MEC# 202075-000

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ENGINEER'S REPORT

DRAINAGE DISTRICT NO. 341
WEBSTER COUNTY, IOWA
MAIN DITCH REPAIRS
AUGUST 2022

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. 8/16/22

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

My license renewal date is December 31, 2023.

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1 Introduction

This report is made at the direction of the Board of Supervisors, acting as trustees for Drainage District (D.D.) No. 341 following concerns of ditch conditions raised by a landowner on the lower quarter mile of the ditch. Outlined below are the findings of the engineer. These findings include the investigation results, along with Engineer's Recommendations and Opinion of Probable Costs. This report is required by and prepared in accordance with Iowa Code Chapter 468. Base information was also derived from the 2010 report by McClure Engineering Company.

The investigation detailed in this report refers to the Main Open Ditch located in Sections 31 and 32 of Otho Township and Sections 4 and 5 of Burnside Township and primarily focuses on the lower 800 feet or so in Webster County Drainage District No. 341. Landowners and Supervisors voiced concern for the lands further downstream from the drainage district needing repairs as well. The waterway serving as DD 341's outlet is an unnamed tributary of Crooked Creek which outlets just south of Lehigh, Iowa to the Des Moines River. With a tributary like this, the drainage district does not have authority to complete the work independently, so it was not evaluated as part of this study. Potential options for further investigation are outlined in the summary of this report.

2 Open Ditch History

Drainage District No. 341 was established September 11, 1907 as Drainage District No. 19. It was renamed DD No. 341 in 1924 following a cleanout of the ditch. DD No. 341 consists of 17,280 feet (3.27 miles) of open ditch and serves as an outlet to DD No. 19 and DD No. 365 as shown on the attached map. The total cost for the original construction and subsequent repairs was $48,519. Three cleanouts have been performed on the ditch. The ditch was widened to a six foot bottom its entire length and deepened in 1924. In 1941 another cleanout was performed on the upper 9,500 feet. Most recently in 2011, the entire ditch was cleaned out with the exception of the lower 800 feet or so due to abundant tree cover. Those trees were removed as part of that project. A reclassification in 1980 created separate assessment schedules for DD No. 341, 356 and 19. DD No. 341 serves approximately 2,900 acres.

3 Scope

This report analyzes the open ditch that is definitively located within the boundaries of D.D. 341. There is a portion of ditch located in the south half of Section 4 that may have been maintained by the District in its early history however definitive records of this work were not found. If the District were interested in performing work in this area a lawyer with experience in drainage and real estate should be consulted and right of way may need to be secured.

4 Existing Conditions

The most up to date design information was disseminated using written records, archived plans, and field measurements. Based on Natural Resource Conservation Service soils data, almost the entire district consists of somewhat poorly drained to very poorly drained soil. It is unknown at this time what percentage of the District has been pattern tiled through private systems.

The original ditch design at the time of the 1924 cleanout included a running grade of 0.05%, a six-foot wide bottom and 1:1 sideslopes for the entirety of the 17,280 feet of ditch (172+80 Stationing). The 2010 report noted the sideslopes were observed to have sloughed to approximately a 1.5:1 (H:V) along the alignment. The 2011 ditch cleanout design, the most recent design used for repairs, is outlined in the table below which notably ended at station 164+20 and did not continue to the end (outlet) of the district at 172+80. While the ditch was not

cleaned at out in that final section, a running ditch grade profile was projected out to the end of the district on those plans and the existing conditions show they are still below those design elevations. In other words, the ditch bottom has not silted-in to a level that would backflow water to the previous cleanout elevations.

Table 1: Existing Ditch Design from Latest Cleanout

Ditch	Stationing	Grade (%)	Bottom Width (ft.)	Side Slopes (H:V)
Main Ditch	127+25 – 164+20	0.05	6	1.5:1
	106+50 – 127+25	0.03	6	1.5:1
	0+00 – 106+50	0.05	6	1.5:1

The 0.03% running grade adjustment was made to accommodate matching an existing culvert around station 127+25 at Oak Avenue which the 2010 report noted was a culvert installed by the County at 0.37 feet above the original design bottom. The 0.05% running grade was projected to continue from station 164+20 to 172+80 (end of the district). Both the 0.05% and 0.03% running grades are extremely flat which makes the ditch more susceptible to siltation and slow-flow environments. As it stands today, the side slopes have eroded between stations 164+20 and the end of the district ditch at 172+80 which have been caused by a variety of reasons. That is the primary area of concern raised by the landowner, Kurt and Julie Stumpf.

Side Slope Conditions

The photos recorded by Mr. Stumpf and McClure highlight a good portion of the types of defects seen throughout the lower section of the ditch. There has been steady vegetation establishment along the ditch side slopes but the integrity of the soil beneath cannot withstand the varying flow, moisture and temperature conditions especially with a steep 1.5:1 slope ratio or more in some cases. While any slope failure can impede the natural flow of water through the ditch, many of the failures encountered were partial slope failures leaving the sloughed sections partially intact with the vegetative cover on the ditch bottom or in some cases left a vertical slough with little to no remaining vegetation. Some slope failures were caused by surface water being drained toward the ditch from adjacent fields without proper surface drains to capture the incoming water. These types of failures are known as a head cut and, over time, eat long crevices into an adjacent field. This then puts pressure on the backslopes which eventually wash into the ditch. Other slope failures were caused simply by the soil material of the ditch being unable to withstand either the vertical pressure of surrounding material with steep sideslopes or the consistent lateral pressures of ongoing ditch flows, especially in wet years with heavy rainfall events. With any erosions of slideslopes, the ditch bottom becomes filled with the eroded material as seen in the photo below which further impedes flow.

Image 1: Example erosion caused by surface water eroding from above the ditch bank. This failure is commonly referred to as a head cut.

Multiple areas were noted with continuous meandering. Failed side slopes often deposit soil into the side of a ditch then those deposits will divert the water flow around it, into a soft sideslope eroding the opposite bank and depositing silt downstream. Left unattended, these meanders will reduce ditch capacity and could erode out of the ditch right of way.

Image 2: Example of meandering and silt accumulation. The sideslope on the right side of the image has sloughed into the ditch and caused the creek to meander and erode the bank on the left side.

Image 3: Example erosion caused by meandering

One unique feature on this stretch of ditch is the low water crossing at the north-south ½ quarter section line between the W/1/2 SW1/4 NE1/4 and the E/1/2 SW1/4 NE1/4. It is unclear how it was originally constructed however the existing conditions show a partially rocked, soil path. If not properly maintained, this may be another source of erosion during heavy rainstorm events, eventually leading to the downstream portion of the ditch. Maintenance of private farm crossings are typically the responsibility of the individual landowner(s) to maintain, and those maintenance records were not immediately available.

Image 4: Low water crossing of rock and soil

Pipe Conditions

Another factor which can impact side slope integrity is the placement of outlet pipes. With the existing conditions of the ditch as is, it was not possible to identify all pipes which may outlet in this stretch of ditch, but future work should consider the possibility of pipes terminating closer to the top of slope than the toe of slope. With water consistently running out of the pipe more than halfway up the side slope or into sloughed areas, the flowing water washes away the soil and vegetative side slope underneath and around the pipe over time. Some of the washouts along the ditch protruding into the adjacent ground may also be caused by failed pipe within the ditch embankment which then take-in surrounding soil material to the pipe and ditch, burying the pipe itself in the process.

One pipe was noted just upstream of the concerned area that appears to be undersized and is allowing water to wash on either side of the pipe. This should be upsized and have an anti-seep collar placed at the midpoint of the pipe run to prevent water bypassing and opening a cavity on either side as shown in the image below.

Image 5: Pipe with bypass erosion

Summary

The lower end of the DD 341 ditch has multiple slope failures caused by a variety of common ditch problems. The positive note is the abundant erosion has not led to uniform ditch bottom elevation increases above design grades in the lower section. The failures however, left unaddressed, will only compound in nature which will further misalign the ditch, eat away at adjacent cropland and prevent farmers from being able to effectively drain their adjacent lands.

5 Proposed Options

McClure recommends a ditch repair consisting of several common types of repairs. Firstly, the proposed repair consists of straightening the channel on the lower 900 feet from the outlet to the vicinity of the low water crossing. This involves excavating and reshaping the side slopes to establish a minimum 6 feet wide straight channel to help prevent further erosion. Meanders curving into the ditch would be excavated from the ditch bottom while erosion and meanders curving into the side slopes would be addressed with more gradual side slopes and some armoring, depending on the severity. The running grade and elevation will also be similar to those projected from the latest project as the intent is not to improve the capacity of the ditch itself but to complete repairs necessary to maintain its useful life.

The proposed repair also consists of dipping the bottom and widening the remaining 1:1.5 side slopes to at least a 2:1. Some areas may require a 3:1 to prevent some of the vertical erosion cases noted in the survey. This will make the side slopes less steep to lower the risk of toe of slope failure in the future. The landowner indicated he is supportive of widening the ditch further into his production land for this purpose. Existing right of way details were not readily available in the records so no specific easement or right of way information has been discussed but should be agreed upon by both parties prior to any widening work. This process will also repair the remaining areas experiencing sloughing and scouring. Widening the side slopes is the most economically expedient method for repair to prevent future damage to the facility, compared to armoring most of the ditch along the existing side slopes. Additional spoil will be spread on the existing berms. In the areas where the running grade is already lower than those design elevations, the ditch bottom would not be filled in just to meet those elevations. It is also standard practice to excavate the ditch to approximately six inches below design grade, where needed, to account for construction related sedimentation and soil washing into the ditch prior to vegetation establishment. When possible, surrounding side slope vegetation will be left undisturbed. In areas where the outside of a bend is eroding away it will be necessary to excavate the inside of the bend and place rip rap at the base of the outer slope.

The proposed repair also consists of replacing all outlet pipes in fair or poor condition with corrugated metal pipe (CMP) and establishing supportive surrounding material. The CMP outlet pipe material is typically durable during Iowa's seasons for both surface drains and sub-surface drains when installed correctly and properly maintained. We recommend installing a minimum of 12" CMP on all outlets regardless of small size to reduce the risk of pipe failure due to differences in manufacturing techniques for smaller sized pipe. We also recommend installing rip rap with engineering fabric beneath the outlet to reduce the chances of future washouts on the side slope around the pipe. Several surface drains and their respective aprons are proposed to be added, after coordination with the adjacent landowner, to better capture surface water flowing towards the ditch from those lands. The upper end of these near the field would be marked with PVC pipe identifiers.

All disturbed side slopes are proposed to be seeded to establish vegetation as soon as possible. With the sloughing seen on this section of ditch, the specified seeding window should be strictly adhered to. As is referenced below, adjacent lands in specific farm programs are the responsibility of the landowner and therefore are not proposed to be re-seeded with any specific type of native plantings or cover crops.

As for the downstream ditch outside of the drainage district, the United States Army Corps of Engineers would have jurisdiction for repairs. The project may require stream mitigation. This could be accomplished through a permitee-responsible mitigation project on that site or another, or through the purchase of stream mitigation credits from a registered mitigation bank. If wetlands are immediately present and the project impacts over 0.10 acre, USACE would require a Section 404 permit and possibly wetland mitigation (separate from stream mitigation) depending on the how it is permitted and any thresholds with the underlying permit. That process would require more coordination from those entities as well as the adjacent landowners as any disturbed wetlands have the potential to impact that landowner's farm programs.

Another option for completing work on the downstream end would be to research annexing that ground into the drainage district. With the different entities which would be involved, an attorney familiar with Iowa Drainage Law should be consulted if annexation is desirable.

6 Engineer's Opinion of Probable Costs

Table 2: Engineer's Opinion of Probable Cost

Option	Total Estimated Construction Cost	Total Estimated Administrative / Engineering Cost	Total Estimated Cost for Repairs with Contingency
Main Ditch Repairs	$52,000	$29,000	$97,200

7 Annexation and Reclassification

The District was reclassified as part of the 1980 improvement project. This proposed work is part of the Main Open Ditch schedule and therefore would be spread amongst the landowners on that schedule based on their pro rata share similar to the spread of the most recent project. Due to the limited stretch of the investigated ditch and the intent to save costs, a detailed classification review was not completed as part of this scope for either reclassification or annexation consideration. If there are landowners who feel their respective assessment is unfair or if conditions of water flow from individual fields within the District have changed since 1980, McClure could investigate those further on a case-by-case basis.

8 Regulatory

While a Drainage District may have the authority to maintain the original capacity of its existing facilities through or adjacent to wetlands, a property owner is ultimately the responsible party for disturbance of jurisdictional wetlands located within the owned parcel. The United States Department of Agriculture (USDA) Farm Program requires conservation measures administered through the National Resources Conservation Service (NRCS) which include wetlands, those same or other wetlands may fall under the jurisdiction of the United States Army Corps of

Engineers (USACE). USACE regulates wetlands and other aquatic habitat through Section 404 of the Clean Water Act and the United States Environmental Protection Agency regulates water quality to those jurisdictional wetlands or waters through Section 401 of the Clean Water Act. Placement of riprap to help prevent scour and stabilize side slopes will require approval from USACE.

9 Administration

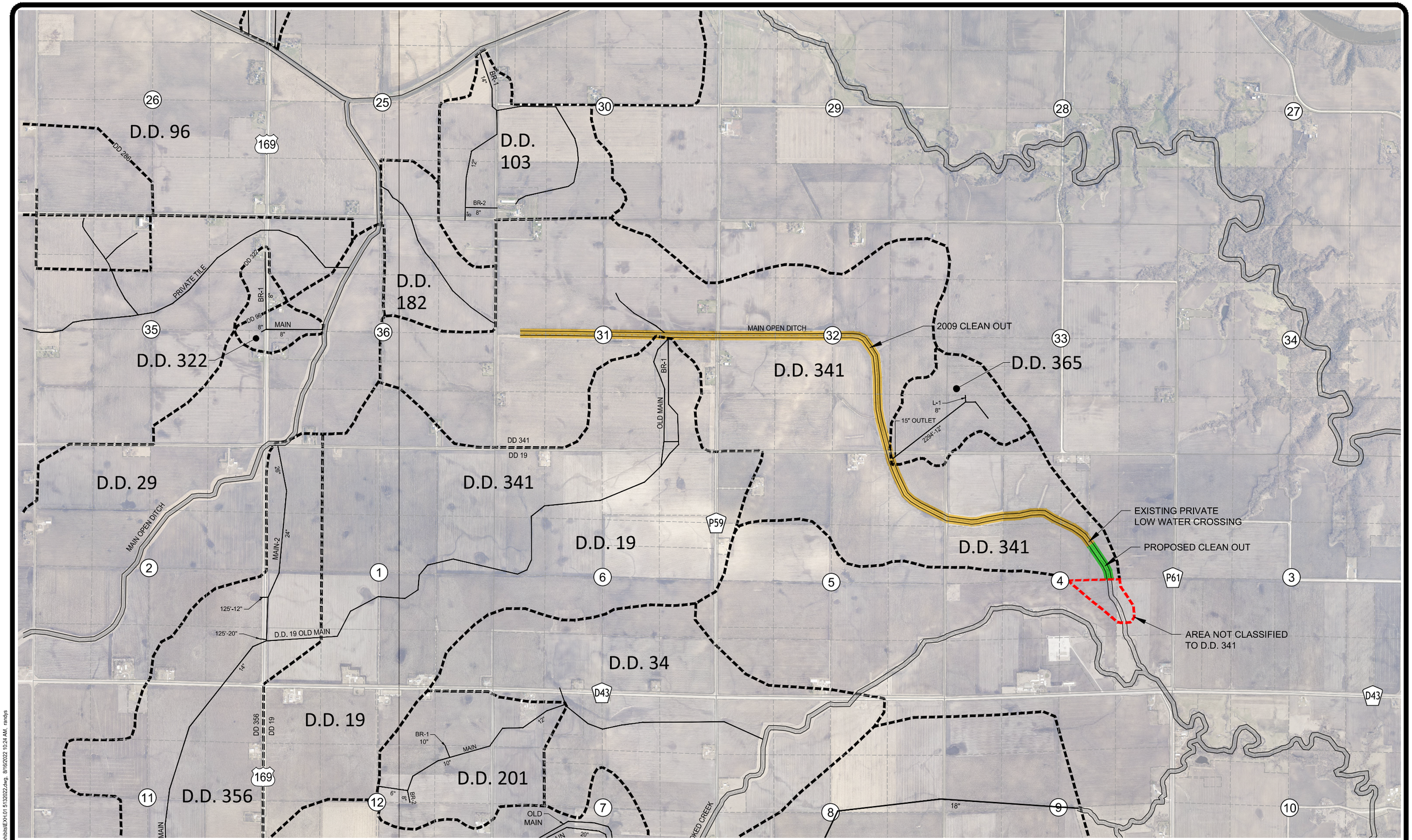
If this report is tentatively approved, The Code of Iowa requires a public hearing date be set regarding this report and notice given to all district landowners included in the Drainage District No. 341 Main Ditch assessment schedule (Section 468.126, para 1.c.). If the project is approved, public bid letting will not be required, however competitive quotes will need to be collected (Section 468.34).

We anticipate the following steps in order to move forward with this report and project:

- Tentatively approve this report
- Set a date and time for the public hearing allowing time to provide notice to landowners
- Notice shall be provided to all landowners pursuant to Sections 468.14 through 468.18 of Iowa Code.
- Conduct public hearing
    - Hear objections to the feasibility of the proposed option(s)
    - Hear arguments for or against reclassification
    - Order the repairs or improvements that are found to be desirable
    - Set a letting date and time
- Obtain necessary permits or other regulatory requirements
- Collect Quotes from Contractors
- Award project to lowest, responsive, responsible contractor
- Construct the repairs or improvements
- Hold completion hearing in accordance with 468.101-468.103

APPENDIX A

REPORT EXHIBIT



WEBSTER COUNTY

DRAINAGE DISTRICT NO. 341
MAIN OPEN DITCH REPAIRS

McCLURE ENGINEERING CO.

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APPENDIX B

ENGINEER'S OPINION OF PROBABLE COSTS

WEBSTER COUNTY D.D. 341
MAIN OPEN DITCH REPAIRS
MEC No. 202075

PRELIMINARY ENGINEER'S OPINION OF PROJECT COST

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1	Channel Straightening - Meander removal	9	STA	$300.00	$2,700.00
2	Channel Excavation - Ditch Widening	1,100	CY	$5.00	$5,500.00
3	Spoil Leveling	9	STA	$130.00	$1,170.00
4	Seeding	1	AC	$1,500.00	$1,500.00
5	6" to 8" Tile Drain	60	LF	$15.00	$900.00
6	15" Tile Drain	20	LF	$22.00	$440.00
7	12" CMP	60	LF	$32.00	$1,920.00
8	15" CMP	200	LF	$39.00	$7,800.00
9	24" CMP	120	LF	$50.00	$6,000.00
10	24" Metal Apron	3	EA	$400.00	$1,200.00
11	Rip Rap - Class E	400	TN	$50.00	$20,000.00
12	Clearing & Grubbing	1	LS	$2,870.00	$2,870.00
	SUBTOTAL CONSTRUCTION				**$52,000.00**
	REPORT AND HEARINGS				**$14,000.00**
	ENGINEERING, DESIGN, AND QUOTE PHASE				**$15,000.00**
	CONTINGENCY (20%)				**$16,200.00**
	TOTAL PROJECT COST				**$97,200.00**

Consultant's *opinions of probable construction costs are to be made on the basis of* ***Consultant's*** *experience, qualifications, and general familiarity with the construction industry. However, because* ***Consultant*** *has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions,* ***Consultant*** *cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from opinions of probable construction cost prepared by* ***Consultant****.*