

**FINAL**

# Technical Memorandum

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**To:** Lisa Hanni  
Goodhue County

**From:** Chris Otterness, PE  
Houston Engineering, Inc.

**Subject:** Goodhue CD1 Tile Inspection and Ditch  
Repair Report

**Date:** January 15, 2020

**Project:** HEI 6400-0004

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am duly Licensed Professional Engineer under the laws of the State of Minnesota.



1-15-2021

Christopher Otterness  
Reg. No. 41961

Date

## INTRODUCTION AND EXECUTIVE SUMMARY

Goodhue County Ditch 1 (CD 1) is in disrepair and in need of maintenance work. The open channel is partially filled with sediment, banks have sloughed in some locations, some culverts are too high and/or in disrepair, and vegetation is restricting flow in some reaches. Flow through the public drain tile is restricted in key areas, and some sections of the tile are undersized relative to their tributary areas due to changes in their tributary areas and accepted design practices.

The Goodhue County Drainage Authority has contracted with Houston Engineering (HEI) to prepare a tile inspection and repair report for the open channel ditch. The purpose of this report is to provide an assessment of the condition of the public drain tile, including an analysis of drainage coefficients, and a description and analysis of repair alternatives for the open channel portion of CD 1, including hydrologic and hydraulic analyses and a preliminary opinion of probable cost for the recommended repairs. It also includes a brief historical review of the CD 1 open channel to determine the repair profile.

To restore the function of CD 1, we recommend a repair of the County Ditch 1 open channel to the As-Constructed and Subsequently Improved Condition (ACSIC) grade. A total of three culvert crossings on CD 1 were identified during this study. We recommend replacing two of the three to allow the ditch to function as constructed.

We also recommend a repair of the tile portions of the public drainage system. Prior to ordering a repair for the public tile, we recommend coordination with landowners to determine the likelihood they will petition to improve the branches that are under-sized relative to their current drainage areas per modern tile sizing guidelines.

We conclude the proposed repairs are necessary to restore the full function of the drainage system and meet future stormwater management needs, and they are in the best interest of benefitted property owners.

To assist the County, concept-level design (**Figure 2**) and cost information (**Attachment B**) are provided in this memorandum. However, detailed construction plans, bid documents, and specifications will need to be prepared subsequent to the County establishing and ordering a project. Goodhue County retains the decision whether to accept, reject, or modify the Engineer's recommendation.

## **SYSTEM LOCATION AND ESTABLISHMENT**

### Location of the Public Drainage System

Goodhue County Ditch 1 (CD 1), shown in **Figure 1**, includes a 2.2-mile open channel ditch and 5 branches of public drain tile that total 2.4 miles in length. The system is located south of the City of Kenyon in Sections 28, 29, 30, 31, 32, and 33 of Kenyon Township (T109N, R18W).

The open channel flows from west to east, with the public drainage system ending on the west end of the CSAH 13 culvert. Runoff from CD 1 then flows down a private ditch, ultimately outletting into the North Branch Middle Fork Zumbro River.

### Establishment of the Public Drainage System and Known System Modifications or Proceedings

Goodhue CD 1 was established in 1954 following the submission of a landowner petition. The petition was originally filed to create capacity in the waterway and lower the ditch bottom to create an outlet for drain tiles. The ditch and drain tile were constructed in 1955 according to the as-designed alignment described in the Final Engineer's Report dated October 13, 1954.

**Figure 1** shows the current alignment of the channel and locations of roadway crossings determined via a review of available records, field survey, aerial imagery, and other available evidence. The historical records do not indicate any changes to the alignment of the channel. Records do show, however, modifications and repairs have been made to the ditch since its construction in 1955.

A petition for improvement of the open channel portion of the ditch was filed in September 1960, and the improvement work was done in 1961. The petitioned improvement widened the ditch bottom from 6' to 10' from Station 0+00 to the confluence with Private Ditch 42 at approximately Station 30+00. The 1961 improvement also created Private Ditch 42, which drains land to the north of CD 1. Private Ditch 42 is not a component of CD 1 and does not fall under the jurisdiction of Goodhue County.

In 1995, landowners petitioned to have CD 1 cleaned out, and in 1996, sediment and vegetation were cleaned for the full length of the ditch.

## **HISTORIC AND CURRENT CONDITIONS - TILE**

### Currently Observed Conditions

The CD 1 drainage system was established with five main branches of drain tile as shown in **Figure 1**. Branches A and B, located west of County Road 59 at the upstream end of the system, are both over a mile long, and the other three branches are short branches that provide local drainage connections.

In order to evaluate the condition of the existing system, portions of the tile system were televised in September 2020 by Empire Pipe Services under the supervision of Houston Engineering staff. Televising began at the downstream end of each tile branch where they outlet into the open ditch. The locations are shown on **Figure 1**.

At each location, inlet grates or rodent traps at the downstream end were removed, and the televising equipment was guided to its maximum extent feasible in the upstream direction. At the completion of the survey, the grates and traps were reinstalled.

The results of the televising investigation are described in the following sections.

### *CD 1 Branch A*

Branch A outlets at a concrete drop structure located west of County Road 59 in the road right-of-way. The tile generally travels to the southwest before terminating with two sub-branches. One sub-branch ends at the boundary of Sections 30 and 31 and the other ends in Section 31 after traveling south under 510<sup>th</sup> St. in a culvert.

Televising work at this location began at the concrete drop structure outlet. The Branch A tile outlets as a 14-inch concrete pipe. Heading upstream, the pipe switches to 14-inch corrugated metal pipe approximately 3 feet from the outlet. The fitting between the two is poor, as evidenced by broken concrete sitting at the joint. The metal section, which was likely placed by an undocumented repair, is approximately 5 feet long before it joins a 14-inch unreinforced concrete pipe. The junction at the transition is cracked longitudinally and a repair is evident in the concrete pipe.

The concrete pipe shows signs of disrepair for the next 66 feet, with longitudinal cracks on many of the tile sections and deterioration of the pipe joints. The joint at 70 feet upstream from the outlet has a large angular crack. The survey was ended 72 feet upstream because the televising equipment could not get around a bend in the pipe.

### *CD 1 Branch B*

Branch B also outlets at the concrete drop structure located west of County Road 59. Branch B generally travels northwest from the outlet before terminating with two sub-branches that end in the middle of Section 30.

Televising of Branch B began at the concrete drop structure. The televising crew was unable to move the televising equipment upstream due to broken concrete blocking the bottom half of the 10-inch concrete pipe near the outlet. Still imagery showed the top of the concrete pipe is decaying near the outlet as well. Significant soil erosion behind the concrete drop structure is evident above the exterior of Branch B.

Branch B provides service to a landowner in the north  $\frac{1}{2}$  of Section 30 who expressed concerns at the August 2020 public meeting about poor drainage in the tile.

### *CD 1 Branch C*

Branch C is a short 450-foot long lateral that outlets into the open channel ditch at approximately Station 101+00. The tile extends south from the ditch before terminating at the southern boundary of Section 29.

Televising of Branch C began at the concrete drop structure that outlets into the ditch. An 8-inch clay pipe approximately 1 foot long was observed at the outlet. The pipe then transitions to an 8-inch smooth PVC pipe, with the PVC pipe offset downward by 2 inches. Rocks and grass were visible at the top of the disjointed pipes. The televising equipment was unable to travel past the offset joint and the televising was ended.

### *CD 1 Branch D*

Branch D is a 450-foot long lateral that outlets into the ditch at approximately Station 94+30. The tile extends south from the ditch outlet before terminating at the southern boundary of Section 29.

Televising of Branch D was attempted at the pipe's outlet into the ditch. The televising crew was unable to access the 6" clay pipe and the survey was immediately terminated. The outlet was completely underwater and backfilled with broken soil.

### *CD 1 Branch E*

Branch E is an 1,800-foot long lateral that outlets into the ditch at approximately Station 78+00. The tile extends south from the ditch into the NE  $\frac{1}{4}$  of Section 32.

Televising of Branch E began at the concrete drop inlet. Beginning at the outlet, an 8-inch RCP pipe was observed. At 15 feet upstream from the outlet, the tile transitions to an 8" corrugated HPDE pipe in good condition. Traveling upstream, some roots are visible growing through the pipe wall, but they



are present at a relatively low density. Generally, the 400 feet upstream of the outlet are in good condition.

At 415 feet from the outlet, the tile transitions to a 6" HPDE tile. Small deflections at the top of the tile were observed at 435', 490', and 620' from the outlet. A greater deflection was observed at 648' which caused the survey to be terminated.

## Hydraulic Capacity

### *Existing Conditions vs. ACSIC*

The evaluation of the as-constructed and subsequently improved condition (ACSIC) of a public drain tile system includes an evaluation of the pipe flow efficiency for the size, material, and grade of pipe used in the original ACSIC construction. Pipe flow efficiency is measured using the Manning's Equation, which accounts for the size, material, and grade of each pipe.

The Manning's Equation can be used to assess reductions in flow capacity that may have occurred over time. The pipe material is accounted for by using a roughness coefficient. Based on the pipe televising survey conducted in September 2020, all of the branches of CD 1 have experienced displacement via pipe settling and deformation, reduction in pipe smoothness due to decay, and blockages of flow. These factors reduce the effective radius of the pipe and increase the roughness coefficient compared to the ACSIC condition.

The Manning's Equation also accounts for the flow area available in the pipe. Deformations and blockages reduce the flow area and thus reduce the carrying capacity of the tile. Reductions in flow increase the residency times of ponded water within the surrounding watershed. The displacements and flow restrictions are especially critical when pipes are running full—which is when the surrounding watershed most in need of the pipe as an outlet for drainage.

For each of the five branches on the CD 1 public tile system (see **Figure 1** for tile locations), we estimated the Manning's *n* values and effective flow areas for the ACSIC condition determined from historical reports and for the current condition as determined by the September 2020 tile televising survey. By estimating the effective diameters of the drain tiles, we can calculate the reduction in carrying capacity of each of the tile lines when flowing full. Calculations are summarized in **Table 1**.

**Table 1 – ACSIC and Current Flow Capacities**

Line	Condition	Pipe Size (in.)	Manning's n Value	Pipe Slope (ft/ft)	Effective Area (square feet)	Effective Diameter (inches)	Velocity (feet per second)	Flow (cfs)	Percent Reduction (%)
A	As-Built	14	0.013	0.005	1.07	14.0	3.6	3.8	
A	Current	14	0.018	0.005	1.07	14.0	2.6	2.8	28%
B	As-Built	10	0.013	0.003	0.55	10.0	2.1	1.1	
B	Current	10	0.015	0.003	0.41	8.6	1.6	0.7	41%
C	As-Built	8	0.012	0.004	0.35	8.0	2.4	0.8	
C	Current	8	0.012	0.004	0.28	7.2	2.2	0.6	25%
D	As-Built	6	0.012	0.007	0.20	6.0	2.6	0.5	
D	Current	6	0.012	0.007	0.14	5.0	2.3	0.3	37%
E	As-Built	8	0.022	0.005	0.35	8.0	1.4	0.5	
E	Current	8	0.022	0.005	0.34	7.9	1.4	0.5	4%

The tile capacity calculations show that due to the deterioration of pipe walls and restrictions of flows, a number of the tile branches have likely experienced substantial reductions in carrying capacity. The two tile lines that drain the largest surface areas (Branches A and B)—which serve areas where concerns have been expressed at a recent public information meeting —have estimated capacity reductions of 28% and 41%, respectively.

Based on the televised conditions and the capacities indicated in **Table 1**, the tile branches of Goodhue County Ditch 1 are in disrepair due to flow restrictions. To restore the function of the drainage system, each of the CD 1 tile branches needs to be replaced in their entirety.

*Design Drainage Coefficient*

An evaluation of an existing drain tile system also includes determining the daily capacity relative to its contributing drainage area (i.e. “drainage coefficient”). Drain tiles have historically been installed to draw down standing water and high water tables in a reasonable amount of time to allow for cultivation. If a drain tile’s diameter is too small for its respective watershed, the lack of carrying capacity may prevent areas of the watershed from properly draining. The required capacity has generally increased since the time of the system’s construction, due to climatic changes (increased precipitation) and modern agricultural practices.

The drawdown capacity of a drain tile network is evaluated with the drainage coefficient, which is equal to the expected drawdown in inches per day assuming the drain tile is flowing full. A low drainage coefficient calculated based on a tile’s ACSIC condition is an indication it may be insufficiently sized for its current demands.

Drainage coefficients for each of the five branches of Goodhue County CD 1 were calculated based on the design pipe material, size, and slope, and the drainage areas were estimated using the ArcGIS software. Coefficients for the ACSIC conditions are summarized in **Table 2**.

**Table 2 – Drainage Coefficients for CD 1 Tile Branches**

Branch	Diameter (Inches)	Q (cfs)	Drainage Area (acres)	Coefficient (in/day)
A	14"	3.81	300	0.30
B	10"	1.12	212	0.13
C	8"	0.83	107	0.18
D	6"	0.50	21	0.57
E	8"	0.51	61	0.20

The NRCS recommended drainage coefficient for Minnesota drainage systems in row crop lands is 0.50 in/day. Each of the CD 1 branches, with the exception of Branch D, appears to be undersized for modern drainage needs.

Minnesota Statute 103E.701 Subd. 1 limits the size at which a tile may be replaced under a repair proceeding to the existing size, or the next larger size that is readily available. Each of the existing tile sizes is readily available with the exception of the 14-inch tile size for Branch A. If that branch were repaired using a 15" tile size, the drainage coefficient will be 0.39, which is closer to the NRCS recommend 0.5-inch drainage coefficient. The landowners on this branch should weigh the added cost required for an improvement proceedings prior to petitioning for either an improvement or a repair on Branch A.

## **HISTORIC AND CURRENT CONDITIONS – OPEN CHANNEL**

### As-Constructed and Subsequently Improved Grade and Geometry

The As-Constructed and Subsequently Improved Condition (ACSIC) establishes the condition to which the ditch can be legally repaired consistent with Minnesota Statute 103E.701. The ACSIC includes the original geometry of the ditch as constructed in 1955 and all subsequent repairs made legally.

Ideally, we would be able to use original as-built drawings to determine the constructed alignment, grade, and geometry. However, since as-built plans were not regularly recorded for public drainage systems in the mid-20<sup>th</sup> century, it has been common engineering practice to use profile drawings from the original design and field-obtained test pits and borings to verify the ACSIC.

For CD 1, the original design plan and profile were located during the review of historical documents. Profile elevations were provided in an arbitrary datum, and so to determine the ACSIC in a modern

datum, elevations from the historical profile were referenced to soil borings collected in the NAVD88 vertical datum during field survey. Soil boring depths were estimated by observing where material transitions from accumulated sediment to native mineral soil.

A total of five crossings were included in the original design and construction of CD 1. However, two of those were field crossings to be constructed as directed by the landowners, and based on findings, they appear to have not been constructed. Field survey for this study included locating current culvert crossings, determining their size, and surveying invert elevations.

### *Open Channel ACSIC Determination*

A total of 19 soil borings were collected along CD 1, as shown in **Figure 2**. A statistical comparison of the soil borings and repair profile elevations was performed for the length of CD 1. Through the comparison process, a datum adjustment factor was calculated to convert the design profile from the local datum to NAVD88.

A good correlation was found between the soil borings and the historical profile by applying a constant value of 1111.55 to adjust the historical profile's datum to NAVD88. The ACSIC was established according to this adjustment value for the full length of the CD 1 open channel with one exception. The ACSIC elevation of the County Road 59 culvert was set at 1234.36 and a slope of 0.53% was assumed to Station 110+26. **Table 3** provides a summary of the datum adjustment and proposed profile for the full length of the CD 1 open channel ditch.

The 1954 Engineer's Report indicated the open channel was to be constructed with 2:1 (Horizontal : Vertical) side slopes. The 1961 Improvement proceeding widened the bottom from 6' to 10' in width from Station 0+00 to the field crossing at 30+00, and the channel bottom was designed to be 4' in width from Station 30+00 to the upstream end at approximately Station 114+44.

Elevations from the historical plans match those used in this study, and thus the ACSIC has a bottom width of 10' from Station 0+00 to the confluence with Private Ditch 42 at Station 30+00 and a bottom width of 4' from Station 30+00 to the upstream end at County Road 59.

**Table 3 – CD 1 Datum Adjustment and Proposed Profile**

Current CD 1 Station	Soil Boring Elevation	Repair Profile Elevation	Proposed Profile Elevation	Deviation of Soil Boring from Proposed Profile
0+00	-----	91.90	1203.45	-----
5+07	1204.66	92.91	1204.46	-0.20
10+06	1204.92	93.91	1205.46	0.54
15+08	1205.52	94.92	1206.47	0.95*
20+07	1206.32	95.91	1207.46	1.14*
30+10	1209.25	97.92	1209.47	0.22
35+12	1210.80	98.94	1210.49	-0.31
40+13	1212.80	100.44	1211.99	-0.81*
50+13	1214.99	103.44	1214.99	0.00
55+15	1216.53	104.94	1216.49	-0.04
61+18	1218.48	106.57	1218.12	-0.36
65+20	1219.48	107.65	1219.20	-0.28
70+20	1221.31	109.00	1220.55	-0.76*
75+20	1222.87	110.35	1221.90	-0.97*
85+26	1224.68	113.07	1224.62	-0.06
90+24	1226.09	114.41	1225.96	-0.13
95+25	1227.29	115.77	1227.32	0.03
100+25	1228.26	117.08	1228.63	0.37
105+29	1229.54	118.69	1230.24	0.70*
110+26	1231.60	120.28	1231.83	0.23
115+00	-----	-----	1234.36	-----

\*Outlier not used in the determination of the channel bottom.

### Currently Observed Conditions in the CD 1 Open Channel

Field survey data, including photographs and elevations, were collected in October 2020 as part of this study. The survey data established the existing conditions and elevations of the open channel system and located culverts and other crossings along the ditch system. Soil borings were also completed to assist in determining the repair profile. Additionally, at the request of Goodhue County, HEI prepared a Ditch Inspection Memo dated June 2020 based on aerial drone footage of the open channel portion of CD 1.

The field survey and the June 2020 ditch inspection report show parts of the CD 1 open channel are in disrepair. Excessive woody vegetation growth, including trees growing in the bottom of the channel, was observed from the CSAH 13 crossing (Station 0+00) to 20<sup>th</sup> Ave. (Station 60+72). Tree growth also restricted flow at the bridge crossing of CSAH 13.

Several of the existing culvert crossings are not functioning as originally constructed due to elevations above the ACSIC profile or being sized too small to handle design flows. The 120" CMP at 20<sup>th</sup> Ave. was observed to be above the channel bottom and appeared to be causing water to pool upstream. The 84" CMP field crossing at Station 31+42 was found to be in disrepair.

Soil borings taken during the field survey verified excessive sedimentation throughout the CD 1 open channel system. Sediment depths of up to 2' were observed at some locations. Several areas of excessive sedimentation were located upstream of perched culvert crossings, providing additional support for their replacement.

## PROPOSED REPAIR

### CD 1 Open Channel

To restore the function of the CD 1 open channel drainage system to the condition as it was originally constructed requires a repair of the full extent of the Main Trunk open channel to the As-Constructed and Subsequently Improved Condition as described in the *Analysis of Current Function in Historical Context* section above. The proposed repair should include a removal of vegetation where needed to allow the open channel to flow freely.

The three culverts established as part of the CD 1 system were assessed for hydraulic capacity, relationship to the proposed channel bottom, and condition. Proposed culvert sizes were selected based on the ability to pass the 2-year discharge (calculated with the USGS Regression Equations) without overtopping the banks and similarity with the sizes of upstream and downstream culverts. The 20<sup>th</sup> Avenue local road crossing was also assessed for its ability to pass the 10-year discharge without overtopping the road, and the County Road 59 culvert was assessed for the 50-year peak discharge.

Based on the hydraulic calculations and conditions of the existing culverts, we recommend the replacement of two of the three culverts. The existing 84" corrugated metal pipe (CMP) field crossing at Station 31+42 is oversized based on the design discharge and replacing it with a 72" CMP culvert at the existing grade will meet the design criteria. The 120" CMP culvert under 20<sup>th</sup> Avenue at Station 60+57 is also oversized, and we recommend replacing it with a 72" CMP at the ACSIC grade to match the capacity of the downstream crossing.

The existing 36" reinforced concrete pipe (RCP) and headwall at the Station 114+86 crossing of County Road 59 appear to be an original installation shown on the 1954 plan set since the Goodhue County Public Works has no documents indicating the record was replaced. Visual inspection showed the culvert is in good condition, and hydraulic modeling showed it is adequately sized. The culvert's present condition is sufficient to convey flows of the public drainage system and does not need to be modified or replaced as part of a proposed repair.

**Table 4** lists the CD 1 culverts and proposed replacement actions, culvert sizes, and materials. **Attachment A** provides additional detail on the sizing criteria.

**Table 4 – Culvert Sizing**

Maintenance Responsibility	Crossing	Location	Existing	Recommendation	Notes
Private	Field Crossing	Station 31+42	84" CMP	Replace with 72" CMP culvert at existing grade	Existing culvert is oversized and in disrepair.
Kenyon Township	20th Avenue	Station 60+57	120" CMP	Replace with 72" CMP culvert at ACSIC grade	Existing culvert is above the ACSIC grade and in disrepair.
Goodhue County	County Road 59	Station 114+86	36" RC	No Action	Existing culvert is original installation with headwall.

*Hydraulic Impacts*

County Ditch 1 has significant sedimentation upstream of 20<sup>th</sup> Avenue and two culverts on the system are located above the ACSIC grade. The proposed repairs will reduce peak water levels for smaller rain events, but they are not expected to significantly impact peak water levels for the 100-year flood event.

All proposed culverts are comparable in size to upstream and downstream locations. Capacities of the recommended replacements are not larger than the ACSIC channel and thus they will not result in an increase in channel capacity.

*Regulatory Considerations*

**Wetlands**

There are three regulatory programs that may be triggered by a drainage system repair project, including the Minnesota Department of Natural Resources (MnDNR) Public Waters Permitting Program, the federal Clean Water Act (CWA), as implemented by the US Army Corps of Engineers (USACE), and the state Wetland Conservation Act (WCA), as implemented by the Local Government Unit, which in this case is Goodhue County. The following is a review of the repair project relative to these three regulatory programs.

As seen in **Figure 3**, CD 1 does not intersect any state-listed Public Waters, Public Water Wetlands, or Public Watercourses.

The CD 1 public drainage system intersects wetlands identified in the MnDNR National Wetland Inventory (NWI) as shown in **Figure 3**. Under the two wetland regulatory programs, (Minnesota WCA and Federal CWA) activities related to repair of a public drainage system are generally exempt from permitting and mitigation requirements. These activities related to public drainage system maintenance and repair, and include:

- Excavation in wetlands when limited to removal of accumulated sediment or debris such as trees, logs, stumps, beaver dams, blockage of crossings, and trash, provided the removal does not result in alteration of the original cross-section of the wetland or watercourse;
- Removing those materials placed by beaver;
- Removing or moving materials blocking installed roadway crossings and related drainage structures; and
- Temporary or seasonal water level management activities done for the purpose of performing maintenance.

Under the federal CWA, drainage system maintenance or repair is exempt from regulation. Under the state WCA, activities related to maintenance or repair of a public drainage system are exempt from replacement, include:

- Maintenance or repair of a public drainage system which drains Type 1, 2, 6, 7, or 8 wetlands; and
- Maintenance or repair of a public drainage system which drains Type 3, 4, or 5 wetlands that have existed for 25 years or less.

Based on a review of the NWI data and aerial photography to confirm wetland types, the wetlands identified within proximity to CD 1 are Type 1 wetlands (Figure 3). There do not appear to be any Type 3, 4, or 5 wetlands within the CD 1 area, therefore the drainage system repair project will meet the exemption criteria of the state WCA and no wetland permitting is required.

### ***Threatened and Endangered Species***

Public drainage systems may encounter situations where Minnesota's Endangered Species Statute (MS 84.0895) and the associated Rules apply. The endangered species program regulates activities that take, import, transport, or sell any portion of an endangered or threatened species where these acts may be allowed by permit issued by the DNR. The statutes exempt the accidental, unknowing destruction of designated plants. However, it is the responsibility of the Engineer when preparing a final report to complete due diligence to avoid impacts to threatened and endangered species.

Based on the MnDNR's Natural Heritage Information System (NHIS) data (Houston Engineering License Agreement LA-944). The Engineer did not observe any state-listed threatened vertebrate or invertebrate animal species within a 1-mile radius of the CD 1 system.



## PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

A Preliminary Opinion of Probable Construction Cost (POPCC) was developed for the recommended repairs to the open channel portion of CD 1. The POPCC is included as **Attachment B**. The estimated cost is shown in **Table 5**.

**Table 5 – Preliminary Opinion of Probable Construction Cost Summary**

Category	Cost
Construction Costs	\$252,860
<i>Public Road Crossings</i>	\$25,920
<i>Public Drainage Infrastructure</i>	\$226,940
Engineering**	\$42,140
Legal and Administrative	\$20,000
<b>Total Repair Project Cost</b>	<b>\$315,000</b>

A contingency of 20% has been added to the construction costs. Engineering is equal to 20% of the total construction cost before the contingency is applied.

## CONCLUSIONS / RECOMMENDATIONS

We recommend the County complete a repair of the CD 1 open channel system to the ACSIC as depicted in Figure 2 to restore the function of the CD 1 public drainage system to the condition as it was originally constructed. We conclude the proposed repairs are necessary to meet current and future stormwater management needs, and that the repairs are in the best interest of the property owners. The recommended repairs are believed to balance the need to provide serviceable drainage and stormwater management with the desire to minimize environmental impacts while implementing the best value alternative.

To assist the Drainage Authority, concept-level design and cost information for the open channel repair of CD 1 are included in this memorandum. However, detailed construction plans, bid documents, and specifications will need to be prepared subsequent to the Drainage Authority establishing and ordering a project. The Drainage Authority retains the decision whether to accept, reject, or modify the Engineer’s recommendation.

The five public tile branches (Branches A through E) are also in need of repair, consisting of replacement in their entirety. Prior to initiating a repair of any of the five public tile branches, the Drainage Authority should consider whether each branch provides public value and determine if they are likely to receive an improvement petition on the system. Branches A and B provide drainage to multiple landowners and clearly provide a public benefit. However, Branches C, D, and E are shorter branches that individually serve only single parcels of land. For this reason, they may not be providing a public value and may be better managed by the landowner.

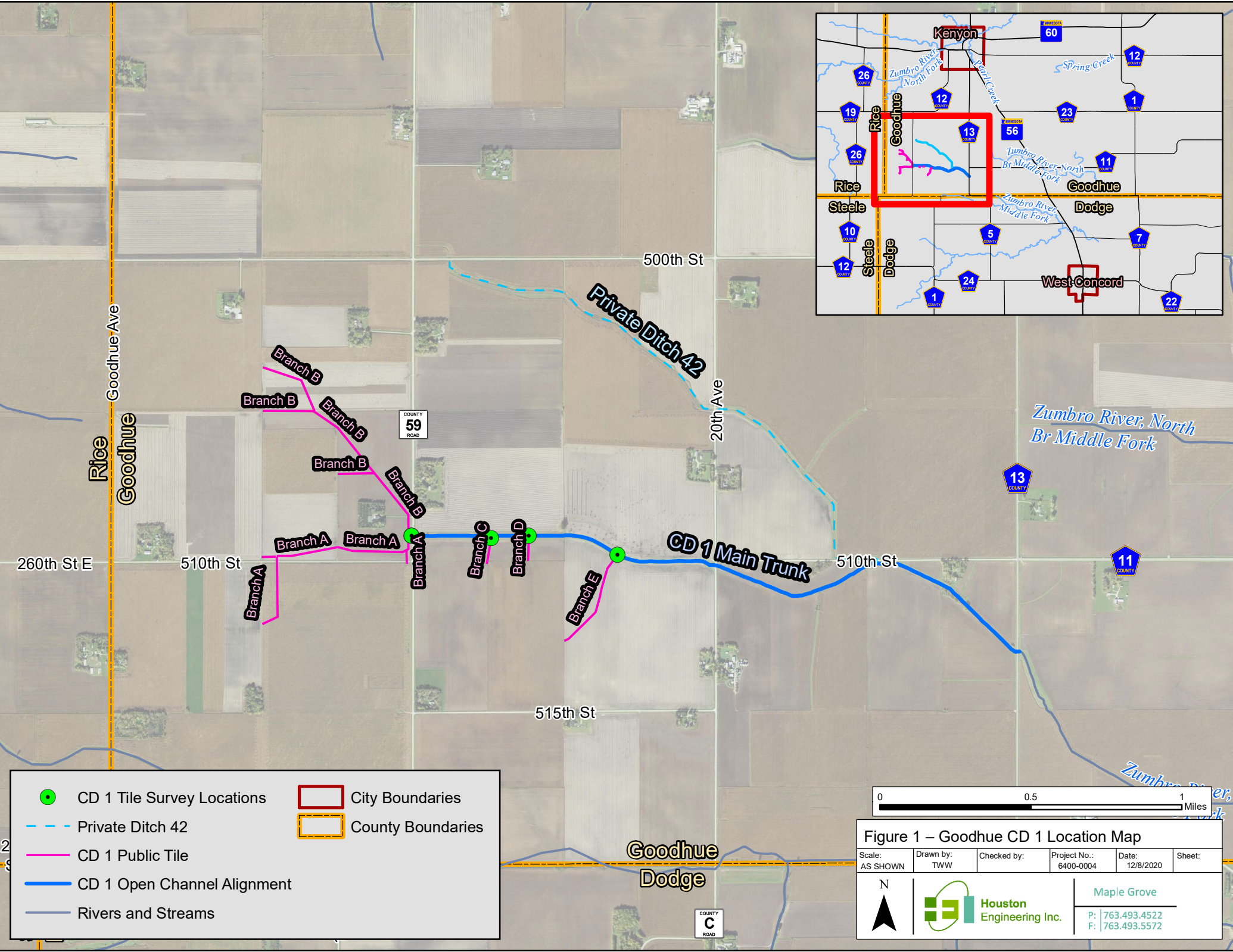
**FINAL**

Based on public feedback and the calculated drainage coefficients, we understand there may be interest from the landowners on Branches A and B to initiate an improvement proceeding. We recommend the Drainage Authority obtain further input from the landowners on their likelihood of initiating an improvement proceeding to increase their drainage capacity. Branch B is sized substantially smaller than modern drain tile sizing standards and increasing the size of the tile will likely result in a substantial increase in drainage benefit. Conversely, if Branch A were repaired, its drainage coefficient would be 0.39 inches per day, close to the NRCS recommended coefficient of 0.5 inch per day. A petition for improvement on this branch would be less likely to be cost effective.

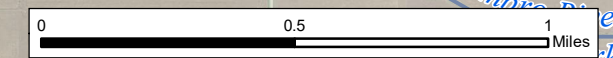
## **LIST OF ATTACHMENTS**

Attachment A: Sizing Criteria for Culvert Replacement

Attachment B: Preliminary Opinion of Probable Construction Cost



	CD 1 Tile Survey Locations		City Boundaries
	Private Ditch 42		County Boundaries
	CD 1 Public Tile		
	CD 1 Open Channel Alignment		
	Rivers and Streams		



**Figure 1 – Goodhue CD 1 Location Map**

Scale: AS SHOWN	Drawn by: TWW	Checked by:	Project No.: 6400-0004	Date: 12/8/2020	Sheet:
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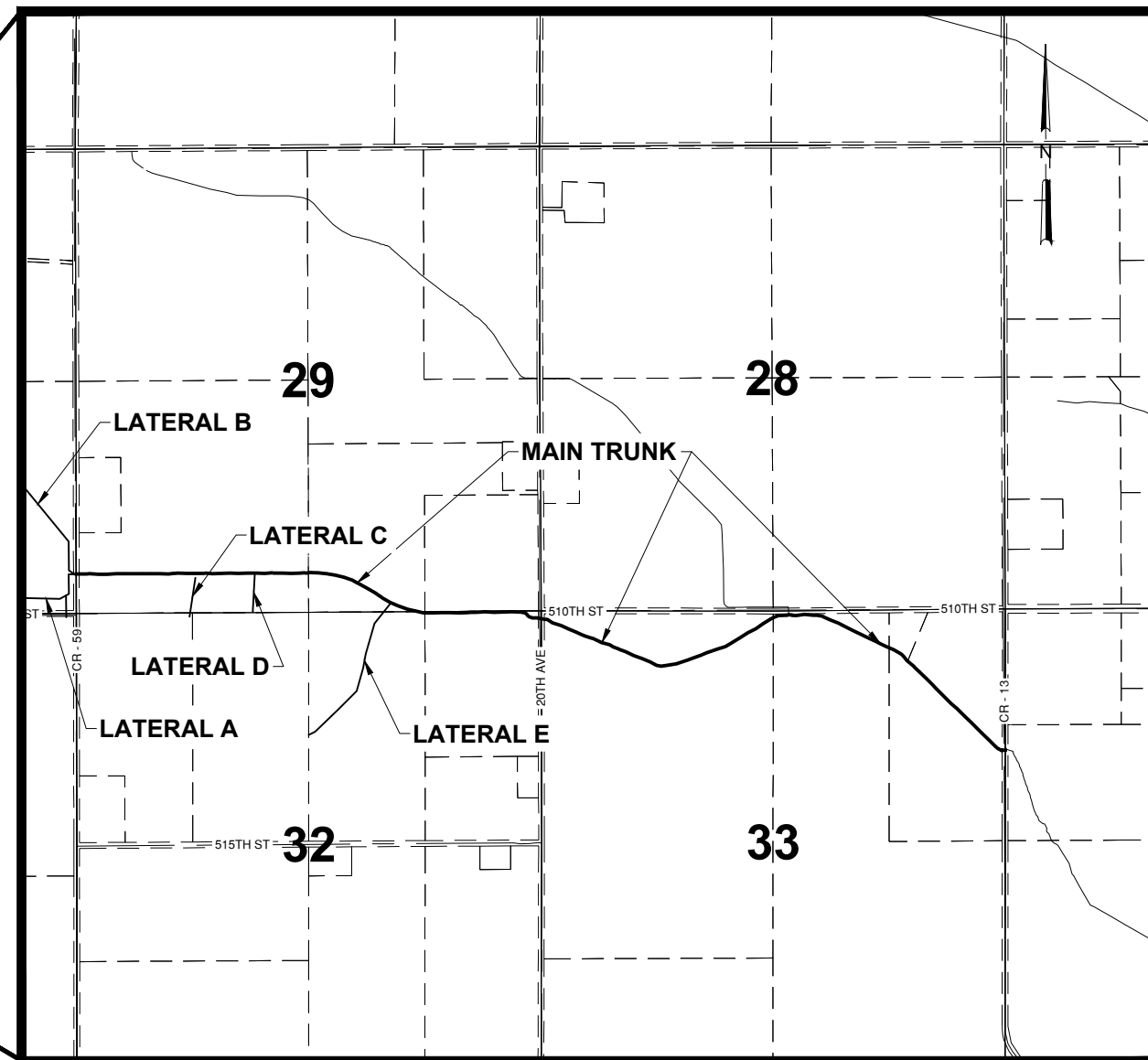
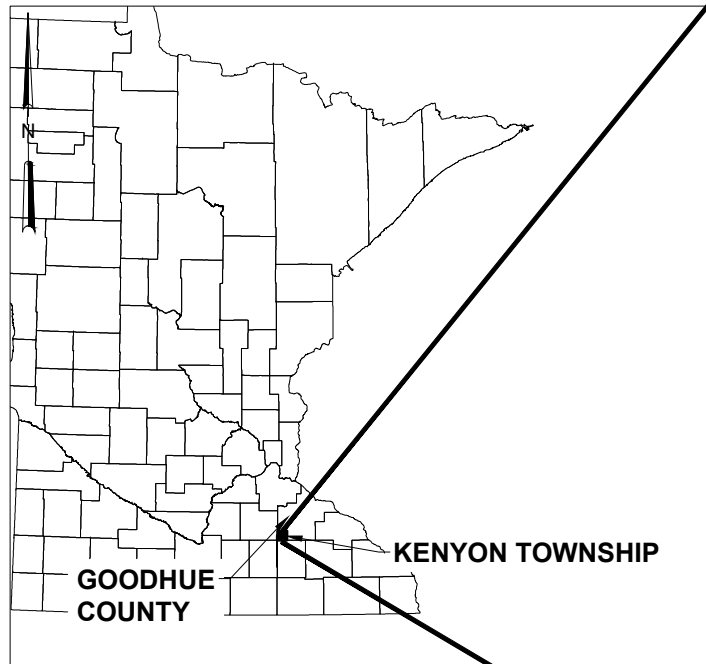
Houston Engineering Inc.

Maple Grove  
 P: 763.493.4522  
 F: 763.493.5572

# GOODHUE COUNTY DITCH 1 REPAIR REPORT

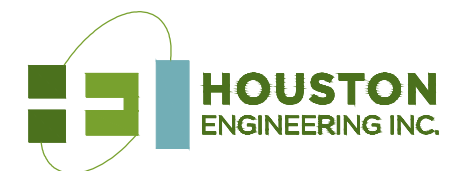
GOODHUE COUNTY  
KENYON TOWNSHIP  
JANUARY 2021

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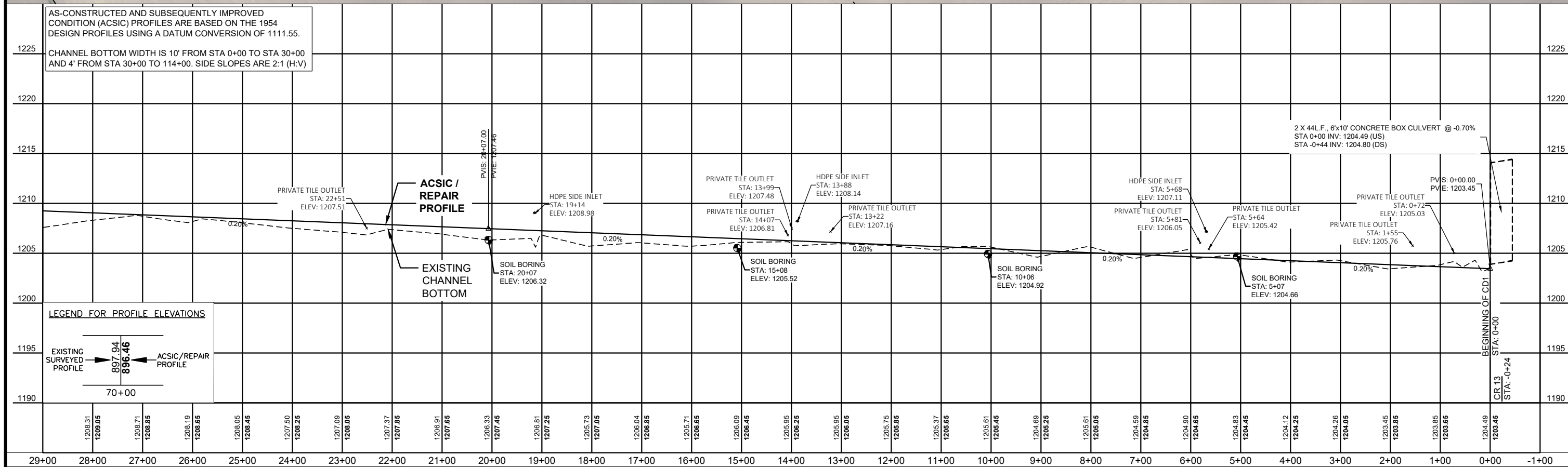
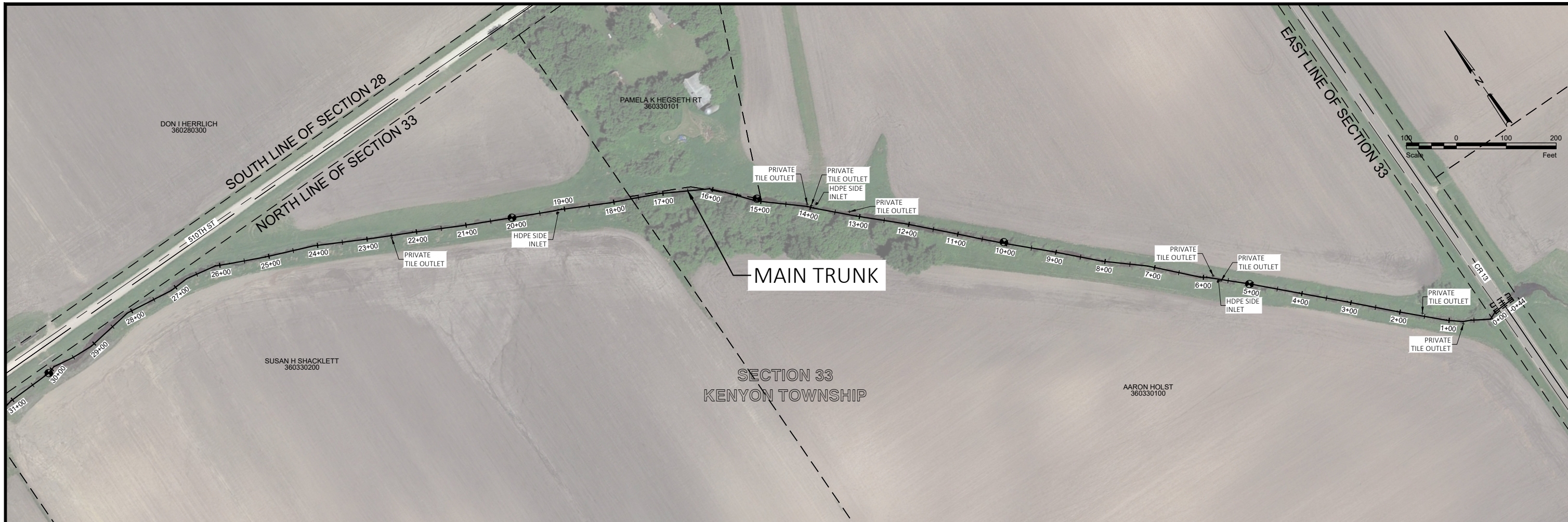
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PREPARED BY:



MAPLE GROVE, MINNESOTA

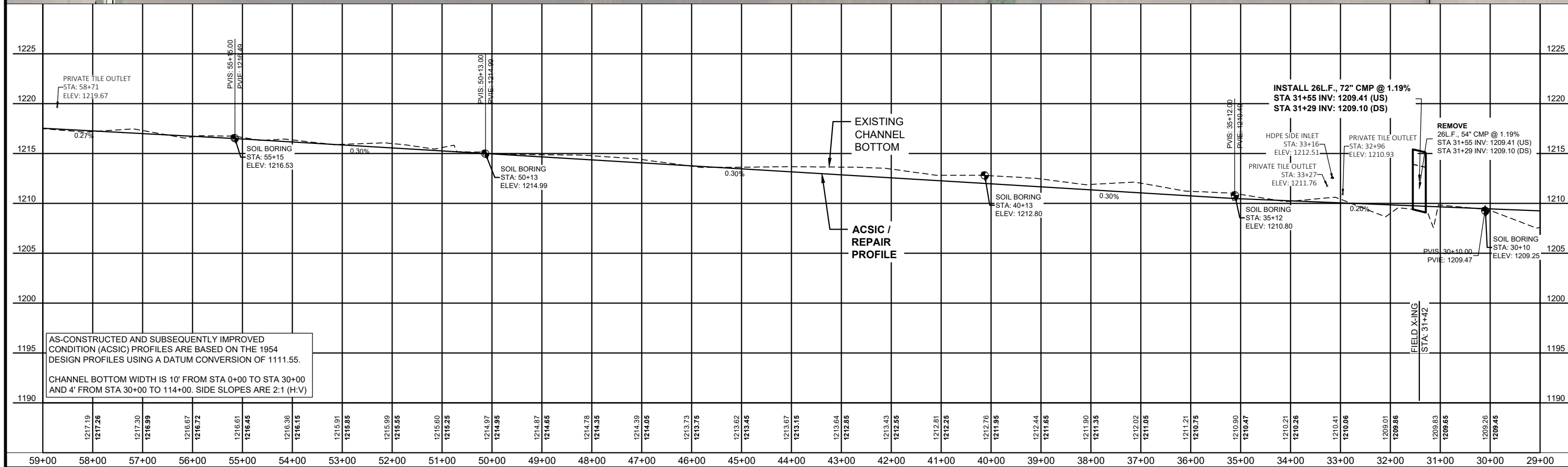
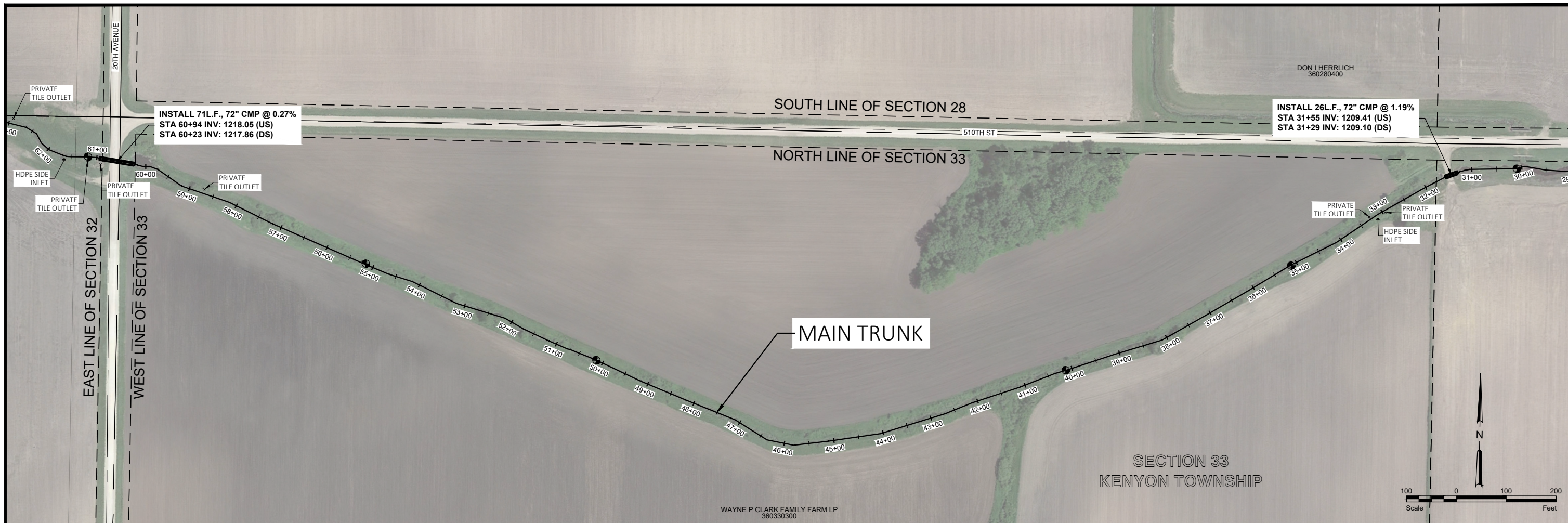




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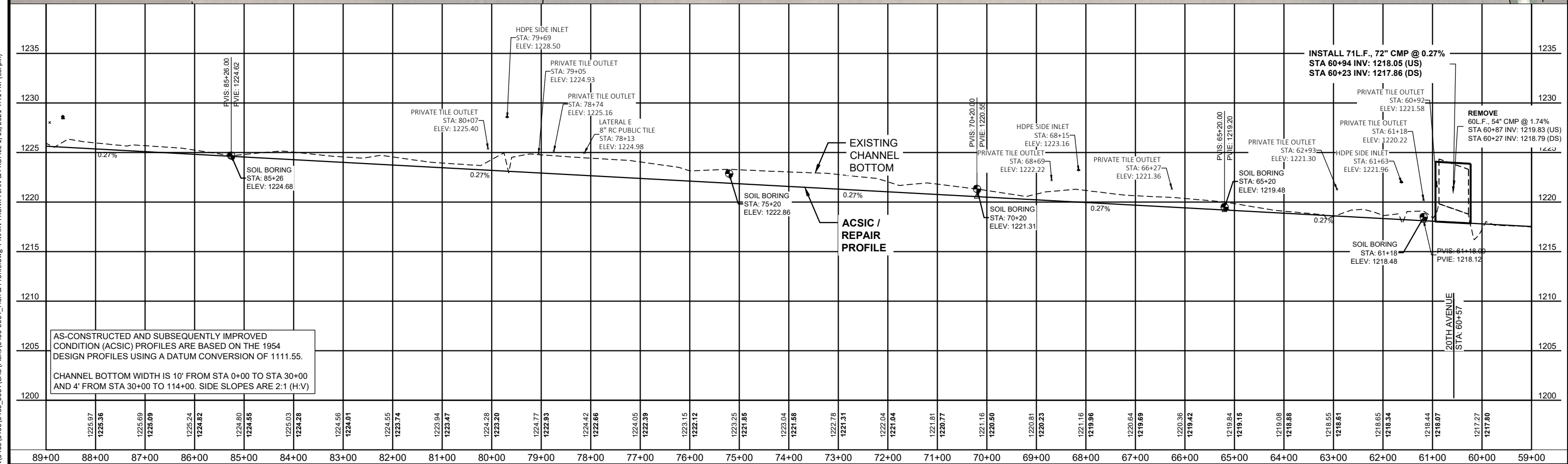
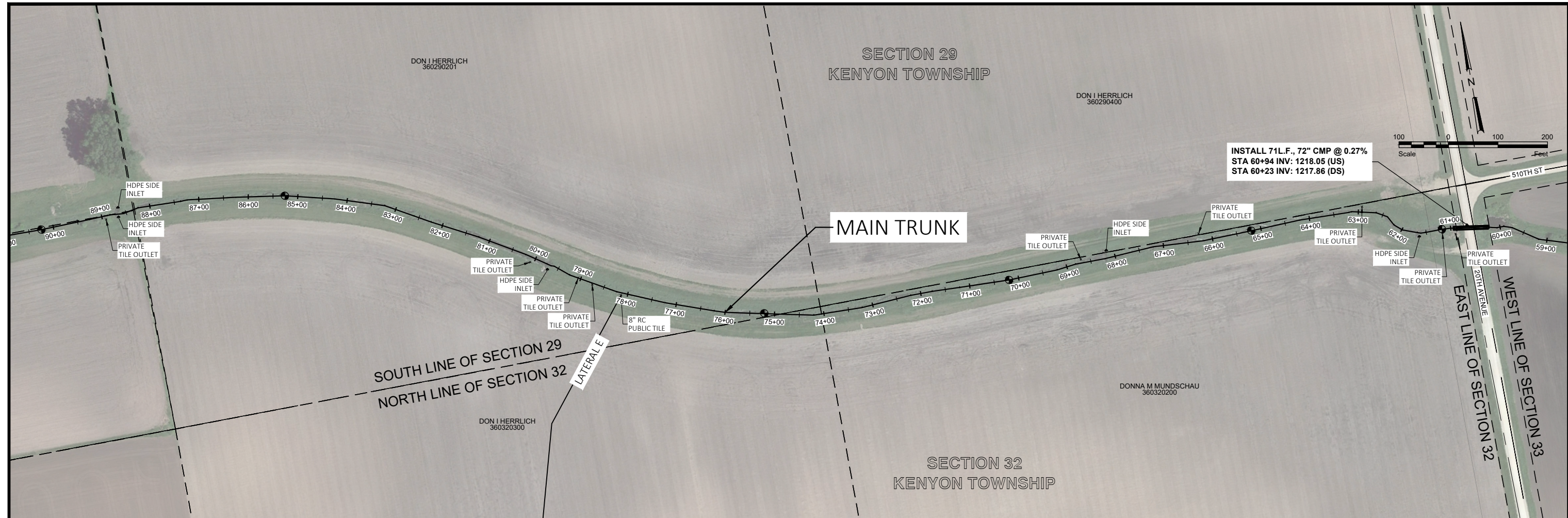
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89+00	88+00	87+00	86+00	85+00	84+00	83+00	82+00	81+00	80+00	79+00	78+00	77+00	76+00	75+00	74+00	73+00	72+00	71+00	70+00	69+00	68+00	67+00	66+00	65+00	64+00	63+00	62+00	61+00	60+00	59+00																											
1225.97	1225.36	1225.69	1225.09	1225.24	1224.82	1224.80	1224.55	1225.03	1224.28	1224.56	1224.01	1224.55	1223.74	1223.94	1223.47	1224.28	1223.20	1224.77	1222.93	1224.42	1222.66	1224.05	1222.39	1223.15	1222.12	1223.25	1221.85	1223.04	1221.58	1222.78	1221.31	1222.04	1221.04	1221.81	1220.77	1221.16	1220.50	1220.81	1220.23	1221.16	1219.96	1220.64	1219.69	1220.36	1219.42	1219.84	1219.15	1219.08	1218.88	1218.55	1218.61	1218.65	1218.34	1218.44	1218.07	1217.27	1217.80

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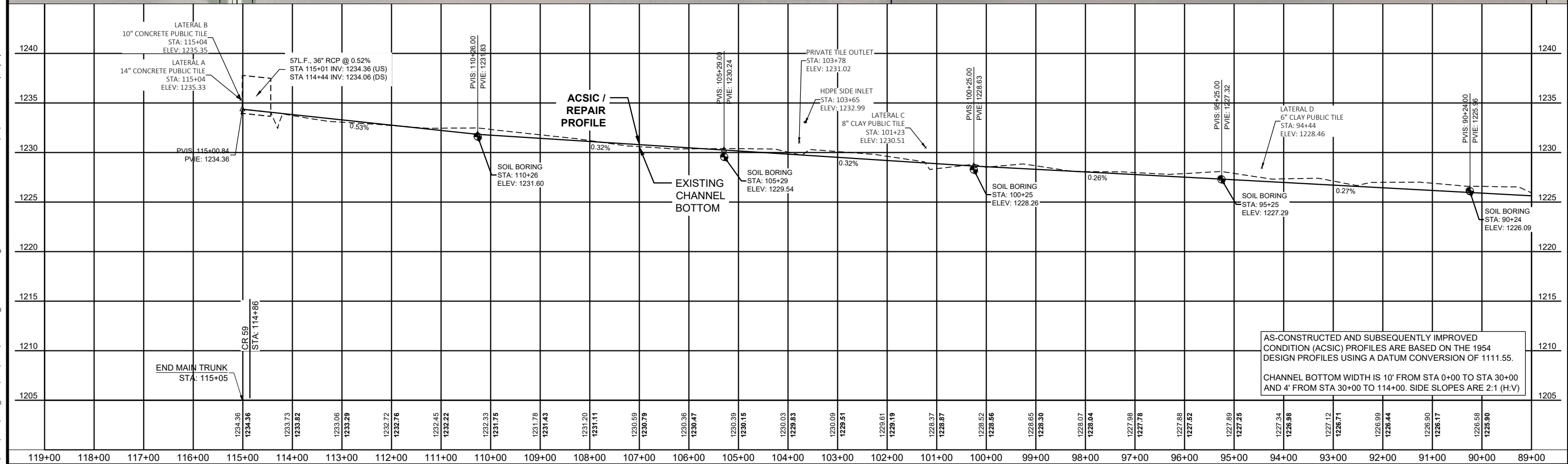
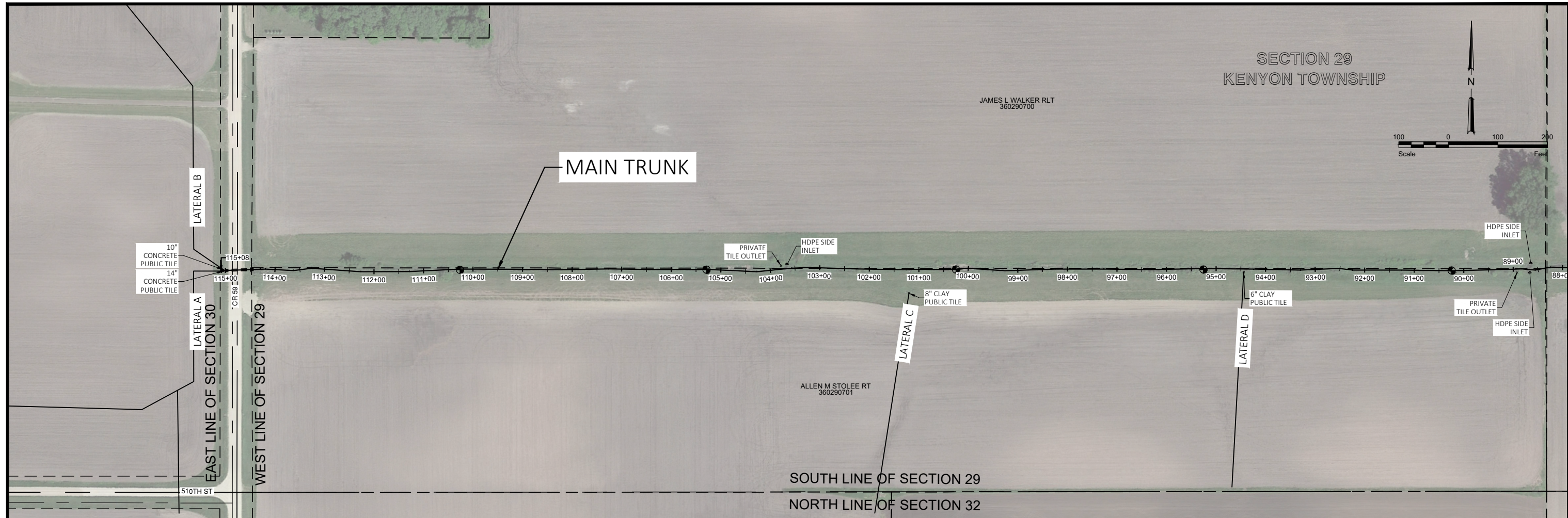
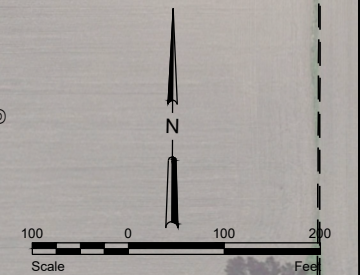
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SECTION 29  
KENYON TOWNSHIP

JAMES L WALKER RLT  
360290700

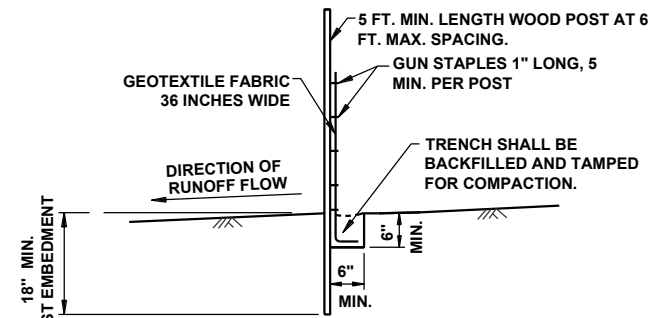


AS-CONSTRUCTED AND SUBSEQUENTLY IMPROVED  
CONDITION (ACSIC) PROFILES ARE BASED ON THE 1954  
DESIGN PROFILES USING A DATUM CONVERSION OF 1111.55.  
  
CHANNEL BOTTOM WIDTH IS 10' FROM STA 0+00 TO STA 30+00  
AND 4' FROM STA 30+00 TO 114+00. SIDE SLOPES ARE 2:1 (H:V)

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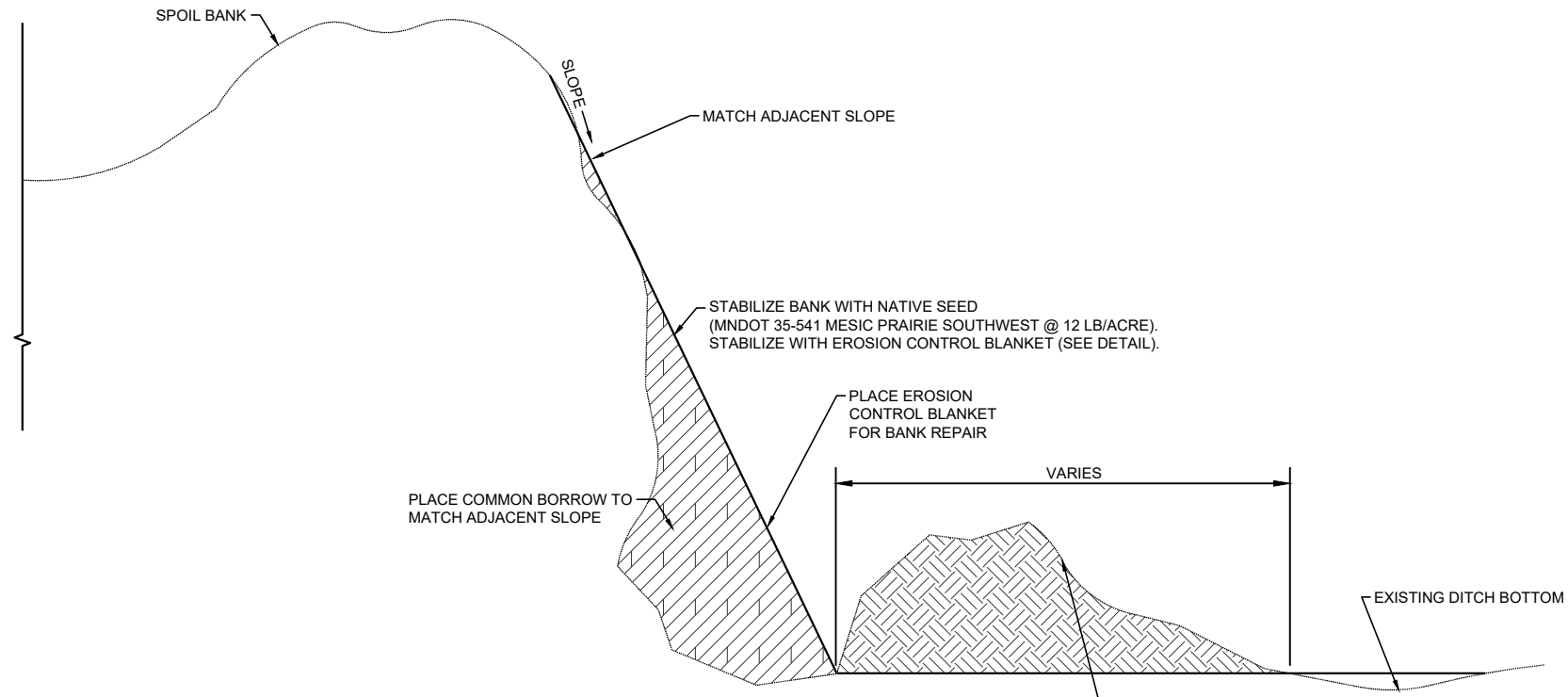
No.		Revision		Date	By	<h1>PRELIMINARY</h1> <p>Not for Construction</p>	<p><b>HOUSTON</b> ENGINEERING INC.</p>	<p>Maple Grove</p> <p>P: 763.493.4522 F: 763.493.5572</p>		Drawn by EJA	Date 01-15-2021	CD1 REPAIR REPORT GOODHUE COUNTY KENYON TOWNSHIP SECTIONS 28, 29, 32 & 33	MAIN TRUNK PLAN & PROFILE		SHEET
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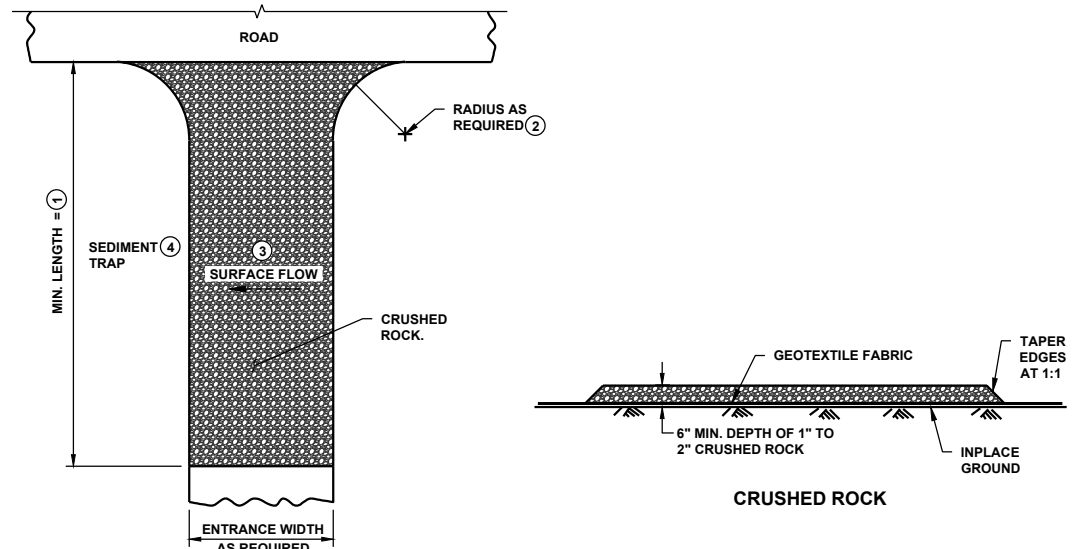


- NOTES:**
1. SILT FENCE, TYPE PREASSEMBLED, SHALL CONFORM TO MNDOT 2573, MNDOT 3886 AND MANUFACTURER'S RECOMMENDATIONS.
  2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY.
  3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

**TYPICAL SILT FENCE - TYPE PA PREASSEMBLED**  
NOT TO SCALE



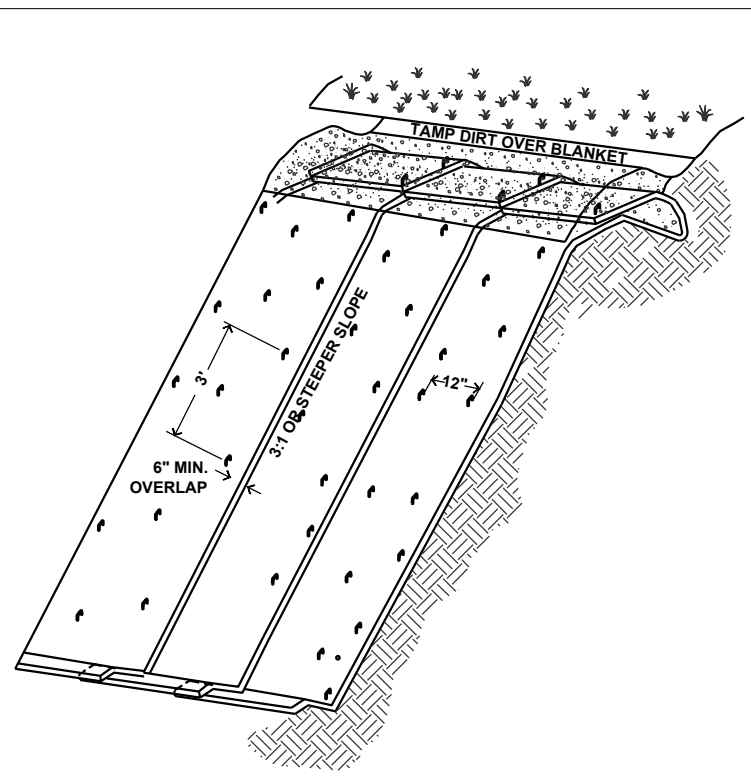
**BANK SLOUGH REPAIR**  
NOT TO SCALE



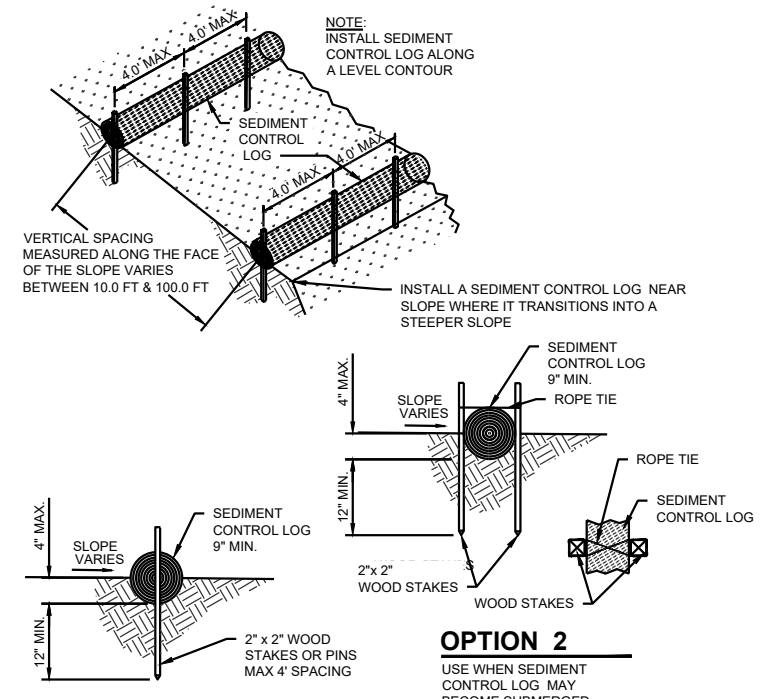
**CRUSHED ROCK CONSTRUCTION EXIT** ⑤ ⑥

- NOTES:**  
SEE MNDOT SPECS. 2573 & 3882.
- ① MINIMUM LENGTH SHALL BE THE GREATER OF 50 FEET OR A LENGTH SUFFICIENT TO ALLOW A MINIMUM OF 5 TIRE ROTATIONS ON THE PROVIDED PAD. MINIMUM LENGTH SHALL BE CALCULATED USING THE LARGEST TIRE WHICH WILL BE USED IN TYPICAL OPERATIONS.
  - ② PROVIDE RADIUS OR WIDEN PAD SUFFICIENTLY TO PREVENT VEHICLE TIRES FROM TRACKING OFF OF PAD WHEN LEAVING SITE.
  - ③ IF RUNOFF FROM DISTURBED AREAS FLOWS TOWARD CONSTRUCTION EXITS, PREVENT RUNOFF FROM DRAINING DIRECTLY TO PUBLIC ROAD OVER CONSTRUCTION EXIT BY CROWNING THE EXIT OR SLOPING TO ONE SIDE. IF SURFACE GRADING IS INSUFFICIENT, PROVIDE OTHER MEANS OF INTERCEPTING RUNOFF.
  - ④ IF RUNOFF FROM CONSTRUCTION EXITS WILL DRAIN OFF OF PROJECT SITE, PROVIDE SEDIMENT TRAP WITH STABILIZED OVERFLOW.
  - ⑤ IF A TIRE WASH OFF IS REQUIRED THE CONSTRUCTION EXITS SHALL BE GRADED TO DRAIN THE WASH WATER TO A SEDIMENT TRAP.
  - ⑥ MAINTENANCE OF CONSTRUCTION EXITS SHALL OCCUR WHEN THE EFFECTIVENESS OF SEDIMENT REMOVAL HAS BEEN REDUCED. MAINTENANCE SHALL CONSIST OF REMOVING SEDIMENT AND CLEANING THE MATERIALS OR PLACING ADDITIONAL MATERIAL (CRUSHED ROCK) OVER SEDIMENT FILLED MATERIAL TO RESTORE EFFECTIVENESS.

**STABILIZED CONSTRUCTION EXIT**  
NOT TO SCALE



**EROSION CONTROL BLANKET FOR BANK REPAIR**  
NOT TO SCALE



**OPTION 1**  
**SEDIMENT CONTROL LOG INSTALLATION**  
NOT TO SCALE

**OPTION 2**  
USE WHEN SEDIMENT CONTROL LOG MAY BECOME SUBMERGED

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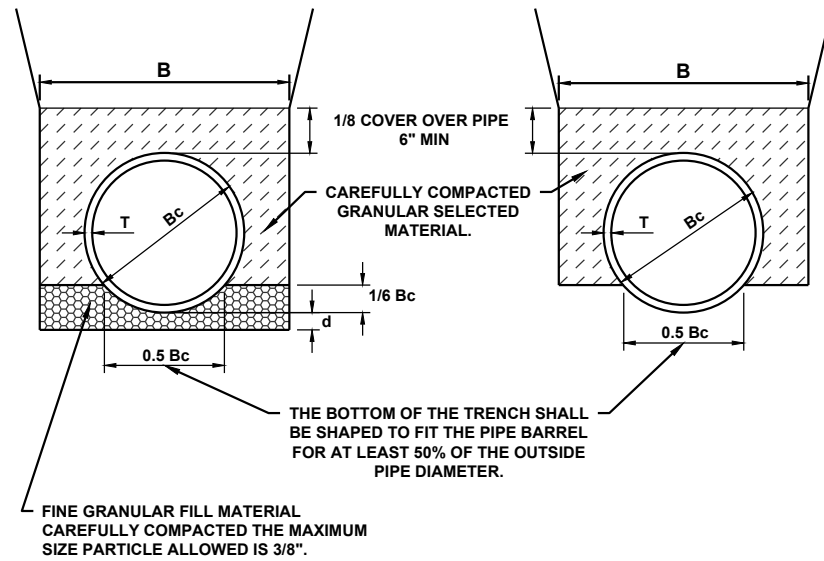
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PIPE SIZE	d
SMALLER THAN 30"	3"
30" TO 60"	4"
LARGER THAN 60"	6"

PIPE DIAMETER	B
36" OR LESS	$B_c + 24"$
42" TO 54"	$1.5 \times B_c$
60" OR OVER	$B_c + 36"$



**OVER EXCAVATED TRENCH CONDITION**

**STD TRENCH CONDITION**

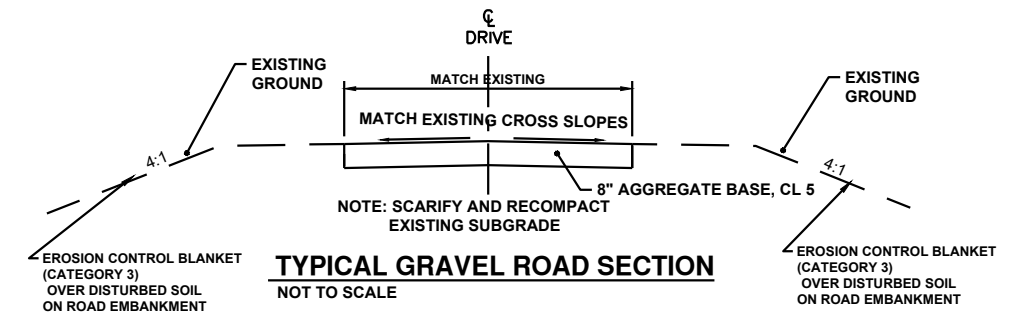
REFERENCE:  
"CONCRETE PIPE DESIGN MANUAL"  
PREPARED BY AMERICAN CONCRETE  
PIPE INSTITUTE

NOTE:  
FOR ROCK OR OTHER INCOMPRESSIBLE MATERIALS,  
THE TRENCH SHOULD BE OVEREXCAVATED A MINIMUM  
OF 6" AND REFILLED WITH GRANULAR MATERIAL.

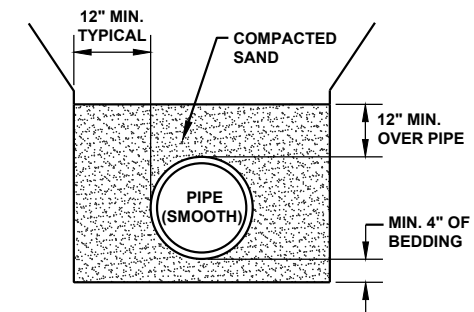
**CLASS C PIPE BEDDING**

**REINFORCED CONCRETE PIPE BEDDING**

NOT TO SCALE



**TYPICAL GRAVEL ROAD SECTION**  
NOT TO SCALE



- NOTES:
- IF PIPE SPRING LINE IS LESS THAN 48" BELOW FINISHED GRADE, PLACE GRANULAR MATERIAL UNDER PIPE TO A MINIMUM OF 48" BELOW FINISHED GRADE.
  - SAND SHALL CONFORM WITH MNDOT SPEC. 3149.

**PIPE BEDDING DETAIL - HDPE/CMP PIPE**  
NOT TO SCALE

STANDARD PLATES	
THE FOLLOWING MNDOT STANDARD PLATES, APPROVED BY THE DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION SHALL APPLY ON THIS PROJECT.	
PLATE NO.	PLATE NAME
3123 J	METAL APRON FOR C.S. PIPE
3124 B	METAL APRON CONNECTION
3129A	METAL APRON FOR CORRUGATED POLYETHYLENE PIPE
3134D	RIPRAP AT CSP OUTLETS

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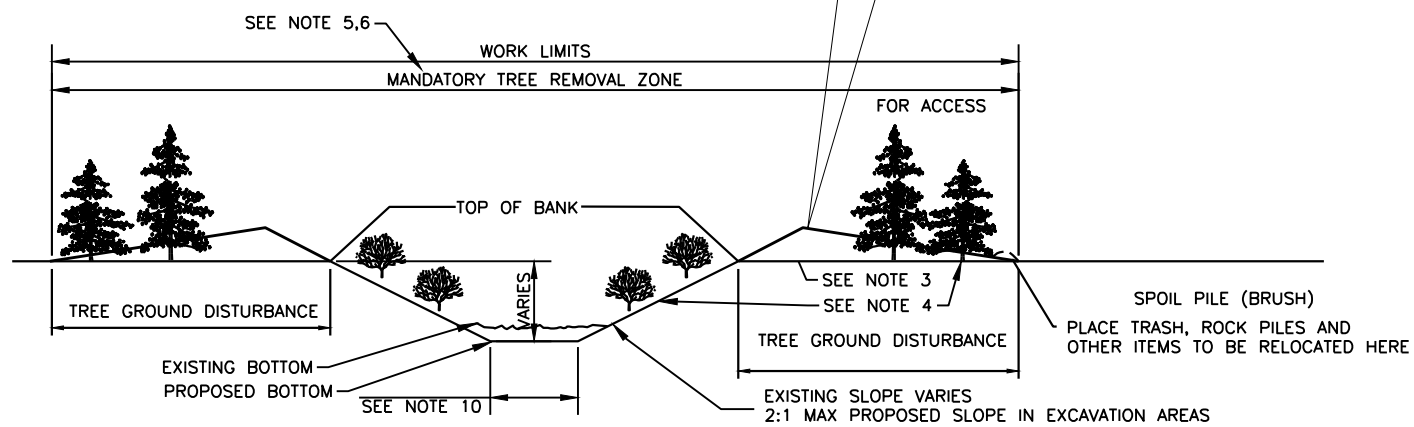
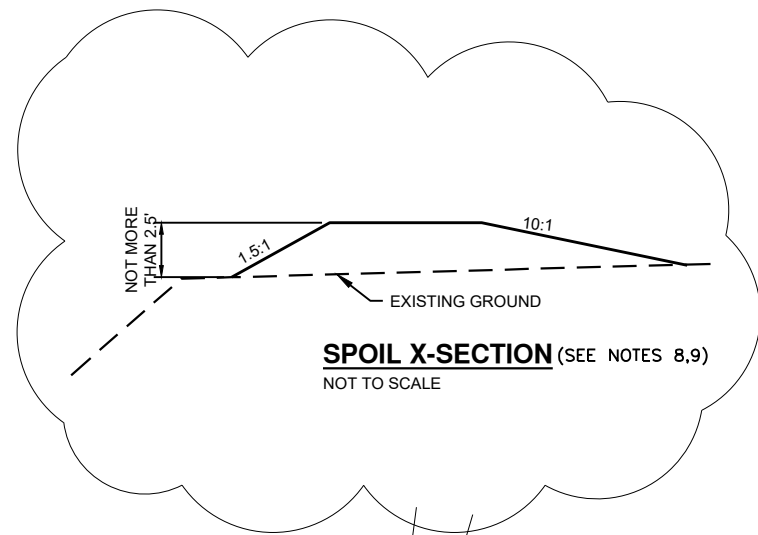
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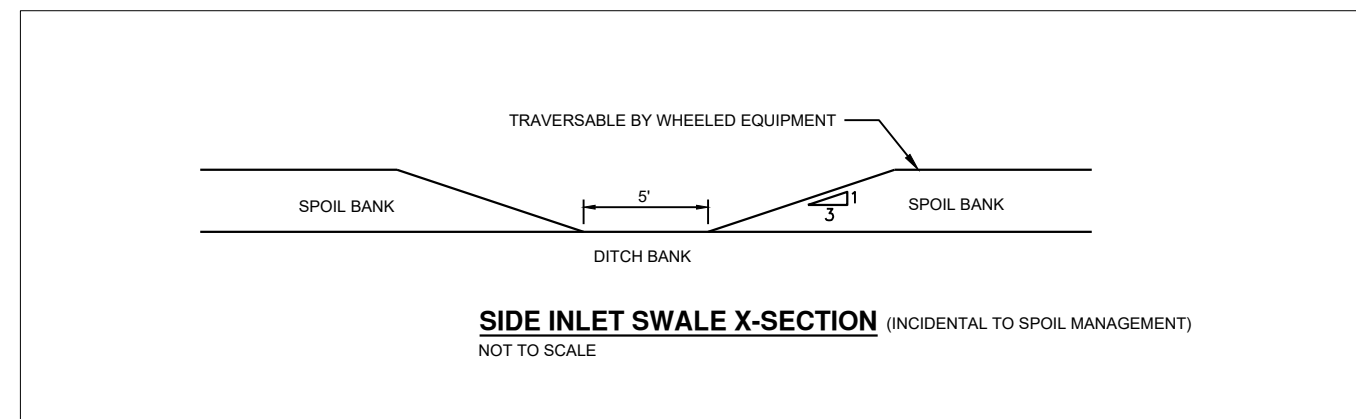


**\*NOTES:**

- 1) WORK LIMITS EXTEND FROM TOP OF BANK TO WORK LIMIT STAKES OR AS SHOWN, ON EITHER SIDE OF THE DITCH.
- 2) LEAVE SIDE INLET SWALE IN LOW AREAS TO PROVIDE DRAINAGE AND AS DIRECTED BY ENGINEER.
- 3) TREES CUT TO 2" OR LESS ABOVE GROUND SURFACE PER SPECIFICATIONS.
- 4) LEAVE SIDE INLET SWALE OR INSTALL SIDE INLET PIPE IN LOW AREAS TO PROVIDE DRAINAGE AND AS DIRECTED BY ENGINEER.
- 5) NO WORK IN CROPPED AREAS.
- 6) WHEN SEDIMENT REMOVAL DEPTH IS GREATER THAN 1.5', PLACE SPOIL ON BOTH SIDES OF DITCH UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
- 7) COMPLETE DITCH EXCAVATION ONLY AT LOCATIONS IDENTIFIED IN THE PLAN.
- 8) SIDE SLOPES ARE NOT TO BE DISTURBED UNLESS INDICATED IN THE PLANS.
- 9) TREES AND BRUSH FROM CLEARING OPERATIONS MUST BE DISPOSED OF OFF-SITE AT CONTRACTOR'S EXPENSE.
- 10) 10' BOTTOM WIDTH (STA 0+00 TO 30+00), 4' BOTTOM WIDTH (STA 30+00 TO 114+44)

**DITCH CLEANING, SPOIL PLACEMENT, AND WORK LIMITS**

NOT TO SCALE



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**STORM WATER POLLUTION PREVENTION PLAN (SWPPP) NARRATIVE**

THE MINNESOTA GENERAL PERMIT AUTHORIZATION TO DISCHARGE STORMWATER ASSOCIATED WITH CONSTRUCTION ACTIVITY ISSUED ON AUGUST 1, 2018 SHALL APPLY FOR THIS PROJECT.

GENERAL CONSTRUCTION ACTIVITY INFORMATION

PROJECT NAME: GOODHUE COUNTY DITCH 1 REPAIR

1. DESCRIBE PROJECT LOCATION:

CITY OR TOWNSHIP: KENYON TOWNSHIP  
 STATE: MN ZIP CODE: 55946 COUNTY: GOODHUE  
 LATITUDE/LONGITUDE OF APPROXIMATE CENTROID OF PROJECT: 44.209683/-93.000842

2. DESCRIBE THE CONSTRUCTION ACTIVITY:

THE GOODHUE CDI REPAIR WILL CONSIST OF REMOVAL AND REPLACEMENT OF CULVERTS AS SPECIFIED IN THE PLANS. TREE AND SEDIMENT REMOVAL FROM THE MAIN TRUNK DITCH WILL ALSO TAKE PLACE. REMOVED SEDIMENT WILL BE SPOIL BANKED ALONG THE DITCH AND DISTURBED AREAS RE-VEGETATED.

PROJECT AREAS

- 1. TOTAL AREA TO BE DISTURBED (ACRES): 15.90
- 2. PRE-CONSTRUCTION IMPERVIOUS SURFACE (ACRES): 0.08
- 3. POST-CONSTRUCTION IMPERVIOUS SURFACE (ACRES): 0.08

TOTAL NEW IMPERVIOUS SURFACE (ACRES): 0.00

RECEIVING WATERS

SURFACE WATERS WITHIN ONE MILE OF PROJECT BOUNDARY (AERIAL RADIUS MEASUREMENT) THAT WILL RECEIVE STORMWATER FROM THE SITE OR DISCHARGE FROM PERMANENT STORMWATER MANAGEMENT SYSTEM:

WATER BODY ID	NAME OF WATER BODY	TYPE	SPECIAL WATER	IMPAIRED WATER
07040004-999	COUNTY DITCH 1	STREAM	NO	NO

CONTACT INFORMATION

PROJECT OWNER: GOODHUE COUNTY  
 509 WEST 5TH ST  
 REDWING, MN 55066  
 PHONE: 651-385-3197  
 CONTACT: LISA HANNI

CONTRACTOR: TO BE DETERMINED

DESIGN OF CONSTRUCTION SWPPP

DESIGN OF CONSTRUCTION SWPPP COMPLETED BY:  
 ELEANOR J ARPIN  
 HOUSTON ENGINEERING, INC.  
 7550 MERIDIAN CIRCLE NORTH, SUITE 120  
 MAPLE GROVE, MINNESOTA 55369  
 PHONE: (763) 493-4522  
 FAX: (763) 493-5572  
 EARPIN@HOUSTONENG.COM

PROJECT INFORMATION

1. CHAIN OF RESPONSIBILITY: OWNER AND CONTRACTOR ARE COPERMITTEES FOR THE MINNESOTA GENERAL PERMIT AUTHORIZATION TO DISCHARGE STORMWATER ASSOCIATED WITH CONSTRUCTION ACTIVITY. THE CONTRACTOR IS RESPONSIBLE TO COMPLY WITH ALL ASPECTS OF THE MINNESOTA GENERAL PERMIT AT ALL TIMES UNTIL THE NOTICE OF TERMINATION (NOT) HAS BEEN FILED WITH THE MPCA. THE CONTRACTOR WILL DEVELOP A CHAIN OF COMMAND WITH ALL OPERATORS ON THE SITE TO ENSURE THAT THE SWPPP WILL BE IMPLEMENTED AND STAY IN EFFECT UNTIL THE CONSTRUCTION PROJECT IS COMPLETE, THE ENTIRE SITE HAS UNDERGONE FINAL STABILIZATION, AND A NOTICE OF TERMINATION (NOT) HAS BEEN SUBMITTED TO THE MPCA.
2. TRAINING DOCUMENTATION: CONTRACTOR SHALL LIST PEOPLE REQUIRING TRAINING PER PART III.F.1, DATES OF TRAINING AND NAME OF INSTRUCTOR(S) AND ENTITY PROVIDING TRAINING, CONTENT OF TRAINING COURSE OR WORKSHOP INCLUDING THE NUMBER OF HOURS OF TRAINING. THE OWNER SHALL BE PROVIDED WITH A COPY OF THE TRAINING DOCUMENTATION BEFORE THE START OF CONSTRUCTION ON THE PROJECT.

PROJECT INFORMATION

1. ENVIRONMENTALLY SENSITIVE AREAS:

- A. IMPAIRED WATERS: THERE ARE NO SPECIAL WATERS WITHIN ONE MILE OF THE DISCHARGE FOR CDI.
- B. SPECIAL WATERS: THERE ARE NO SPECIAL WATERS WITHIN ONE MILE OF THE DISCHARGE FOR CDI.
- C. WETLANDS: SEGMENTS OF THE WORK LIMITS CROSS WETLANDS. WORK SHALL CONFORM TO STATE AND FEDERAL WETLAND LAWS.
- D. KARST AREAS: THERE ARE NO KNOWN KARST AREAS WITHIN THE PROJECT BOUNDARY.
- E. CALCAREOUS FENS: THERE ARE NO KNOWN CALCAREOUS FENS WITHIN THE PROJECT BOUNDARY.
- F. ENDANGERED OR THREATENED SPECIES: NO STATE-LISTED THREATENED VERTEBRATE OR INVERTEBRATE WERE OBSERVED WITHIN A 1-MILE RADIUS OF THE CDI SYSTEM.
- G. HISTORIC PLACES OR ARCHEOLOGICAL SITES: THERE ARE NO KNOWN HISTORIC PLACES OR ARCHEOLOGICAL SITES WITHIN THE PROJECT BOUNDARY.
- H. STEEP SLOPES: SLOPES 1:3 (V:H) OR STEEPER IN GRADE ARE CONFINED TO THE SLOPES OF THE PUBLIC DRAINAGE SYSTEM.

2. SOIL TYPES.

THE SEDIMENT REMOVAL WILL GENERALLY CONSIST OF SILT LOAM, SILTY CLAY LOAM, AND MUCK. ESTIMATED PARTICLE SIZE RANGING FROM 0.0001 MM TO 0.5MM.

3. ORDER OF CONSTRUCTION ACTIVITIES:

- A. INSTALL EROSION AND SEDIMENT CONTROL MEASURES.
- B. PROCEED WITH REMOVAL OF TREES FROM DITCH AND SPOIL BANK AREAS. WORK FROM DOWNSTREAM TO UPSTREAM TO REMOVE SEDIMENT FROM DITCH AND PLACE IN SPOIL BANK AREAS. REMOVE AND REPLACE CULVERTS WHILE WORKING FROM DOWNSTREAM TO UPSTREAM.
- C. STABILIZE AREAS DISTURBED WITH TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES.
- D. COMPLETE PERMANENT RESTORATION WITH EROSION AND SEDIMENT CONTROL MEASURES.

EROSION PREVENTION PRACTICES

1. STABILIZATION MUST BE INITIATED IMMEDIATELY AND NO LATER THAN 14 CALENDAR DAYS WHENEVER ANY CONSTRUCTION ACTIVITY HAS TEMPORARILY OR PERMANENTLY CEASED ON ANY PORTION OF THE SITE. STABILIZATION MEANS THE EXPOSED GROUND SURFACE HAS BEEN COVERED BY APPROPRIATE MATERIALS SUCH AS MULCH, STAKED SOD, RIPRAP, EROSION CONTROL BLANKET, MATS OR OTHER MATERIAL THAT PREVENTS EROSION FROM OCCURRING. GRASS, AGRICULTURAL CROP OR OTHER SEEDING ALONE IS NOT STABILIZATION. MULCH MATERIALS MUST ACHIEVE APPROXIMATELY 90 PERCENT GROUND COVERAGE (TYPICALLY 2 TON/ACRE).
2. STABILIZATION OF THE NORMAL WETTED PERIMETER OF THE LAST 200 LINEAR FEET OF TEMPORARY OR PERMANENT DRAINAGE DITCHES OR SWALES THAT DRAIN WATER FROM THE SITE MUST OCCUR WITHIN 24 HOURS AFTER CONNECTING TO A SURFACE WATER OR PROPERTY EDGE.
3. STORMWATER CONVEYANCE CHANNELS MUST BE ROUTED AROUND UNSTABILIZED AREAS. EROSION CONTROLS AND VELOCITY DISSIPATION DEVICES MUST BE USED ALONG THE LENGTH OF THE CONVEYANCE CHANNEL AND AT ANY OUTLET.
4. PIPE OUTLETS MUST BE PROVIDED WITH TEMPORARY OR PERMANENT ENERGY DISSIPATION WITHIN 24 HOURS AFTER CONNECTION TO A SURFACE WATER.
5. IF FEASIBLE, STORMWATER DISCHARGES FROM BMPS MUST BE DIRECTED TO VEGETATED AREAS. USE VELOCITY DISSIPATION DEVICES AT DISCHARGE POINT IF NECESSARY.

SEDIMENT CONTROL PRACTICES

1. SEDIMENT CONTROL PRACTICES MUST BE ESTABLISHED ON ALL DOWN GRADIENT PERIMETERS AND BE LOCATED UP GRADIENT OF ANY BUFFER ZONES. THE PERIMETER SEDIMENT CONTROL PRACTICE MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITIES BEGIN. THESE PRACTICES SHALL REMAIN IN PLACE UNTIL FINAL STABILIZATION.
2. RE-INSTALL ALL SEDIMENT CONTROL PRACTICES THAT HAVE BEEN ADJUSTED OR REMOVED TO ACCOMMODATE SHORT-TERM ACTIVITIES SUCH AS CLEARING OR GRUBBING, OR PASSAGE OF VEHICLES, IMMEDIATELY AFTER THE SHORT-TERM ACTIVITY HAS BEEN COMPLETED. COMPLETE ANY SHORT-TERM ACTIVITY THAT REQUIRES REMOVAL OF SEDIMENT CONTROL PRACTICES AS QUICKLY AS POSSIBLE. RE-INSTALL SEDIMENT CONTROL PRACTICES BEFORE THE NEXT PRECIPITATION EVENT EVEN IF THE SHORT-TERM ACTIVITY IS NOT COMPLETE.
3. ALL STORM DRAIN INLETS MUST BE PROTECTED BY APPROPRIATE BMPS DURING CONSTRUCTION UNTIL ALL SOURCES WITH POTENTIAL FOR DISCHARGING TO THE INLET HAVE BEEN STABILIZED. INLET PROTECTION MAY BE REMOVED FOR A PARTICULAR INLET IF A SPECIFIC SAFETY CONCERN (STREET FLOODING/FREEZING) HAS BEEN IDENTIFIED BY THE PERMITTEE OR THE JURISDICTIONAL AUTHORITY. THE PERMITTEE MUST DOCUMENT THE NEED FOR REMOVAL AND RETAIN THE RECORD WITH THE SWPPP.
4. TEMPORARY SOIL STOCKPILES MUST HAVE SILT FENCE OR OTHER EFFECTIVE SEDIMENT CONTROLS, AND CANNOT BE PLACED IN ANY NATURAL BUFFERS OR SURFACE WATERS, INCLUDING STORMWATER CONVEYANCES SUCH AS CURB AND GUTTER SYSTEMS, OR CONDUITS AND DITCHES UNLESS THERE IS A BYPASS IN PLACE FOR THE STORMWATER.
5. WHERE VEHICLE TRAFFIC LEAVES ANY PART OF THE SITE (OR ONTO PAVED ROADS WITHIN THE SITE) A VEHICLE TRACKING BMP, APPROVED BY THE ENGINEER, MUST BE INSTALLED TO MINIMIZE THE TRACK OUT OF SEDIMENT FROM THE CONSTRUCTION SITE. STREET SWEEPING MUST BE USED IF SUCH VEHICLE TRACKING BMPS ARE NOT ADEQUATE TO PREVENT SEDIMENT FROM BEING TRACKED ONTO THE STREET.
6. SOIL COMPACTION MUST BE MINIMIZED AND, UNLESS INFEASIBLE, PRESERVE TOPSOIL. MINIMIZING SOIL COMPACTION IS NOT REQUIRED WHERE THE FUNCTION OF A SPECIFIC AREA OF THE SITE DICTATES THAT IT BE COMPACTED.
7. SOIL COMPACTION MUST BE MINIMIZED AND, UNLESS INFEASIBLE, PRESERVE TOPSOIL. MINIMIZING SOIL COMPACTION IS NOT REQUIRED WHERE THE FUNCTION OF A SPECIFIC AREA OF THE SITE DICTATES THAT IT BE COMPACTED.

CONTROL OF WATER

1. WORK IN DRY CONDITIONS.
2. PUMPING, IF NECESSARY, SHALL BE PROVIDED AND CONDUCTED AT DISCHARGE RATES THAT DO NOT ERODE SOIL MATERIAL. DISSIPATION BMP'S SHALL BE IMPLEMENTED TO MITIGATE SOIL EROSION.

INSPECTIONS AND MAINTENANCE

1. THE CONTRACTOR SHALL IDENTIFY THE INDIVIDUAL(S) CERTIFIED AS A SITE MANAGER FOR OVERSEEING IMPLEMENTATION OF, REVISING, AND AMENDING THE SWPPP AND PERFORMING INSPECTIONS.
2. THE CONTRACTOR SHALL IDENTIFY THE INDIVIDUAL(S) CERTIFIED AS A BMP INSTALLER FOR PERFORMING OR SUPERVISING THE INSTALLATION, MAINTENANCE AND REPAIR OF BMPS.
3. INSPECTIONS WILL BE CONDUCTED AT LEAST ONE TIME PER WEEK AND WITHIN 24 HOURS AFTER A RAINFALL EVENT GREATER THAN 0.50 INCH IN 24 HOURS.
4. WHERE PARTS OF THE CONSTRUCTION SITE HAVE UNDERGONE FINAL STABILIZATION, BUT WORK REMAINS ON OTHER PARTS OF THE SITE, INSPECTIONS OF THE STABILIZED AREAS MAY BE REDUCED TO ONCE PER MONTH.
5. WHERE WORK HAS BEEN SUSPENDED DUE TO FROZEN GROUND CONDITIONS, THE REQUIRED INSPECTIONS AND MAINTENANCE SCHEDULE MUST BEGIN WITHIN 24 HOURS AFTER RUNOFF OCCURS AT THE SITE OR 24 HOURS PRIOR TO RESUMING CONSTRUCTION, WHICHEVER COMES FIRST.
6. ALL PERIMETER CONTROL DEVICES MUST BE REPAIRED, REPLACED, OR SUPPLEMENTED WHEN THEY BECOME NONFUNCTIONAL OR THE SEDIMENT REACHES ONE-HALF (1/2) OF THE HEIGHT OF THE DEVICE. THESE REPAIRS MUST BE MADE BY THE END OF THE NEXT BUSINESS DAY AFTER DISCOVERY, OR THEREAFTER AS SOON AS FIELD CONDITIONS ALLOW ACCESS.
7. SURFACE WATERS, INCLUDING DRAINAGE DITCHES AND CONVEYANCE SYSTEMS, MUST BE INSPECTED FOR EVIDENCE OF EROSION AND SEDIMENT DEPOSITION.
8. CONSTRUCTION SITE VEHICLE EXIT LOCATIONS MUST BE INSPECTED FOR EVIDENCE OF OFF-SITE SEDIMENT TRACKING ONTO PAVED SURFACES. TRACKED SEDIMENT MUST BE REMOVED FROM ALL PAVED SURFACES BOTH ON AND OFF SITE WITHIN 24 HOURS OF DISCOVERY.
9. ALL INFILTRATION AREAS MUST BE INSPECTED TO ENSURE THAT NO SEDIMENT FROM ONGOING CONSTRUCTION ACTIVITY IS REACHING THE INFILTRATION AREA. ALL INFILTRATION AREAS MUST BE INSPECTED TO ENSURE THAT EQUIPMENT IS NOT BEING DRIVEN ACROSS THE INFILTRATION AREA.

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Maple Grove	Drawn by EJA	Date 01-15-2021
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CD1 REPAIR REPORT  
 GOODHUE COUNTY  
 KENYON TOWNSHIP SECTIONS 28, 29, 32 & 33

SWPPP NARRATIVE  
 PROJECT NO. 6400-0004

SHEET  
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**STORM WATER POLLUTION PREVENTION PLAN (SWPPP) NARRATIVE (CONTINUED)**

**POLLUTION PREVENTION MANAGEMENT MEASURES**

THE FOLLOWING POLLUTION PREVENTION MANAGEMENT MEASURES SHALL BE IMPLEMENTED ON THE SITE AND SHALL BE A LUMP SUM PAYMENT:

1. BUILDING PRODUCTS THAT HAVE THE POTENTIAL TO LEACH POLLUTANTS, PESTICIDES, HERBICIDES, INSECTICIDES, FERTILIZERS, TREATMENT CHEMICALS, AND LANDSCAPE MATERIALS MUST BE UNDER COVER (E.G., PLASTIC SHEETING OR TEMPORARY ROOFS) TO PREVENT THE DISCHARGE OF POLLUTANTS OR PROTECTED BY A SIMILARLY EFFECTIVE MEANS DESIGNED TO MINIMIZE CONTACT WITH STORMWATER.
2. HAZARDOUS MATERIALS, TOXIC WASTE, (INCLUDING OIL, DIESEL FUEL, GASOLINE, HYDRAULIC FLUIDS, PAINT SOLVENTS, PETROLEUM-BASED PRODUCTS, WOOD PRESERVATIVES, ADDITIVES, CURING COMPOUNDS, AND ACIDS) MUST BE PROPERLY STORED IN SEALED CONTAINERS TO PREVENT SPILLS, LEAKS OR OTHER DISCHARGE. RESTRICTED ACCESS STORAGE AREAS MUST BE PROVIDED TO PREVENT VANDALISM. STORAGE AND DISPOSAL OF HAZARDOUS WASTE OR HAZARDOUS MATERIALS MUST BE IN COMPLIANCE WITH MINN. R. CH.7045 INCLUDING SECONDARY CONTAINMENT AS APPLICABLE.
3. SOLID WASTE MUST BE STORED, COLLECTED AND DISPOSED OF PROPERLY IN COMPLIANCE WITH MINN. R. CH.7035.
4. PORTABLE TOILETS MUST BE POSITIONED SO THAT THEY ARE SECURE AND WILL NOT BE TIPPED OR KNOCKED OVER. SANITARY WASTE MUST BE DISPOSED OF PROPERLY IN ACCORDANCE WITH MINN. R. CH.7041.
5. REASONABLE STEPS SHALL BE TAKEN TO PREVENT THE DISCHARGE OF SPILLED OR LEAKED CHEMICALS, INCLUDING FUEL, FROM ANY AREA WHERE CHEMICALS OR FUEL WILL BE LOADED OR UNLOADED INCLUDING THE USE OF DRIP PANS OR ABSORBENTS UNLESS INFEASIBLE. FUELING MUST BE CONDUCTED IN A CONTAINED AREA UNLESS INFEASIBLE. ADEQUATE SUPPLIES MUST BE AVAILABLE AT ALL TIMES TO CLEAN UP DISCHARGED MATERIALS AND AN APPROPRIATE DISPOSAL METHOD MUST BE AVAILABLE FOR RECOVERED SPILLED MATERIALS. REPORT AND CLEAN UP SPILLS IMMEDIATELY AS REQUIRED BY MINN. STAT. § 115.061, USING DRY CLEAN UP MEASURES WHERE POSSIBLE.
6. WASHING THE EXTERIOR OF VEHICLES OR EQUIPMENT ON THE PROJECT SITE MUST BE LIMITED TO A DEFINED AREA OF THE SITE. RUNOFF FROM THE WASHING AREA MUST BE CONTAINED IN A SEDIMENT BASIN OR OTHER SIMILARLY EFFECTIVE CONTROLS AND WASTE FROM THE WASHING ACTIVITY MUST BE PROPERLY DISPOSED OF. STORE AND PROPERLY USE THE SOAPS, DETERGENTS, OR SOLVENTS. NO ENGINE DEGREASING IS ALLOWED ON SITE.
7. EFFECTIVE CONTAINMENT SHALL BE PROVIDED FOR ALL LIQUID AND SOLID WASTES GENERATED BY WASHOUT OPERATIONS (CONCRETE, STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS AND OTHER CONSTRUCTION MATERIALS) RELATED TO THE CONSTRUCTION ACTIVITY. THE LIQUID AND SOLID WASHOUT WASTES MUST NOT CONTACT THE GROUND, AND THE CONTAINMENT MUST BE DESIGNED SO THAT IT DOES NOT RESULT IN RUNOFF FROM THE WASHOUT OPERATIONS OR AREAS. LIQUID AND SOLID WASTES MUST BE DISPOSED OF PROPERLY AND IN COMPLIANCE WITH MPCA RULES. A SIGN MUST BE INSTALLED ADJACENT TO EACH WASHOUT FACILITY THAT REQUIRES SITE PERSONNEL TO UTILIZE THE PROPER FACILITIES FOR DISPOSAL OF CONCRETE AND OTHER WASHOUT WASTES.
8. IN THE EVENT OF A SPILL, THE CONTRACTOR WILL MAKE THE APPROPRIATE NOTIFICATION(S) TO THE MPCA, CONSISTENT WITH THE FOLLOWING PROCEDURES:
 

SPILLS OF PETROLEUM IN A QUANTITY GREATER THAN 5 GALLONS MUST BE REPORTED IMMEDIATELY TO THE MINNESOTA DUTY OFFICER.

SPILLS OF ANY QUANTITY OF ALL OTHER CHEMICALS OR MATERIALS WHICH MAY CAUSE POLLUTION OF WATERS OF THE STATE MUST BE REPORTED IMMEDIATELY TO THE MINNESOTA DUTY OFFICER.

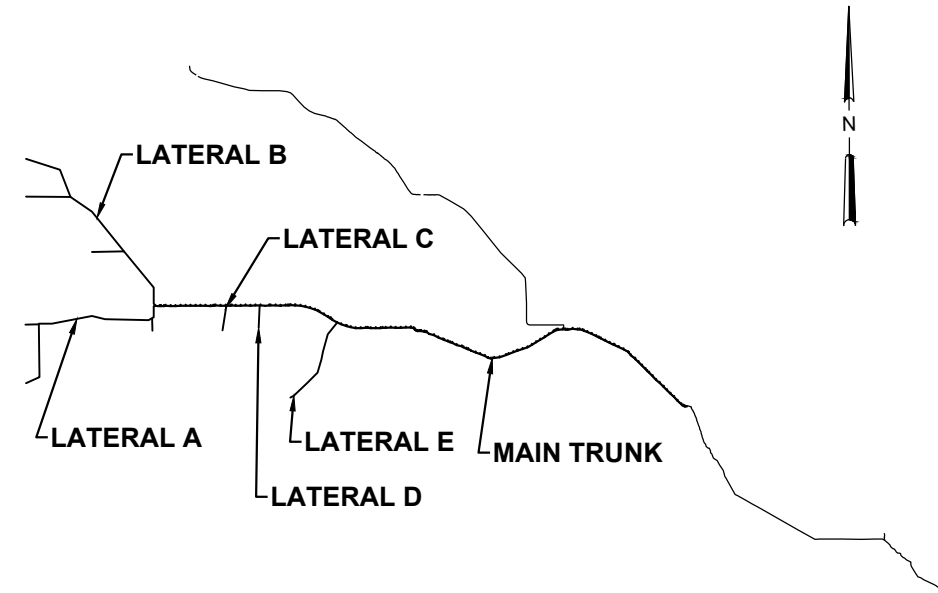
REPORTABLE SPILLS SHOULD BE DIRECTED TO THE MINNESOTA DUTY OFFICER BY IMMEDIATELY CALLING THE FOLLOWING NUMBERS: (651) 649-5451 OR (800) 422-0798.

**FINAL STABILIZATION**

FINAL STABILIZATION IS NOT COMPLETE UNTIL ALL OF THE FOLLOWING REQUIREMENTS ARE COMPLETE:

1. ALL SOIL DISTURBING ACTIVITIES AT THE SITE HAVE BEEN COMPLETED AND ALL SOILS ARE STABILIZED BY A UNIFORM PERENNIAL VEGETATIVE COVER WITH A DENSITY OF 70 PERCENT OF ITS EXPECTED FINAL GROWTH DENSITY OVER THE ENTIRE PERVIOUS SURFACE AREA, OR OTHER EQUIVALENT MEANS NECESSARY TO PREVENT SOIL FAILURE UNDER EROSION CONDITIONS.
2. ALL TEMPORARY SYNTHETIC AND STRUCTURAL EROSION PREVENTION AND SEDIMENT CONTROL BMPs (SUCH AS SILT FENCE) HAVE BEEN REMOVED. BMPs DESIGNED TO DECOMPOSE ON SITE (SUCH AS SOME COMPOST LOGS) MAY BE LEFT IN PLACE.
3. FOR CONSTRUCTION PROJECTS ON AGRICULTURAL LAND (E.G., PIPELINES ACROSS CROP, FIELD PASTURE OR RANGE LAND) THE DISTURBED LAND HAS BEEN RETURNED TO ITS PRECONSTRUCTION AGRICULTURAL USE.

**AMENDMENTS**



EROSION AND SEDIMENT CONTROL QUANTITY SUMMARY AND BMP SCHEDULE		
DESCRIPTION	UNITS	QUANTITY
SEEDING & MULCH	ACRE	6

\*SILT FENCE, SEDIMENT CONTROL LOG AND BLANKET TO BE INSTALLED AT LOCATIONS SPECIFIED BY ENGINEER

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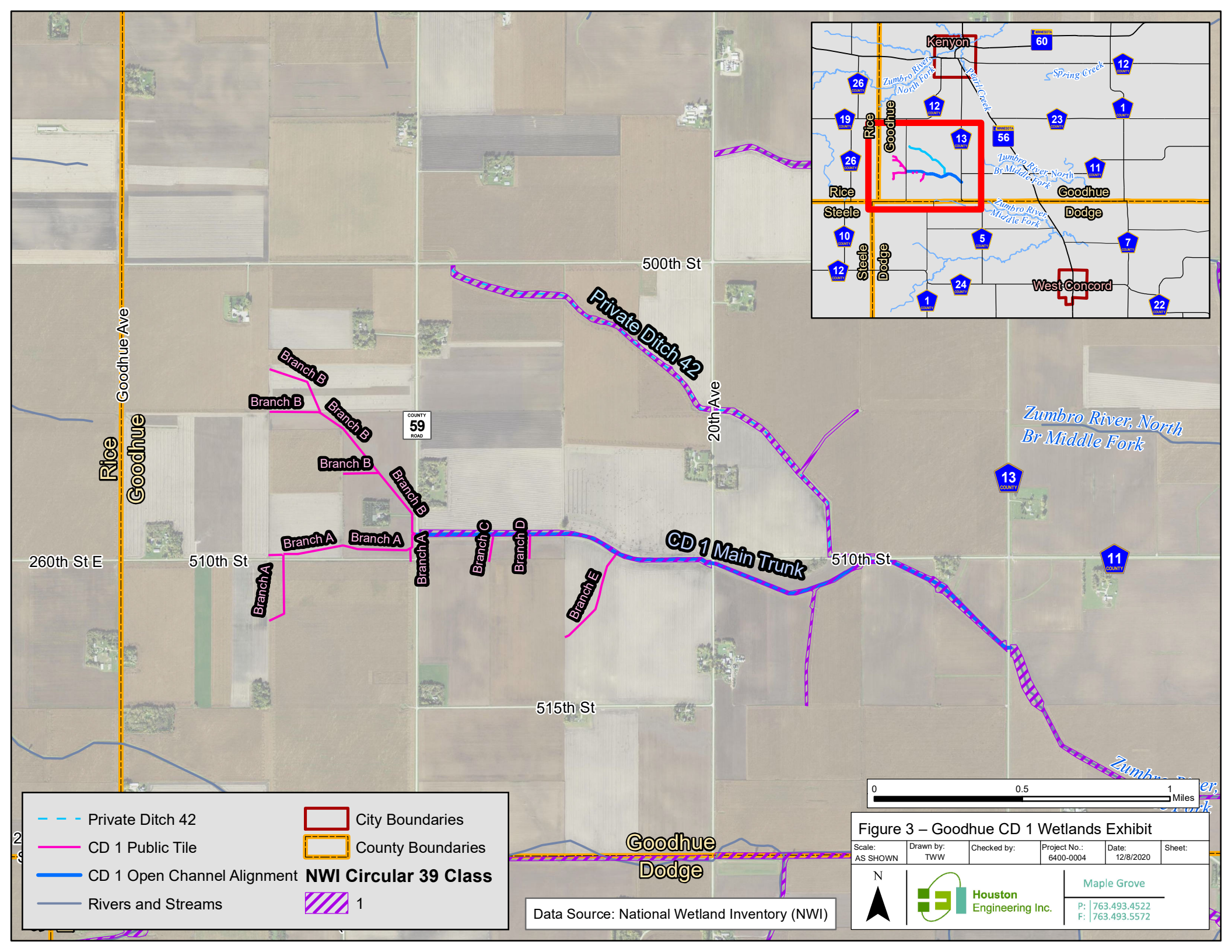
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CO

Date  
01-15-2021  
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CD1 REPAIR REPORT  
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KENYON TOWNSHIP SECTIONS 28, 29, 32 & 33

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	Private Ditch 42		City Boundaries
	CD 1 Public Tile		County Boundaries
	CD 1 Open Channel Alignment		NWI Circular 39 Class 1
	Rivers and Streams		

Data Source: National Wetland Inventory (NWI)

Figure 3 – Goodhue CD 1 Wetlands Exhibit

Scale: AS SHOWN	Drawn by: TWW	Checked by:	Project No.: 6400-0004	Date: 12/8/2020	Sheet:
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Maple Grove

Houston Engineering Inc.

P: 763.493.4522  
F: 763.493.5572

### Attachment A: Culvert Design Criteria

Crossing	Type	Existing Size	Design Standard	2-Year Q (cfs)	10-Year Q (cfs)	50-Year Q (cfs)
31+42	Field	84" CMP	2-Yr in Banks	66	----	----
60+57	20th Ave.	120" CMP	10-Yr Doesn't Overtop Road	56	149	----
114+86	CR-59	36" RCP	50-Yr Doesn't Overtop Road	34	----	159

Design discharges were determined based on watersheds delineated by the USGS StreamStats program and Peak-Flow Statistics calculated using the USGS regression equations developed by Lorenz, Sanocki, and Kocian, 2009.

*Reference:*

Lorenz, D.L, Sanocki, C.A., and Kocian, M.J., 2009. Techniques for Estimating the Magnitude and Frequency of Peak Flows on Small Streams in Minnesota Based on Data Through Water Year 2005: U.S. Geological Survey Scientific Investigations Report 2009-5250, 54 p.

**Attachment B: Preliminary Opinion of Probable Construction Cost**

**Public Drainage System Infrastructure**

Item Number	Description	Units	Est'd Quantity	Unit Price	Extension
1	Mobilization	Lump Sum	1	\$30,000	\$30,000
2	Traffic Control	Lump Sum	1	\$10,000	\$10,000
3	Temporary and Permanent Removals	Lump Sum	1	\$2,000	\$2,000
4	Tree Clearing	Acre	1.8	\$8,500	\$15,300
5	Excavation of Open Channel (P)	Linear Foot	11,310	\$5	\$56,550
6	Spoil Management (P)	Linear Foot	11,310	\$2.50	\$28,275
7	Resloping at Bank Sloughing Areas	Lump Sum	1	\$10,000	\$10,000
8	Removal of Existing Culvert	Linear Foot	26	\$15	\$390
9	72" CM Pipe Culvert	Linear Foot	26	\$200	\$5,200
10	SWPPP Documentation & Reporting	Lump Sum	1	\$2,500	\$2,500
11	Seeding and Mulch (P)	Acre	5.62	\$5,000	\$28,100
12	Erosion Control Blanket Cat. 3	Square Yard	100	\$4	\$400
13	Sediment Control Log	Linear Foot	100	\$4	\$400
<b>Public Drainage Subtotal</b>					<b>\$189,115</b>

**Public Road Crossings**

Item Number	Description	Units	Est'd Quantity	Unit Price	Extension
1	Removal of Existing Culvert	Linear Foot	60	\$15	\$900
2	72" CM Pipe Culvert	Linear Foot	71	\$200	\$14,200
3	72" Galvanized Apron	Each	2	\$2,000	\$4,000
4	Gravel Roadway Patch	Each	1	\$2,000	\$2,000
5	Seeding and Mulch	Acre	0.02	\$5,000	\$100
6	Erosion Control Blanket Cat. 3	Square Yard	100	\$4	\$400
<b>Public Road Crossing Subtotal</b>					<b>\$21,600</b>

**Construction Subtotal      \$210,715**

Engineering	\$42,143
Legal/Admin	\$20,000
Contingency	\$42,143

**TOTAL PROJECT COST      \$315,001**