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705 First Avenue North
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P 515.576.7155

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ENGINEER'S REPORT

DRAINAGE DISTRICT NO. 34
HEADWALL INVESTIGATION
WEBSTER COUNTY, IOWA

February 2021

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Daniel P. Wiedmeier P.E. 2/10/21

Daniel P, Wiedmeier, P.E. No. 24743 (Date)

My license renewal date is December 31, 2021.

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1 Introduction

This report is prepared in response to inquiries by the Webster County Board of Supervisors and impacted landowners for investigation of the existing headwall structure conditions located along the south property line of SWNE Section 18 of Burnside Township (18-87-28).

2 History and Background

The purpose of the headwall is to serve as structural support for subsurface district lateral outlets and to direct surface water to the greater hydraulic capacity of the open ditch while preventing debris from entering the upper end of the ditch. When considering which laterals Tie into the headwall, we needed to initially confirm which laterals are daylighted there. Initial conversations, and review of courthouse records highlighted the fact that the naming convention for the lateral outlets were somewhat ambiguous and interchanged fluidly throughout history's reports and projects for the District, or the names were left off all together.

While Laterals A through E were constructed as part of the original district, a relief lateral for Lateral E starting at the outlet was proposed in 1917 followed by a subsequent 1918 report addressing interest for relief lines for Laterals C and D as well. A 1918 project was planned and constructed which included installing a new bulkhead of unknown material to house the outlets for original Lateral A on the west, original Lateral C in the middle and a new Lateral D Relief line on the east. Each pipe was, and is still, 30" reinforced concrete pipe (RCP). The Lateral D Relief line was installed at an alignment slightly more south-easterly in direction than original Lateral C for approximately 100' then it ran parallel to original Lateral C, upstream to the junction of original Lateral D, where it ran parallel to the original Lateral D tile, with the exception of the last quarter mile or so, where it curved slightly more as seen on the 1918 plat map. Lateral E Relief was installed parallel to the original Lateral E and both were tied into Lateral D Relief. No relief tile was ever installed but the construction of the other two, did remove water from Lateral C and therefore provided relief.

Figure 1: Headwall outlets from a south facing view

One pipe also located near the other outlets but not utilizing the headwall is Lateral A Relief installed in 2010 just west of the headwall. The 2010 pipe parallels the original Lateral A and Lateral B alignments so it could also be referred to as Lateral A Relief along the Lateral A alignment and Lateral B Relief along the Lateral B alignment to keep things simplified. In 2016 the upper, wester, portion of the original Lateral A was reclassified into its own system called Lateral A-1. This lateral outlets into Lateral A.

Over the last 30 years there have been several petitions and investigations completed to address structural and hydraulic deficiencies of the structure. District records indicate a petition for an open ditch cleanout in 1990 led to a project that included the cleanout and removal of the old concrete headwall and repairing the wooden headwall. The extent of repairs to the headwall and the original date of installation were not specifically noted. It is unclear if the remaining concrete was debris from a previous replacement with the wooden structure or if it was still serving as a supplemental headwall. Following that project in the summer of 1990, another petition for headwall repairs was submitted on November 28, 1990 citing a deteriorated state. Said petition precipitated a repair project originally bid on April 23, 1991 however no bids were submitted. The repairs included repairing wood sections, replacing pipe, realigning Lateral C to outlet in the center section of the headwall, adding deadman tie supports, placing riprap downstream of the headwall and grading the site upstream for positive surface drainage to the overflow. The project was let again on May 13, 1991 and Lund Construction was the low bidder at $13,636. That work was completed in July of 1991. A letter on May 27, 1992 indicated high waters experienced during 1991 and shortly thereafter caused washouts behind and around the headwall prior to seeding establishment so those washouts were recommended to be re-filled and compacted with fill material and seeded. A June 15, 1993 letter noted another large storm event washed out fill material again and landowners observed water running freely between the two parallel outlet pipes. Repairs were recommended at a cost estimate of $5,000 for additional compacted fill, crushed rock, galvanized wire rope and four feet of outlet pipe.
Following these multiple years of ongoing repairs, a more comprehensive repair plan was recommended in a 1994 report including repairing the headwall, fine grading the site and replacing approximately 228' of outlet pipe between the three outlets. That project was ultimately abandoned due to lack of interest by landowners. Next, a 1997 report was submitted following further requests for repairs to the upstream waterway and that project was abandoned due to remonstrance.

While the records did not indicate any major repairs or improvements to the headwall since the early 1990's, it is known that several landowners have added fill material and rip rap both upstream and around the headwall as recently as the summer of 2020. McClure staff spoke with contractor Dan Rasmussen who indicated some of these intermittent repair attempts were stymied by the galvanized wires serving as tie supports to the "deadman" posts behind the headwall structure making it difficult to remove unsuitable material and/or add additional fill and rip rap.

3 Existing Conditions

We completed a comprehensive field review of the structure to take survey measurements and assess the structure integrity and hydraulic inefficiencies as they exist today. The findings are outlined below:

Pilings: The 15 existing 12" circular wood pilings similar to a common power line pole, appear to be serving their intended purpose of providing vertical structural support for the horizontal cross member boards of the headwall with the exception of one piling in particular shown below. The natural deterioration of this pile has led to buckling in that section of the headwall as seen below.

Figure 2: Broken pile allowing buckling next to Lateral C

Figure 3: Another view of the broken pile and adjacent broken cross member

Some of the other piles are showing signs of natural deterioration as seen in Figure 4 however they are not displaying buckling of the cross members behind them.

Figure 4: Another pile experiencing deterioration on the top, center.

Cross Member Boards: The numerous 3"X12" horizontal boards spanning the length and height of headwall also are noted as serving their intended purpose with slight natural deterioration. As was shown above in Figure 2, buckling around the failing pile has altered an adjacent board.

Figure 5: Base board failing.

Figure 5 also shows one base board that has bowed outward however that section of headwall is also being supported by the old concrete debris.

Galvanized wire rope and deadman supports: No exploratory digging was conducted on site so each individual tie rope and deadman support was not exposed for review. As noted earlier, they were recently found by landowners to be intact and unable to be moved during excavation and fill operations.

Pipes: The RCP outlets were examined internally up to approximately 100 feet upstream of the headwall. The newest, 2010 Lateral A Relief outlet just west of the headwall was not examined internally. Lateral A, the west parallel outlet, and Lateral D Relief, the east parallel outlet, are both exhibiting deteriorated conditions especially when they transition back to vitrified clay pipe (VCP) approximately 20 feet upstream of the outlet. The following is a photographic log of each lateral.

Lateral A, the westernmost of the pipes in the headwall, exhibits longitudinal cracking and broken clay pipe past the initial 23 feet of RCP. This can be categorized as suitable for imminent failure.

Figure 6: Lateral A broken 30" clay pipe segments.

At 50′ Lateral A transitions to corrugated metal pipe (CMP) for 17′ which is rotted and deteriorating.

Figure 7: Lateral A deteriorating 30″ CMP.

Clay pipe beyond that was found in good condition. Several separated joints were noted throughout these stretches of varying materials and one separated joint showed the physical relation between this Lateral A outlet and Lateral C with the pipes almost touching without fill material between the two.

Figure 8: View of Lateral C from Lateral A separated joint.

Lateral C, the middle pipe outletting in the headwall, has a poor connection at the joint between RCP and VCP at 21′. It then switches to CMP in good condition for approximately 15′ then back to clay pipe in good condition past that.

Figure 9: Lateral C offset joint.

Figure 10: Lateral C CMP in good condition.

Lateral D Relief, the eastern most pipe outletting in headwall, had 37 feet of good RCP followed by a spot repair of plastic pipe for approximately 6 feet followed by cracked and broken clay pipe for the next 15 feet. Most notably that clay pipe is categorized as suitable for imminent failure needing immediate repairs.

Figure 11: Lateral D Relief view from plastic pipe to cracked and broken clay pipe.

Lateral A Relief installed in 2010 shown below, is located just west of the headwall. It was not investigated upstream due to the animal guard however a pipe this new would theoretical still be functioning near its intended capacity.

Figure 12: Lateral A Relief west of the headwall.

4 Recommendation

The exact age of the headwall is not known however records indicate the general structure has held up through multiple record storm events and several repairs over at least the last thirty years. That time has caused some deterioration but overall, the headwall itself appears to be in good shape with only a few specific components in need of immediate attention.

Repairing the existing headwall and piping would be the most economical option. It is recommended that, for such a repair, the one failing pile next to the Lateral C outlet be removed and replaced with a steel piling installed 10 feet deep. An additional pile would be placed in between the Lateral A and C pipes. It is also recommended that any broken boards attached to that existing pile be replaced. We recommended replacing any of the plastic, CMP, or broken clay pipe sections with tongue and groove RCP of the same or next available size. Construction of any headwall repairs would provide the ideal time to address those repairs and any further pipe conditions identified at that time can be reviewed for future work as needed. To address some of the surface water back pressure and prevent future washouts behind the headwall, we recommend installing two six-inch surface intakes with hickenbottom covers above the parallel Lateral C and Lateral A outlet tiles approximately 20' south of the headwall to serve as primary surface water catchment basins. The surrounding area should be graded toward the weir opening of the headwall with a gradual flow path over the intakes. The existing headwall opening will serve as the secondary overflow for larger rainfall events. New geotextile fabric will be placed where the headwall is exposed to mitigate future soil losses. The estimated project cost to repair the existing headwall is listed in table 1.

If the Board finds it more desirable to replace the entire headwall, a new headwall constructed of wood or steel has been examined. A full replacement would also provide an opportunity to spread each of the outlet pipes along the headwall for better soil compaction around each. An estimate of total project cost is shown in the table below.

With all options the cost of the headwall will be assessed to the Main Open Ditch. The cost to repair the pipes beyond the initial RCP outlet will be assessed to each lateral tile. The detailed Opinions of Probable Cost can be found in Appendix B with a summary of each in Table 1 below.

Table 1: Summary of Opinions of Probable Cost with Contingency

Option	Main Open Ditch	Lateral A	Lateral C, D, E	Total Project
Repair Existing Headwall and Replace Damaged Pipes	$28,420	$10,260	$10,480	**$49,160**
Replace with New Wood Headwall and Replace Damaged Pipes	$60,850	$10,260	$10,480	**$81,590**
Replace with New Steel Headwall and Replace Damaged Pipes	$83,330	$9,430	$8,560	**$101,300**

5 Classification

D.D. 34 is comprised of 4 classification schedules, each having been established as needed throughout the district's history. These 4 classifications are for the Main Open Ditch, Lateral A, Lateral A-1, and a single classification for any work done on Laterals C, D, and E. The classification for the Main Open Ditch has not substantially changed since the district was established. The classifications for Laterals A and A-1 have been updated relatively recently and appear to be in good order. The classification for Laterals C, D, and E was set in in 1919. A few irregularities were noted in the Main Open Ditch and Lateral C, D, E schedules, the most notable of which includes assessing ground in the SW ¼ of Section 29-87-28 that does not appear to benefit from the district. By Iowa Code Section 468.65, when a repair or improvement has become necessary the Board may consider whether the existing assessments are equitable. If they find the same to be inequitable, they shall order a reclassification. Furthermore, should an improvement be performed on an individual branch of Lateral C, D, or E it will be necessary to reclassify this portion of D.D. 34. None of the options detailed in this report meet the requirements of an improvement.

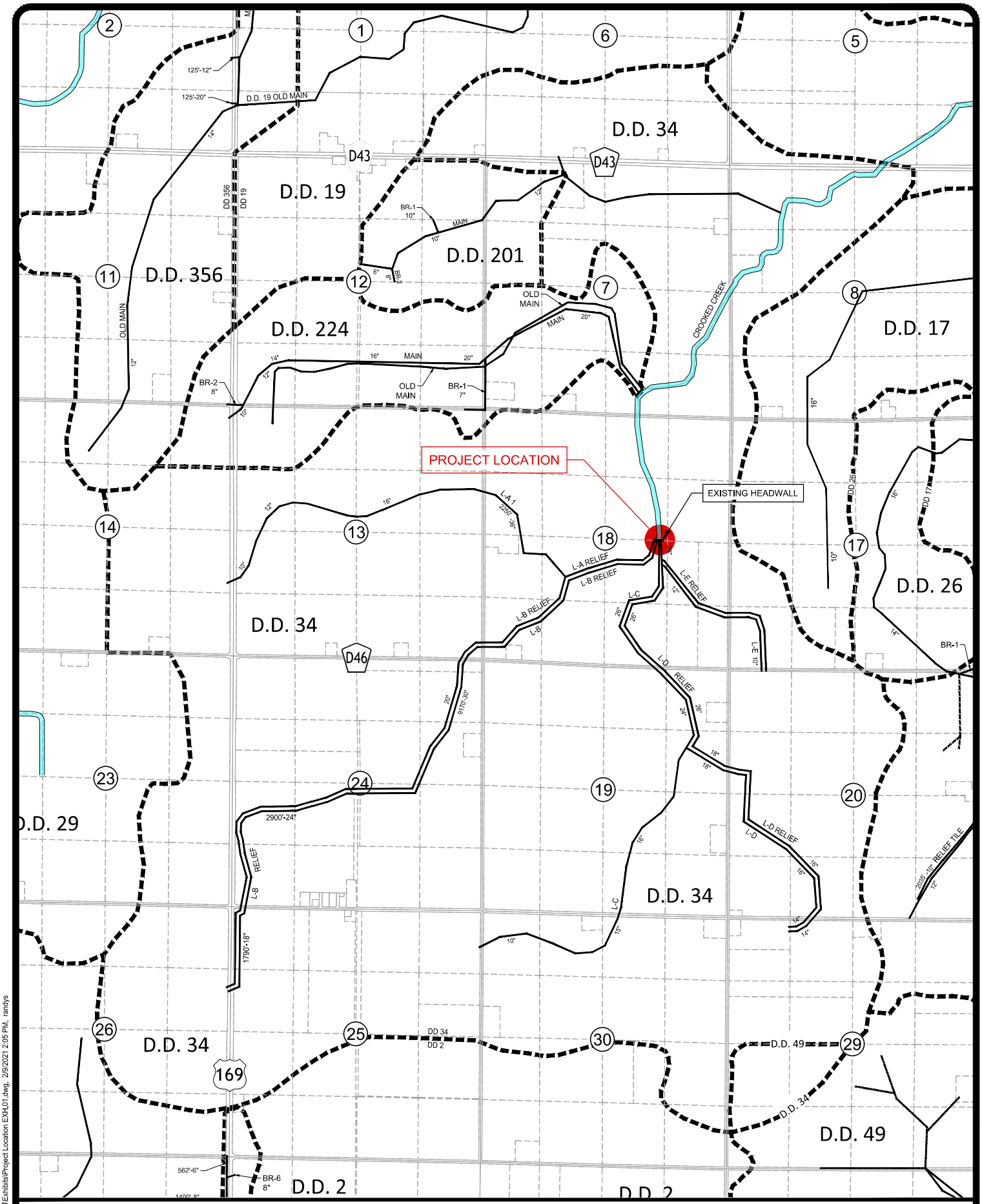
6 Administration

All estimated options are below the competitive quote threshold for county vertical infrastructure as provided in Iowa Code section 468.3. As such neither bids nor quotes will not be required, and the Board of Supervisors acting as Trustees of D.D. 34 may appoint a contractor of their choice.

The repair option is estimated to cost less than the $50,000. Per Iowa Code Section 468.126.c the Board may order the repair option done without conducting a hearing on the matter.

APPENDIX A

REPORT EXHIBIT



NOT TO SCALE

PROJECT LOCATION MAP
D.D. 34 HEADWALL REPAIRS

Webster County, Iowa

McCLURE™ ENGINEERING Co.

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APPENDIX B

ENGINEER'S OPINION OF PROBABLE COSTS

Opinion of Probable Costs
Drainage District No. 34
Repair Existing Headwall Option

Item	Description	Quantity	Unit Price	Extension
1	8" x 18' Treated Wood Pilings	2 EA	$550.00	$1,100.00
2	Remove Damaged Wood Pilings	2 EA	$400.00	$800.00
3	I Beam W 14x26 - 20'	2 EA	$1,250.00	$2,500.00
4	3" x 12" Treated Wood Planking	20 LF	$15.00	$300.00
5	5/8" x 7" Galvanized Lag Bolts	52 EA	$10.00	$520.00
6	Geotextile Fabric	235 SY	$4.00	$940.00
7	5/8" Galv Wire Rope	50 LF	$3.00	$150.00
8	5/8" Clamps	8 EA	$7.50	$60.00
9	6" Hickenbottom Intake	2 EA	$300.00	$600.00
10	Revetment, Remove and Replace	50 CY	$30.00	$1,500.00
11	Seeding	6 SQ	$25.00	$150.00
12	Imported fill	170 CY	$20.00	$3,400.00
13	30" RCP 2000D	84 LF	$50.00	$4,200.00
14	Crush & Bury Existing Tile on Site	84 LF	$5.00	$420.00
15	Trench Stabilization Rock	8 TN	$25.00	$200.00
16	Field Tile Connections	4 EA	$200.00	$800.00

Total Estimated Construction Cost	$17,640.00
Engineering and Administration	$23,320.00
20% Contingency	$8,200.00
Total Estimated Project Cost	**$49,160.00**
Main Open Ditch Estimated Share	$28,420.00
Lateral A Estimated Share	$10,260.00
Lateral C, D, E Estimated Share	$10,480.00

Opinion of Probable Costs
Drainage District No. 34
Wood Headwall Replacement Option

Item	Description	Quantity	Unit Price	Extension
1	Wood Headwall	1 LS	$22,900.00	$22,900.00
2	Geotextile Fabric	325 SY	$4.00	$1,300.00
3	6" Hickenbottom Intake	2 EA	$300.00	$600.00
4	Revetment, Remove and Replace	90 CY	$30.00	$2,700.00
5	Seeding	6 SQ	$25.00	$150.00
6	Imported Fill	170 CY	$20.00	$3,400.00
7	Removal & Dispose of Old Wall	1 EA	$8,000.00	$8,000.00
8	30" RCP 2000D	84 LF	$50.00	$4,200.00
9	Crush & Bury Existing Tile on Site	84 LF	$5.00	$420.00
10	Trench Stabilization Rock	8 TN	$25.00	$200.00
11	Field Tile Connections	4 EA	$200.00	$800.00

Estimated Construction Cost	$44,670.00
Engineering and Administration	$23,320.00
20% Contingency	$13,600.00
TOTAL	**$81,590.00**

Main Open Ditch Estimated Share	$60,850.00
Lateral A Estimated Share	$10,260.00
Lateral C, D, E Estimated Share	$10,480.00

Opinion of Probable Costs
Drainage District No. 34
Steel Headwall Replacement Option

Item	Description	Quantity	Unit Price	Extension
1	Steel Headwall	1 EA	$27,080.00	$27,080.00
2	Concrete Foundation	8 CY	$1,500.00	$12,000.00
3	Geotextile Fabric	325 SY	$4.00	$1,300.00
4	36" A-2000 Pipe	60 LF	$40.00	$2,400.00
5	6" Hickenbottom Intake	2 EA	$300.00	$600.00
6	Revetment, Remove and Replace	90 CY	$30.00	$2,700.00
7	Seeding	6 SQ	$25.00	$150.00
8	Imported Fill	170 CY	$20.00	$3,400.00
9	Trench Stabilization Rock	6 TN	$25.00	$150.00
10	Removal & Dispose of Old Wall	1 EA	$8,000.00	$8,000.00
11	30" RCP 2000D	24 LF	$50.00	$1,200.00
12	Remove and Replace 30" RCP	64 LF	$10.00	$640.00
13	Crush & Bury Existing Tile on Site	84 LF	$5.00	$420.00
14	Trench Stabilization Rock	10 TN	$25.00	$250.00
15	Field Tile Connections	4 EA	$200.00	$800.00

Estimated Construction Cost	$61,090.00
Engineering and Administration	$23,320.00
20% Contingency	$16,890.00
TOTAL	**$101,300.00**

Main Open Ditch Estimated Share	$83,330.00
Lateral A Estimated Share	$9,410.00
Lateral C, D, E Estimated Share	$8,560.00