotal				$4,366,960.00
Contingency (25%)				$1,091,740.00
Estimated Capital Cost				**$5,458,700.00**
Notes				

(1) Mobilization has been estimated at 2.5% of the Division 2 Subtotal.

(2) Traffic Control will be required for Warlow Drive at the crossing intersections and driveways and along Badger Ave. Traffic control is estimated at 2% of the Division 2 items.

(3) Conformance with Sediment and Erosion Control has been estimated at 4.0% of the Division 2 Subtotal.

(4) Actual dewatering will depend on soils report as well as seasonal conditions during construction. Dewatering is based on 2% of the Division 2 items.

(5) One cutoff wall has been estimated for every 500 feet of pipe. with additional cutoff wall for areas adjacent to a water crossing.

(6) Trench Stabilization Material is based installing 6-inches of rock for 1/2 of the total project footage for a 10 foot (average) trench. Actual stabilization will depend on field conditions.

(7) Assumes 40% of total pressure pipe footage will require restraint. Total length of 18 inch pipe is based on the estimated length for Segment #2.

(8) Butterfly Valve in Vaults are estimated at a spacing of 1,000 feet.

(9) Connection to existing waterline consist of a stub and 18-inch butterfly valve in a vault followed by a blind flange.

(10) Air Relief and Vacuum Valve locations were estimated based on Figures 10 and 11. The actual number will be dictated by the final profiles.

(11) Blow Off Valve and Manhole locations were estimated based on Figures 10 and 11. The actual number will be dictated by the final profiles.

(12) Cathodic protection was estimated for protection of the 18" Blending Waterline was estimated at $0.25/LF of alignment.

(13) Removal and replacement of pavement is based on a 10 foot wide trench that crosses intersecting roadways and driveways.

(14) Removal and replacement of dirt pavement is based on a 10 foot wide trench that crosses intersecting roadways and driveways.

(15) Seeding is estimated to be 100 feet in width (60' permanent + 40' temporary for construction).

10 PERCENT OPINION OF PROBABLE CONSTRUCTION COST
Gillette Madison Pipeline Project - 18" Blending Waterline, Segment #3
City of Gillette

Description	Unit	Quantity	Unit Cost	Total Cost
DIVISION 1				
General Requirements				
Mobilization [1]	LS	1	$76,599.75	$76,600.00
Traffic Control [2]	LS	1	$61,279.80	$61,280.00
Conformance with Sedment and Erosion Control [3]	LS	1	$107,239.65	$107,240.00
Dewatering [4]	LS	1	$61,279.80	$61,280.00
Subtotal Division 1				**$306,400.00**
DIVISION 2				
Trenching and Backfilling for Utilities				
Cut Off Walls [5]	EA	31	$500.00	$15,500.00
Trench Stabilization Material [6]	TON	5,472	$50.00	$273,610.00
Utility Casings				
30-inch Bored Casing	LF	480	$900.00	$432,000.00
Pressure Pipe				
18-inch Restrained Raw Water Pipe and Appurtenances [7]	LF	6,200	$120.00	$744,000.00
18-inch Unrestrained Raw Water Pipe and Appurtenances	LF	9,300	$100.00	$930,000.00
Utility Valves and Accessories				
18-inch Butterfly Valve in Vault [8]	EA	16	$28,000.00	$448,000.00
Regional Connection [9]	EA	1	$28,000.00	$28,000.00
Air Relief and Vacuum Valve [10]	EA	5	$13,000.00	$65,000.00
Blow Off Valve and Manhole [11]	EA	5	$16,000.00	$80,000.00
Cathodic Protection System [12]	LS	1	$3,875.00	$3,875.00
Surface Restoration				
R & R AC Pavement (9-inch depth) [13]	TON	0	$145.00	$0.00
R&R Dirt Pavement [14]	LF	180	$50.00	$9,000.00
Seeding and surface restoration [15]	Acre	35	$1,000.00	$35,000.00
Subtotal Division 2				**$3,063,990.00**
Subtotal				$3,370,390.00
Contractor Overhead and Profit (15%)				$505,559.00
Subtotal				$3,875,950.00
Contingency (25%)				$968,990.00
Estimated Capital Cost				**$4,844,900.00**
Notes				

(1) Mobilization has been estimated at 2.5% of the Division 2 Subtotal.

(2) Traffic Control will be required for Warlow Drive at the crossing intersections and driveways and along Badger Ave. Traffic control is estimated at 2% of the Divison 2 items.

(3) Conformance with Sedement and Erosion Control has been estimated at 4.0% of the Division 2 Subtotal.

(4) Actual dewatering will depend on soils report as well as seasonal conditions during construction. Dewatering is based on 2% of the Division 2 items.

(5) One cutoff wall has been estimated for every 500 feet of pipe. with additional cutoff wall for areas adjacent to a water crossing.

(6) Trench Stabilization Material is based installing 6-inches of rock for 1/2 of the total project footage for a 10 foot (average) trench. Actual stabilization will depend on field conditions.

(7) Assumes 40% of total pressure pipe footage will require restraint. Total length of 18 inch pipe is based on the estimated length for Segment #3.

(8) Butterfly Valve in Vaults are estimated at a spacing of 1,000 feet.

(9) Connection to existing waterline consist of a stub and 18-inch butterfly valve in a vault followed by a blind flange.

(10) Air Relief and Vacuum Valve locations were estimated based on Figures 12 and 13. The actual number will be dictated by the final profiles.

(11) Blow Off Valve and Manhole locations were estimated based on Figures 12 and 13. The actual number will be dictated by the final profiles.

(12) Cathodic protection was estimated for protection of the 18" Blending Waterline was estimated at $0.25/LF of alingment.

(13) Removal and replacement of pavement is based on a 10 foot wide trench that crosses intersecting roadways and driveways.

(14) Removal and replacment of dirt pavement is based on a 10 foot wide trench that crosses intersecting roadways and driveways.

(15) Seeding is estimated to be 100 feet in width (60' permanent + 40' temporary for construction).

Table 1-1 Alignment Weighting Matrix Table

Abbrev	Criteria	Relative Importance													Weight
A	Availability of Existing ROW/Easements	**A**	A 2	A 0	A 3	A 0	A 0	A 1	A 0	A 2	A 1	A 0	A 2		11
B	Cost (without easements)		**B**	B 2	B 1	B 2	B 2	B 1	B 0	B 1	B 0	B 1	B 0		10
C	Existing Utilities			**C**	C 2	C 2	F 1	C 0	C 1	C 1	C 0	C 1	C 1		8
D	Land Acquisition Requirements				**D**	D 1	F 1	D 0	D 0	D 1	D 1	D 2	D 1		6
E	Ditch/Creek Crossing					**E**	F 0	E 0	H 1	E 0	E 0	E 0	L 0		0
F	Major Highway/Street Crossing						**F**	F 1	F 1	F 0	F 0	F 0	F 0		4
G	Ease of Maintenance Access							**G**	H 2	G 1	G 2	G 0	G 2		5
H	Constructability								**H**	H 2	H 2	H 2	L 1		9
I	Traffic Control During Construction									**I**	I 0	I 0	L 0		0
J	Pavement Replacement Requirements										**J**	J 0	L 1		0
K	Work Zone Availability											**K**	L 1		0
L	Surface Restoration												**L**		3

Table 1-2 Alignment Ratings Matrix Table

Alternatives	Availability of Existing ROW/Easements	Cost (without easements)	Existing Utilities	Land Acquisition Requirements	Ditch/Creek Crossing	Major Highway/Street Crossing	Ease of Maintenance Access	Constructability	Traffic Control During Construction	Pavement Replacement Requirements	Work Zone Availability	Surface Restoration
Segment 1	4	5	5	4	5	3	6	6	5	5	5	5
Segment 2	8	7	5	5	5	4	4	4	5	5	5	5

Table 1-3 Alignment Scoring Matrix Table

Alternatives	Availability of Existing ROW/Easements	Cost (without easements)	Existing Utilities	Land Acquisition Requirements	Ditch/Creek Crossing	Major Highway/Street Crossing	Ease of Maintenance Access	Constructability	Traffic Control During Construction	Pavement Replacement Requirements	Work Zone Availability	Surface Restoration	TOTALS
Segment 1	44	50	40	24	0	12	30	54	0	0	0	15	269
Segment 2	88	70	40	30	0	16	20	36	0	0	0	15	315