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Engineer's Report for

Proposed Tile Repairs & Improvements

Drainage District No. 34

Worth County, Iowa

2023

Submitted by:
Bolton & Menk, Inc.
300 W. McKinley St.
Jefferson, IA 50129
Phone: 515-386-4101

Certification

Engineer's Report

for

Proposed Tile Repairs & Improvements

Drainage District No. 34
Worth County, Iowa
0T7.131919

2023

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Iowa. My renewal date is December 31, 2024.

By: _____

Jacob Hagan, P.E.
License No. 25738

Date: 10-5-23

Table of Contents

Tables

Appendices

I. INTRODUCTION

A. Scope of Work

In August of 2023, the Board of Supervisors requested an investigation and report of recommended tile repairs and improvements of the Drainage District No. 14 facilities and appointed Bolton & Menk, Inc. to complete the necessary survey, study, plan and report. This report addresses the request for repairs and improvements.

B. Location

The watershed of Drainage District No. 34 covers approximately 3,593 acres in Sections 27-28, 32-34 of Deer Creek and Sections 3-5, 8-11, 14-15 of Barton Township in Worth County, Iowa. The district is 6 miles east of Northwood. The district outlets into Drainage District 11 open ditch also known as Deer Creek.

Currently the existing Drainage District No. 34 facilities include the main open ditch, main tile, main relief tile and 52 other lateral tiles ranging in size from 36" to 6" totaling 154,000 linear feet of tile.

C. History

Drainage District No. 34 has been studied several times since its construction. Below are listed items that have occurred since the establishment of the district.

1918-4-15 Preliminary drainage bond issued.

1918-6-10 Petition filed to establish DD #34.

1919-1-16 Engineer's Report filed.

1919-2-28 DD #34 established and ordered built according to the Engineer's plans and specifications.

1919-3-19 Bids unsealed and contract awarded to John Rafdal of Northwood, Iowa for labor and The Cement Products Company of Mason City, Iowa for materials.

1919-7-7 Commision appointed to assess drainage benefits in the district.

1919-12-18 Classification commision's report filed assessing the benefits to each parcel.

1965-6-29 Deer Creek Watershed Work Plan approved by Board of Supervisors.

1974-9-30 Engineer's Report filed recommending improvements as part of Deer Creek Federal Project. Annexation Recommended.

1977-8-11 Construction Completed. Lower Main Relief Tile and Ditch Installed.

1979-1-4 Classification Report filed.

2003-7-11 Improvement for Main E Remonstranced .

2008-7-5 Petition for repairs to Lateral No. 1.

2023-5-30 Annexation and reclassification approved.

2023-7-12 Quote for repairing upper main.

II. INVESTIGATION

Survey of the tile system was made in August 2023. The records of the district were reviewed and the original and 1970's plans were located. We limited our study to the main tile. It is likely that the lateral tiles are also in need of repair or improvement.

It is our understanding that the 100-year old district tile upstream of the 1970's relief tile is in poor condition prompting a request for quotes to replace the existing tile in this area with a new tile. We have not investigated the condition on the tile for this report. We could pothole the tile after crops are out to investigate the condition if requested.

Looking at aerial photos, it appears a considerable investment has been made within the district installing private tile systems, including extensive pattern tiling. These private tiles rely on the district tile as an outlet, and their capacity is impacted by the capacity of the district tile. We have included a map showing where we think private tile are located by looking at aerial photos. If you would like to contribute your tile maps, we would appreciate it.

Tha natural swale over the tile provides some drainage relief in large storm events. This swale has a grade of approximatley 0.15% over its length. Ungrassed swales can lead to soil erosion, and depressed yields in the swale. There are some drainage districts that have constructed grassed waterways to provide additional drianage relief, though it is not generally recommended due the high cost of acquiring right-of-way and maintainance nor do swales function the same as a properly-sized tile.

When evaluating drainage tile capacity, we use what is referred to as the drainage coefficient (Dc). The drainage coefficient represents the depth of excess water removed from the surface of the watershed in a 24-hour period. The modern standard of ½" of water removed from the surface area of the watershed in 24 hours (½" Dc) has been in use since the mid-1950's. In other words, for an agricultural field to be deemed adequately drained, that field will drain ½" per acre per day (½" Dc).

In 1919, the original system was designed to roughly a 0.15" drainage coefficient. It is more typical to find drainage districts from that time designed at 0.25" Dc. However, larger districts sometimes had smaller drainage coefficients due to material availability.

In the 1970's as part of the Deer Creek Federal project, the lower poriton of the district was improved. They replaced the lower 3,000 feet of tile with a ditch and installed a relief tile that was interconnected with the existing tile. The combined existing tile and relief tile was designed to an approximately 0.30" drainage coefficient. We have no record why the decision was made to improve the facilities to a 0.30" Dc instead of a ½" Dc. No improvement was made upstream of Lateral No. 9.

The coefficients and percent of modern capacity, as shown in the table on the next page, assume the tile is clean, straight and unrestricted. However, due to the age of this system, it is likely that the actual capacity of the existing system is roughly 80-90% of that shown on the table below.

Existing DD 34 Tile Capacities					
Facility	**Size & Grade (Diameter @ %)**	**Station Range**	**Acres Served**	**D_c* (Inches/Acre/Day)**	**% of ½" D_c (Modern Standard)**
1919 Main 1976 Relief	36" @ 0.10% 42" @ 0.11%	30+00-43+00	3,574	0.14 0.22	72%
1919 Main 1976 Relief	36" @ 0.10% 34" @ 0.08%	43+00-70+00	3,081	0.16 0.13	58%
1919 Main 1976 Relief	34" @ 0.10% 34" @ 0.08%	70+00-103+00	2,813	0.15 0.14	58%
1919 Main 1976 Relief	34" @ 0.10% 30" @ 0.10%	103+00-119+00	2,650	0.16 0.12	56%
1919 Main 1976 Relief	28" @ 0.20% 32" @ 0.08%	119+00-129+00	2,548	0.14 0.13	54%
1919 Main	24" @ 0.20%	129+00-170+00	1,060	0.23	46%
1919 Main	20" @ 0.15%	170+0-183+00	537	0.24	48%
1919 Main	18" @ 0.15%	183+00-200+00	458	0.21	42%
1919 Main	14" @ 0.15%	200+00 – 212+00	355	0.14	28%
1919 Main	12" @ 0.25%	212+00- 223+00	207	0.21	42%
1919 Main	10" @ 0.25%	223+00-231+00	67	0.39	78%
1919 Main	8" @ 0.40%	231+00-236+00	49	0.37	74%

III. FARM PROGRAM COMPLIANCE

A. Farm Program Wetland Conservation Rules

The farm program wetland conservation rules are regulated by the USDA Farm Service Agency. The USDA Natural Resources Conservation Service provides technical assistance. This technical assistance includes policing for program violations and making certified wetland determinations. We have made requests of landowners receiving benefits from the proposed improvements to secure certified wetland determinations from the USDA/NRCS and to provide them to the district. Only landowners or their authorized agents may request the determinations. Some have not yet provided this information. We have received information that there are wetlands in this district.

The USDA has recently adopted a few new interpretations of the farm program wetland conservation rules which are applicable here.

- For any improvements constructed by a drainage district, the NRCS will make a rebuttable assumption that every farmed wetland in the drainage district will be converted. (This assumption can be appealed by the impacted landowners, but not by the drainage district.)

- Mitigation of converted farmed wetland must compensate for all lost wetland functions and must also be made at a minimum acre for acre basis.
- A plan for the mitigation of all converted farmed wetland in the drainage district must be approved by the NRCS prior to the beginning of the construction of the improvements. After all opportunities for appeals are exhausted, the farmed wetland not covered by that mitigation plan would be found converted and the landowner and tenant would be in technical violation of the farm program. Penalties can be avoided when a drainage district causes the conversion, but only at the price of abandoning farming of the converted farmed wetlands or ceasing to participate in the farm program.
- The planned mitigation must be in place and functioning no later than the completion of the project which converts the farmed wetlands.

If a landowner does not request a certified wetland determination and he happens to end up with a converted farmed wetland, he will find themself in technical violation of the farm program rules and be subject to a USDA claim for the forfeiture and possibly refund of farm program payments when the work commences.

The Board of Supervisors may approve and authorize construction of the proposed improvements without accruing risk to the district from farm program wetland conservation rules violations. Obviously, the Board will want to know the wetlands status of all landowners and to help to keep them all in farm program compliance, but the Board cannot allow the failure of an individual landowner to share wetland information to influence the very important decisions it is charged to make for all of the benefitted landowners. However, by the rules, the program penalties will fall solely to the owners of the converted farmed wetlands for which compensatory mitigation is not secured. It is fully up to the landowner to cooperate with the district toward keeping himself/herself in farm program compliance.

B. Converted Wetland Mitigation Alternatives

Since 1987, the USDA has assumed jurisdiction over the conversion (or improved drainage) of what has become commonly termed “farmed wetland”. It being the rebuttable assumption of the current USDA policies that all farmed wetlands will be converted and that acre-for-acre mitigation will be necessary to put the converted farmed wetlands back into production, the decision process is made a little easier—although mitigation is much costlier.

Mitigation options include the purchase of wetland credits in a mitigation bank. Mitigation banks are not common and their credits are expensive. Another alternative is for the district to self-mitigate, wherein a mitigation plan to use a suitable site inside or outside the district on which to create wetlands for mitigation of impacted wetlands is developed for review and approval by the NRCS.

Farm program rules clearly provide that when a farmed wetland is converted by a drainage district the conversion act is attributed to the owner of the farmed wetland. However, the farm program rules also clearly provide that the owner of the converted farmed wetland may remain eligible for farm program benefits by opting to not farm the converted farmed wetland. If for some reason mitigation is delayed, this can be a temporary solution for the farmed wetland owners in a drainage district. It is also an option for those who choose not to report certified farmed wetland determinations and for which mitigation will not be provided.

C. Conservation Reserve Program Complications

We note that there may be areas of CRP along the proposed new drains alignments. There

are some manageable drawbacks that must be addressed by the owners of affected CRP tracts.

The CRP includes an option to enroll farmed wetland and prior converted cropland where the underlying tile drains are disabled and a wetland cover is created. It has been our experience that if the disabled tile is not restored, the USDA may allow the land to stay in the CRP until the contract expires. However, only the landowner can seek and secure this waiver.

But, if a CRP site includes a certified farmed wetland and the USDA determines that it will be converted by the tile improvement project, the alternative of leaving the farmed wetland sit idle does not exist and mitigation will need to be secured immediately. The drainage district could make some reasonable accommodations, such as sealed pipe joints or an altered alignment, to help the owner, but it will be up to the owner to work with the USDA in securing immediate mitigation. Perhaps taking additional steps to make the CRP site wetter will be possible for the landowner.

D. CRP Damage Waivers

The destruction of CRP vegetation by construction activities places the landowner in technical violation of farm program conservation rules. The penalties can include loss of the CRP contract, forfeiture of back CRP payments and financial penalties. To avoid these penalties, landowners are advised to request a waiver from the USDA Farm Service Agency County Committee. The state committee will grant waivers for ditch or tile work if CRP vegetation restoration, in compliance with NRCS requirements, is timely done after the work is complete. If the project is authorized, all CRP owners in the path of construction must independently seek the FSA County Committee waivers. This process should be initiated immediately if the project is authorized.

E. Nesting Season Restrictions

The CRP rules also restrict disturbances during the primary nesting season, which covers the period of May 15 to August 1 in Worth County. Recent relaxations of this rule, although specific to drainage district maintenance of open ditches having CRP buffers, likely would now favor allowing tile installation work without penalty on CRP during the primary nesting season. It makes no sense for a drainage district to wait for up to 3 months during ideal work weather. This is another situation where only the landowner can seek and secure the needed waiver.

IV. CLEAN WATER ACT COMPLIANCE

Dredging and filling of “Waters of the United States” (WOTUS) is regulated under Section 404 of the Clean Water Act. In the 1990’s the USEPA & USACE adopted rules to extend section 404 jurisdiction to isolated wetlands, including farmed wetlands. For a few years it became necessary to get CWA Sec 404 permits for drainage district improvements where farmed wetland conversions were expected. Drainage districts were helped at the time with the issuance of a memorandum of understanding entered into by 4 regulatory agencies. This agreement gave the NRCS primacy in mapping and regulating wetlands on agricultural land. Great relief came in 2001 when the U.S. Supreme Court ruled that isolated wetlands were not subject to CWA Sec 404 jurisdiction.

However, in 2012 the USEPA launched an aggressive rulemaking procedure to reestablish jurisdiction of isolated wetlands by revising the definition of “waters of the United States” (WOTUS) to include isolated wetlands. This massive rule change became effective on August 28, 2015. However, a temporary stay was imposed by the Sixth Circuit Court of Appeals in October 2015 and

the revisions were repealed on September 12, 2019, returning the USEPA jurisdiction to the pre-2015 guidance. A revised WOTUS rule took effect on March 20, 2023.

It is all but certain that if it were to be unleashed the WOTUS rule would 1) expand CWA Sec 404 jurisdiction to include all isolated farmed wetlands and even drained prairie potholes, 2) identify more jurisdictional wetland than the USDA has identified under the farm program and 3) demand more stringent and costly mitigation for the conversion of farmed wetlands. That is assuming drainage improvements will be allowed at all – a scary thought but one that is applicable from a plain reading of the CWA Section 404(b)(1) guidelines which requires proof of inability to avoid draining a wetland before it can be drained and mitigated.

On April 12, 2023 the federal district court of North Dakota stayed the revised WOTUS rule in several states including Iowa. We are reasonably confident that until the WOTUS rule stay is lifted there are no CWA Section 404 jurisdictional wetlands found in the benefited area and that only the farm program wetland rules are in play.

V. WATER QUALITY

The hydrologic impacts to tile drainage entail a complex interaction of processes dependent upon landscape, climatic, and human influences, watershed scale, soil permeability, and rainfall event size. There is a popular and often accepted idea that an increase in subsurface drainage facilities adds to an increase in both peak and total flow values, thereby increasing flooding. Recently published research from the University of Iowa's IIHR – Hydroscience and Engineering Center refutes that perception. This University of Iowa report was the result of a water model study of the Clear Creek Watershed in Iowa and Johnson Counties and found that an increase in field tile and subsurface drainage decreases peak flows for most storm events. The field scale DRAINMOD model was used in the research in conjunction with a simplified routing equation to analyze the impact of tile drains in the Clear Creek Watershed.

However, additional steps are required to slow, impound, or infiltrate water to receive benefits in water quality. Water quality is a growing topic throughout the nation and more recently throughout Iowa. The particle loads and nutrient levels within drainage water is a concern that is receiving increased scrutiny. Processes and reduction practices are being developed and incorporated on farms and into projects throughout Iowa which reduce nitrogen loss and improve water quality. Enhancement of water quality is possible through many different drainage applications that can see both immediate and long-term benefits.

We encourage the landowners of this District to consider multi-purpose drainage management, which incorporates Best Management Practices (BMPs) which utilize effective measures aimed at reducing sediment and nutrient loading and improving water quality. These BMPs are divided into three (3) areas: preventative measures, control measures, and treatment measures.

Preventative measures can be applied throughout the watershed including crop rotation, cover crops, residue management, and nutrient management. These measures are aimed at controlling sediment, minimizing erosion and nutrient loss, and sustaining the soil's health, all without dramatically changing the current land use of the landscape.

Control measures are practices aimed at improving water quality directly associated with the flow of water by reducing peak flows, providing in-stream storage, sedimentation, and nutrient uptake. Examples of control measures include alternative tile intakes, grassed waterways, two (2) stage ditches, water control structures, and controlled subsurface drainage. These practices are directly

linked to the conveyance of subsurface tile water or open channel ditch flow.

The function of **treatment measures** is to improve water quality by directly removing sediment and nutrients from the subsurface or surface water flow throughout a watershed. Examples of treatment measures include surge basins (storage ponds), filter/buffer strips, wetland restorations, woodchip bioreactors, and water and sediment control basins (WASCOBs).

These practices may be incorporated into either the public or private drainage systems. Funding options are available to landowners through the Environmental Quality Incentives Program (EQIP) and the Iowa Water Quality Initiative. EQIP is a voluntary program that provides financial assistance to individual landowners for various conservative practices as identified above. Also, the State of Iowa, through the Iowa Water Quality Initiative, provides cost share funds to participating landowners to voluntarily install nutrient reduction practices.

A unique opportunity may exist when a wetland is created within the district for the treatment of the tile and/or surface waters of the watershed. A properly sized and created wetland may be able to be utilized as a mitigation site for any farmed wetlands that are found within the drainage district. With the possibility of a large share of the created wetland being funded by the Iowa Water Quality Initiative program, any potential farmed wetlands could be mitigated at a much-reduced cost.

If there is landowner interest in any of these water quality features and funding options, further study and review would be required to select, site, and fund the water quality measures appropriate for the area.

VI. PROPOSED WORK

Tile Improvement or Repairs

The investigation has confirmed the need for drainage relief within the district. Modern farming practices rely upon well drained soils to achieve maximum productivity. We recommend replacement of the existing upper Drainage District No. 34 tile with a system designed according to modern standards.

The standard design for drainage tile in northern Iowa is the ½" drainage coefficient, or "Dc." This standard is adequate for the majority of drainage districts in Worth County and is a cost-effective design to maximize the productivity of today's farming practices. Paralleling the existing 1919 system is not recommended because the function of the system would rely upon a 100 year old tile. The ½" Dc would provide two times the drainage capacity of the existing DD 34 Upper Main Tile and would be a substantial improvement for the lands in Drainage District No. 34.

We have included plans for both a upper main repair and a full main tile improvement. The repair would be constructed using the same size tile as what is currently there. If that tile is not commerically available, the next larger size is used.

The proposed tile will generally follow similar route as the existing tile following the swale of the district. The proposed tile route is described below.

- The Upper Main would outlet into the improved relief tile line near station 132+50 just upstream of Lateral 10 in Section 4. From there, it would go southeast into the SW quarter of Section 3 crossing 450th Street. In Section 10, it would head southeasterly crossing 440th Street and turning east, ending just east of Warbler Avenue.

- We have also included plans to construct a parallel tile downstream, clean out the open ditch, and improve the upper main tile. We have decided to include these plans in this report because the lower tile is undersized and relying on approximately half of its capacity uising a 100 year old tile. This proposed new main tile would parallel the 1976 tile. It follows a different path than the existing tile as we have tried to minimize length and maximize grade. The open ditch will be deepened to lower the new tile outlet and provide more grade for the tile. The new upper main tile would closely follow the path of the existing tile.

The preliminary plans included in this report show the proposed tile route in more detail.

The proposed tile will cross the existing district tile at several locations. Where the existing tile is crossed, the upstream end will be connected to the proposed main and the downstream end will be capped to allow the tile to continue functioning as a collector to bring smaller private tile to the new main. The function of the existing tile will be replaced by the new system and it is recommended that the existing facilities be abandoned as district facilities. Maintenance of these tiles will be turned over to the landowners following completion of the project. If sections of the orginial tile are in poor condition, those sections will be crushed in the field and all tile connections will be connected directly into the new tile.

It is recommended that this new tile be constructed using tongue and groove reinforced concrete pipe (RCP). RCP is recommended over dual wall HDPE pipe for several reasons including, less demanding installation requirements, assured smooth walls, and proven longevity of the material. Our understanding is there are some areas which may be sugar sand. In those areas, additonal rock will be needed to bed the pipe.

To comply with the manufacturers recommended installation methods, the dual wall HDPE pipe would need to be completely encased in crushed rock. The inclusion of this bedding envelope raises the cost of the dual wall HDPE installation above the typical installation cost of RCP. RCP also does not deform under the weight of the soil. In cases where dual wall HDPE has been used, such deformation stresses the liner, causing rippling and detachment. Finally, the existing rigid wall tile mains found throughout north central Iowa were constructed of clay or concrete and these materials have shown their durability over the past 100 years. We expect a much longer service life from today's RCP products.

The improvement would cost about $2,353,000 and the repair would cost about $791,000. The table below shows the breakdown of only the estimated construction costs for the proposed improvements and repairs. Please be reminded that assessments are based upon benefits, and that following reclassification some highly benefited parcels will likely bear 2 to 2½ times the average assessments. A complete opinion of probable total costs is included in Appendix C of this report.

Estimated Construction Costs Summary			
Facility	**Estimated Construction Cost ($)**	**Acres Served (ac)**	**Cost per Acre ($/ac)**
Improvement			
Full Improvement	$2,353,000	3,533	$666
Repair			
Upper Repair	$791,000	3,533	$224

A. Utilities

Overhead and buried power lines and other utility lines likely parallel or cross the tile at various locations. Extra care will need to be taken when working under or near these utility lines. The contractor will be responsible for using Iowa One Call to notify utility companies and to cooperate in the locating, marking, and protection of these facilities.

B. Road Crossings

Five county roads are required to be crossed as part of the recommended repairs and improvements. It is assumed that the paved road will be bored and the other crossings will be open cut. The following table summarizes the road crossings which are part of the proposed repairs and improvements.

Tile Road Crossings						
Road	**Control Agency**	**Type**	**Facility**	**Station**	**Repair Diameter**	**Improvement Diameter**
HWY 105	Worth County	Bored	Lower Main	64+76	-	42”
Vine	Worth County	Open Cut	Upper Main	149+20	24”	36”
450th	Worth County	Open Cut	Upper Main	163+70	24”	30”
440th	Worth County	Open Cut	Upper Main	231+16	12”	12”
Warbler	Worth County	Bored	Upper Main	241+10	12”	12”

Iowa Code Section 468 requires that all costs of primary and secondary road crossing are to be paid from funds available to the entity that controls the road. The total estimated cost for the full improvement option to the Worth County Secondary Roads is $66,000.

C. Work Limits

The district will need an area to install the tile. The extent of the work limits on the tile will be finalized when the final construction plans are developed, but it will typically be 50 to 100 feet from the tile centerline on whatever side(s) the work will be done. Landowners will also be entitled to compensation for damages in the work area. It is recommended that, whenever possible, a landowner not crop the work area and instead accept fair rent for the land. Compensation for use of and damages within the temporary work area is normally determined at the project completion hearing.

VII. EXISTING SCHEDULE REVIEW

A. Existing Assessment Schedule Review

Drainage District No. 34 was last reclassified in 2023. This report is on file at the Auditor’s Office. Appendix B contains a map showing the existing benefited units assessed per acre and the classification for each parcel based on a $1 million assessment.

B. General Classification Methodology

The process of reclassification uses several factors to equitably spread project costs based upon benefits received. The three common factors are: Use; Proximity; and Wetness.

The Use Factor considers how much of the facility is required to bring an outlet to a particular location. The more of a facility that is used by any given property, the higher the Use Factor on that property. A parcel using one mile of a facility should pay less than a parcel using 5 miles of the facility.

The Proximity Factor considers the land's proximity to the outlet provided by the facility. Lands nearer to the ditch receive a higher assessment because they have easy access to district facilities. Lands farther from the facility must invest in additional private drainage to access the facility. A 40 acre tract which is crossed by a ditch should pay more than a 40-acre tract a mile away which must build a private system to reach the open ditch.

The Wetness Factor accounts for the soil types' varying natural wetness and need for drainage. Wet soils in a pothole are high because the soils have more need for drainage than drier soils on the hill tops.

Other considerations may be necessary to achieve equitable assessments.

VIII. DISCUSSIONS & RECOMMENDATIONS

This report confirms the need to improve the drainage efficiency and capacity of the Drainage District No. 34 drainage system. The work described herein can accomplish that improvement.

Improvement Recommended. The improvements proposed will provide the drainage capacity needed for modern farming practices. The estimated assessable cost of the recommended ½" Dc improvement is $2,353,000. We find that the proposed improvements are practicable, feasible, and beneficial to the public.

Repairs Recommended. The repair proposed will restore the drainage capacity as designed in 1919. The estimated assessable cost is $791,000.

Installment Payments. Iowa drainage district law provides that large repair and improvement assessments may be paid in no less than ten nor more than twenty annual installments at the discretion of the Board of Supervisors. We anticipate that the Board will spread assessments of the magnitude contemplated in this report over twenty years. If we assume that the Board will allow twenty annual installments at 8% simple interest, the recommended improvement costs for all benefited lands would be about $21 per acre per year. Please be reminded that assessments are based upon benefits, and that following reclassification some highly benefited parcels will likely bear two to two-and-a-half times the average assessments.

Tiling is a long-term investment. The upfront costs are high, but the cost of operation tends to be low during its useful life. Included in Appendix C is a financial analysis of the probable costs and the likely payback period for different assessment thresholds at different yield increases resulting from this project. The financial analysis uses current commodity prices and average yields from the Agricultural Decision Maker website. Varying yield increases have been used to estimate payback periods for a range of possible assessments. Iowa State University and University of Minnesota research indicates a likely average yield increase between 10% and 25% for an improvement of this type.

The average price received by Iowa corn growers in the last 5 years when adjusted for inflation has been $5.07/bushel. Assuming corn averages $5.00/bushel over the next 20 years and using only the increase in revenue from an assumed 10% yield increase, an average assessment for the recommended ½" Dc could be repaid in approximately 7 years. These improvements would likely continue to function well for another century bringing continued benefit to future generations and owners.

It is recommended that the Board of Supervisors of Worth County, acting as trustees for Drainage District No. 34, take appropriate action with legal guidance to accomplish the following:

- Tentatively approve this Engineer's Report.
- Conduct a public hearing on the proposed improvements or repairs.
- Adopt the improvement plan, modified as deemed appropriate to satisfy the needs of the district.
- Direct the Engineer to prepare the necessary plans and specifications and to proceed toward a bid letting.

Respectfully submitted,

Jacob Hagan, PE

Appendix A: Existing Conditions

Photo 2- Intake and bridge northwest of the intersection of 105 and Vine Ave

Photo 1- DD 34 Open Ditch looking downstream.

Draiange District No. 34

Worth County, IA

Soil Drain Class

August 2023

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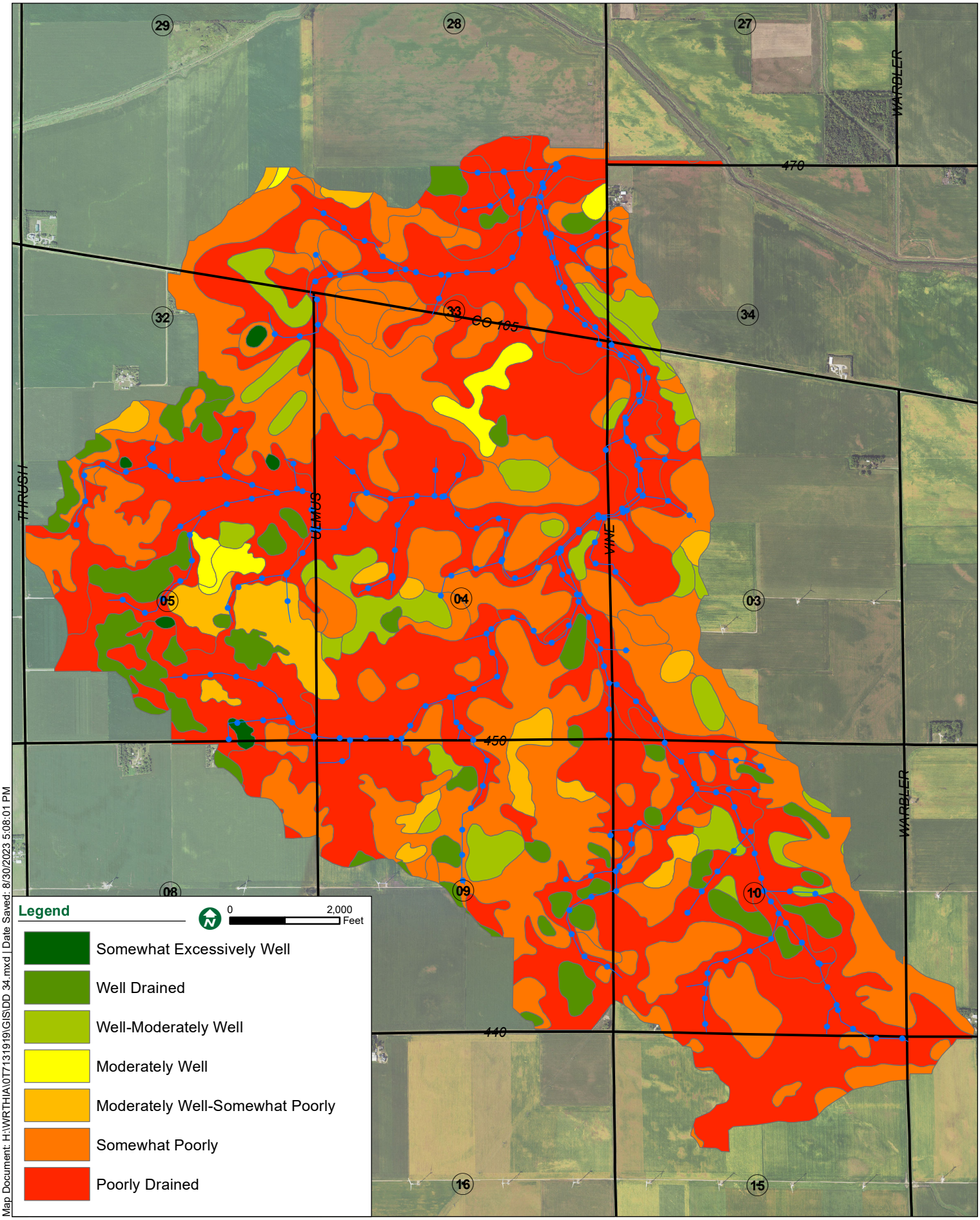

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Draiange District No. 34

Worth County, IA

Slope of the Land

August 2023

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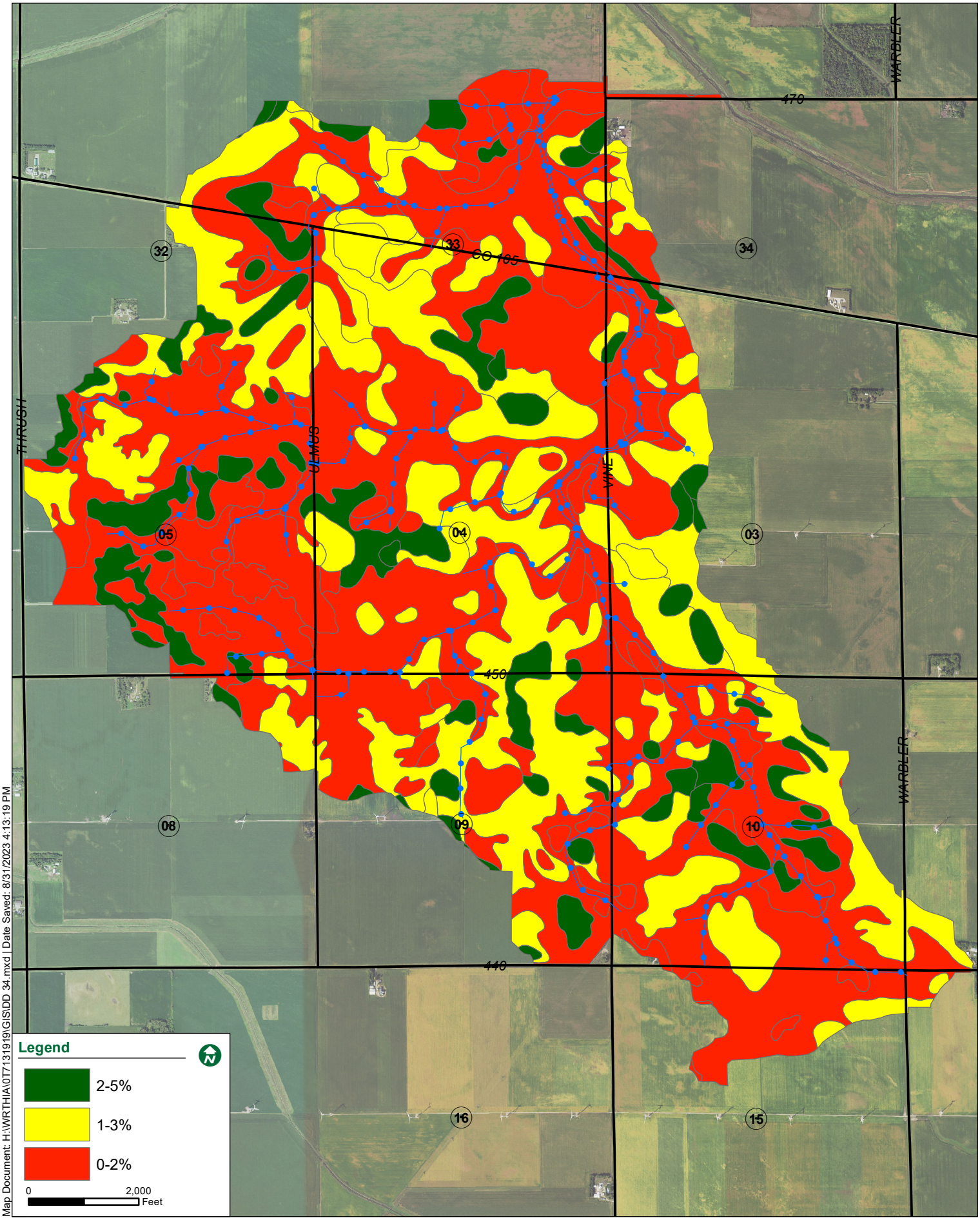

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Draiange District No. 34

Worth County, IA

Drainage Tiles

September 2023

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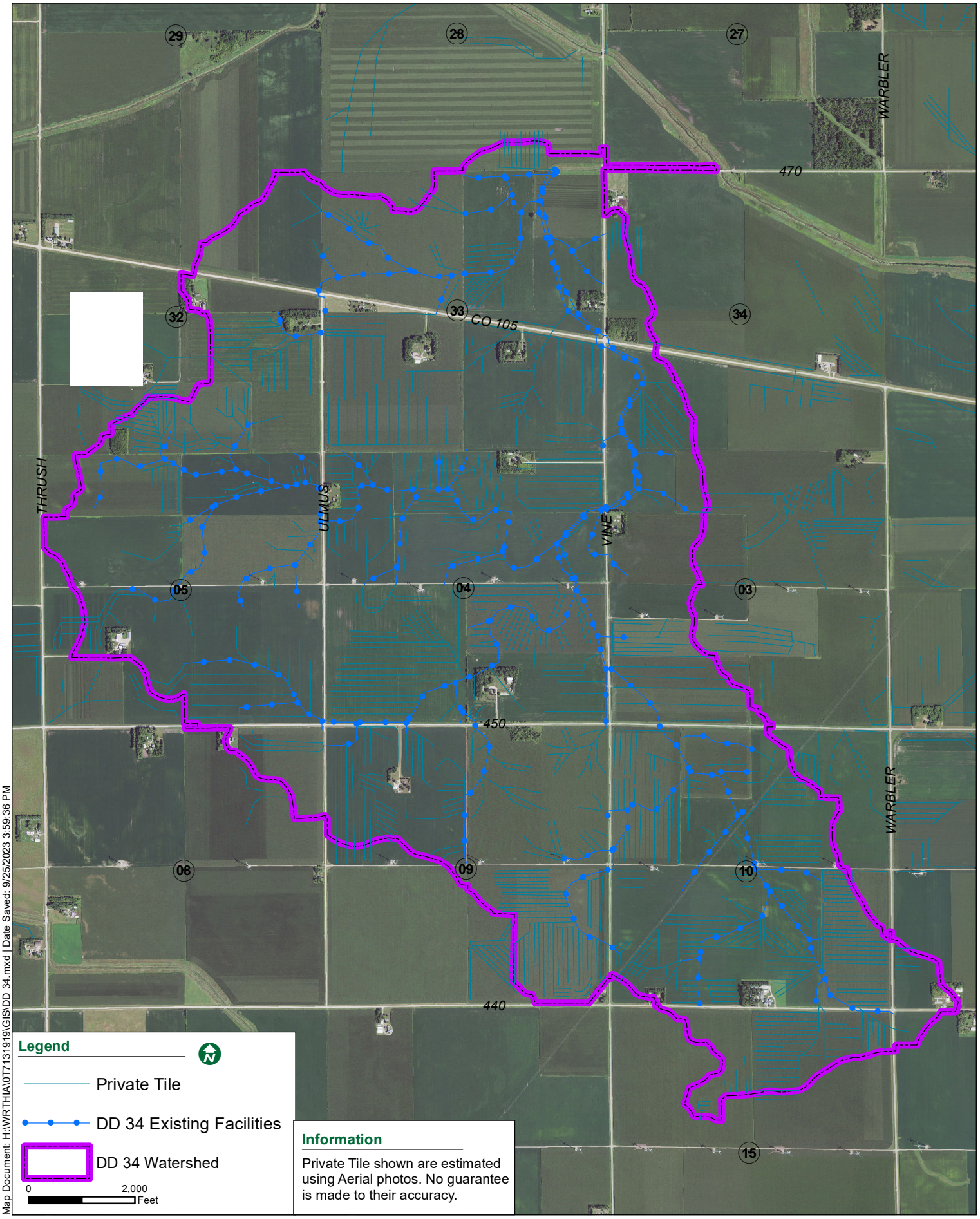

Legend

- Private Tile
- DD 34 Existing Facilities
- DD 34 Watershed

0 2,000 Feet

Information

Private Tile shown are estimated using Aerial photos. No guarantee is made to their accuracy.

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Appendix B: Existing Schedule Review

Drainage District No. 34, Main Tile and Laterals 3 ,3A, 4, 5, 6, 7, 8, 11, 12, 13, 15, 17, 19, & 20

Worth County, IA

Parcel Assessment Based on a $1,000,000 Cost

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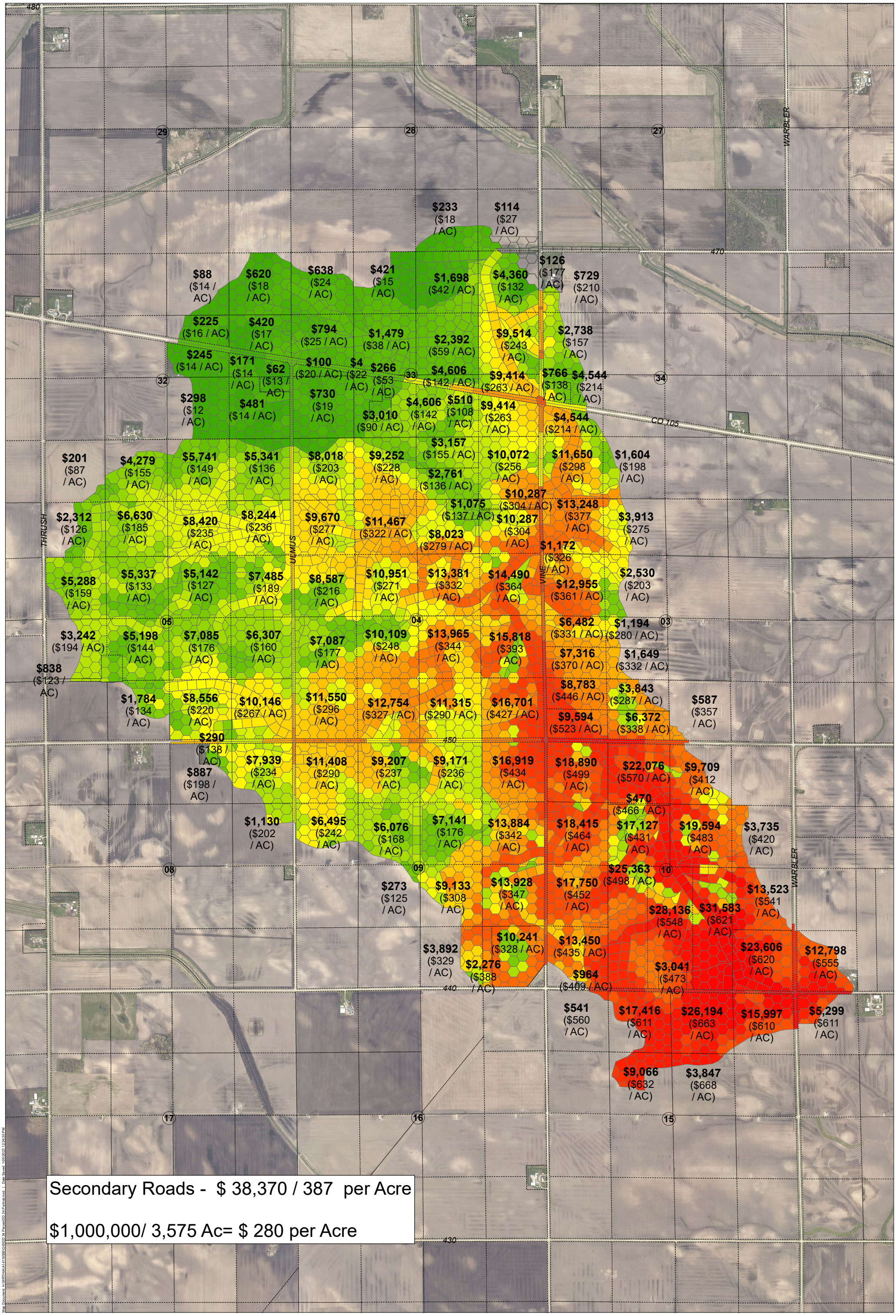

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Appendix C: Engineer's Opinion of Probable Cost

Drainage District No. 34

Tile Repairs

Worth County, Iowa

OPINION OF PROBABLE COSTS

Thursday, October 5, 2023

Construction Division 1--Tile Work on Private Lands

Item	Description	Unit	Quantity	Unit Price	Total
100	Class III R.C.P., 24'' Dia.	LF	5,494	$50	$274,700
101	Class III R.C.P., 18'' Dia.	LF	1,650	$42	$69,300
102	Class III R.C.P., 15'' Dia.	LF	1,150	$38	$43,700
103	Class III R.C.P., 12'' Dia.	LF	2,371	$34	$80,614
104	HDPE, 12'' Dia.	LF	200	$25	$5,000
105	24'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	16	$700	$11,200
106	18'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	4	$600	$2,400
107	12'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	4	$400	$1,600
108	24'' on 24'' Dia. R.C.P. Tee, Fabrication Only	EA	6	$800	$4,800
109	12'' on 24'' Dia. R.C.P. Tee, Fabrication Only	EA	1	$800	$800
110	18'' on 18'' Dia. R.C.P. Tee, Fabrication Only	EA	1	$600	$600
111	12'' on 18'' Dia. R.C.P. Tee, Fabrication Only	EA	1	$600	$600
112	12'' on 12'' Dia. R.C.P. Tee, Fabrication Only	EA	2	$500	$1,000
113	24'' to 18'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$800	$800
114	18'' to 15'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$800	$800
115	15'' to 12'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$800	$800
116	12'' Dia., R.C.P. Endcap	EA	1	$125	$125
117	Crush Existing Tile	LF	10,500	$2	$21,000
118	12" Hickenbottom Intake	EA	5	$800	$4,000
119	Lateral Tile Connections, 10" Dia. or Smaller	EA	24	$400	$9,599
120	Lateral Tile Connections, 12" Dia. or Larger	EA	3	$500	$1,333
121	Tile Trench Stabilization and Cradling Rock	TN	213	$35	$7,455
122	Administration of Erosion Management Plan	LS	1	$3,000	$3,000
123	Silt Fence Install and Remove	LF	530	$3.00	$1,590
124	Spot Tile Exploration	HR	11	$200	$2,200
125	Mobilization	LS	1	$27,500	$27,500
				Estimated Division 2 Subtotal	**$577,000**

Construction Division 2--County Secondary Roads

Item	Description	Unit	Quantity	Unit Price	Total
200	Drain Tile, Trenchless, Steel, 0.188" wall, 12" Dia.	LF	52	$250	$13,000
201	Class IV R.C.P., 24'' Dia.	LF	156	$54	$8,424
202	Class IV R.C.P., 12'' Dia.	LF	66	$36	$2,376
203	Hickenbottom Intake, 12" Dia.	EA	8	$800	$6,400
204	Tile Trench Stabilization and Cradling Rock	TN	65	$35	$2,275
205	Seeding and Fertilizing (Rural)	EA	4	$1,000	$4,000
206	Traffic Control	EA	4	$2,000	$8,000
207	Silt Fence-Install and Remove	LF	274	$3	$822
208	Exploratory Excavation	HR	4	$200	$800
209	Mobilization	LS	1	$2,300	$2,300
				Estimated Division 4 Subtotal	**$48,000**

Drainage District No. 34

Tile Repairs

Worth County, Iowa

OPINION OF PROBABLE COSTS

Thursday, October 5, 2023

Subtotal of Construction Divisions 1 - 4	**$625,000**
Construction Contingency	**$31,000**
Total Estimated Construction Cost	**$656,000**
Less Estimated Secondary Roads Construction Costs Paid by Others	**$48,000**
Total Estimated Assessable Construction Cost	**$608,000**
Construction Related Damages	
Work Area Rental (27.0 ac)	$27,000
Other Damages	$16,000
Basic Engineering Services	
Survey, Study & Report, Meetings & Hearing	$50,000
Construction Plans, Specifications, & Bid Letting	$15,000
Construction Engineering Services	$30,000
Legal Services, Publications, Mailings, Etc.	$7,000
Finance, Interest & Contingency	$38,000
Total Estimated Assessable Project Cost	**$791,000**
Estimated Average Cost Per Benefited Acre (3,533 ac)	$224
Estimated Average Cost Per Acre Per Year at 8% interest (10 years)	$32
Estimated Average Cost Per Acre Per Year at 8% interest (20 years)	$21

Drainage District No. 34

Tile Improvements

Worth County, Iowa

OPINION OF PROBABLE COSTS

Thursday, October 5, 2023

Construction Division 1--Lower Main Tile Work on Private Lands

Item	Description	Unit	Quantity	Unit Price	Total
100	Class IV R.C.P., 42'' Dia.	LF	400	$136	$54,400
101	Class III R.C.P., 42'' Dia.	LF	6,240	$127	$792,480
102	Class III R.C.P., 36'' Dia.	LF	1,544	$92	$142,048
103	HDPE, 12'' Dia.	LF	178	$25	$4,450
104	42'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	5	$2,000	$10,000
105	36'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	2	$1,600	$3,200
106	36'' on 42'' Dia. R.C.P. Tee, Fabrication Only	EA	2	$1,200	$2,400
107	12'' on 42'' Dia. R.C.P. Tee, Fabrication Only	EA	2	$1,200	$2,400
108	12'' on 36'' Dia. R.C.P. Tee, Fabrication Only	EA	1	$1,100	$1,100
109	42'' to 36'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$2,000	$2,000
110	96" Dia. Manhole Connections	EA	2	$15,000	$30,000
111	12" Hickenbottom Intake	EA	5	$800	$4,000
112	Lateral Tile Connections, 10" Dia. or Smaller	EA	18	$400	$7,366
113	Lateral Tile Connections, 12" Dia. or Larger	EA	2	$500	$1,023
114	Tile Trench Stabilization and Cradling Rock	TN	164	$35	$5,740
115	Administration of Erosion Management Plan	LS	1	$3,000	$3,000
116	Silt Fence Install and Remove	LF	410	$3.00	$1,230
117	Spot Tile Exploration	HR	11	$200	$2,200
118	Open Ditch Excavation	STA	30	$300	$9,000
119	Open Ditch Spoil Leveling	STA	30	$150	$4,500
120	Open Ditch Rock Pickup and Tillage	STA	30	$25	$750
121	Open Ditch Seeding & Fertilizing	STA	30	$100	$3,000
122	Mobilization	LS	1	$53,500	$53,500
				Estimated Division 1 Subtotal	**$1,140,000**

Drainage District No. 34

Tile Improvements

Worth County, Iowa

OPINION OF PROBABLE COSTS

Thursday, October 5, 2023

Construction Division 2--Upper Main Tile Work on Private Lands

Item	Description	Unit	Quantity	Unit Price	Total
200	Class III R.C.P., 36'' Dia.	LF	1,672	$92	$153,824
201	Class III R.C.P., 30" Dia.	LF	3,799	$69	$262,131
202	Class III R.C.P., 24'' Dia.	LF	1,679	$50	$83,950
203	Class III R.C.P., 18'' Dia.	LF	1,350	$42	$56,700
204	Class III R.C.P., 15'' Dia.	LF	1,100	$38	$41,800
205	Class III R.C.P., 12'' Dia.	LF	1,070	$34	$36,380
206	HDPE, 12'' Dia.	LF	200	$25	$5,000
207	36'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	3	$900	$2,700
208	30'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	7	$800	$5,600
209	24'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	3	$700	$2,100
210	12'' Dia., R.C.P. Elbow Section, Fabrication Only	EA	4	$400	$1,600
211	36'' to 30'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$1,600	$1,600
212	30'' to 24'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$1,500	$1,500
213	24'' to 18'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$800	$800
214	18'' to 15'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$800	$800
215	15'' to 12'' Dia., R.C.P. Reducer Section, Fabrication Only	EA	1	$800	$800
216	10'' on 36'' Dia., R.C.P. Tee Section, Fabrication Only	EA	1	$1,100	$1,100
217	24'' on 30'' Dia., R.C.P. Tee Section, Fabrication Only	EA	1	$900	$900
218	18'' on 24'' Dia., R.C.P. Tee Section, Fabrication Only	EA	1	$800	$800
219	12'' on 24'' Dia., R.C.P. Tee Section, Fabrication Only	EA	1	$800	$800
220	12'' on 18'' Dia., R.C.P. Tee Section, Fabrication Only	EA	3	$600	$1,800
221	12'' on 15'' Dia., R.C.P. Tee Section, Fabrication Only	EA	1	$500	$500
222	12'' Dia., R.C.P. Endcap	EA	1	$125	$125
223	12" Hickenbottom Intake	EA	5	$800	$4,000
224	Lateral Tile Connections, 10" Dia. or Smaller	EA	24	$400	$9,532
225	Lateral Tile Connections, 12" Dia. or Larger	EA	3	$500	$1,324
226	Tile Trench Stabilization and Cradling Rock	TN	212	$35	$7,420
227	Administration of Erosion Management Plan	LS	1	$3,000	$3,000
228	Silt Fence Install and Remove	LF	530	$3.00	$1,590
229	Spot Tile Exploration	HR	8	$200	$1,600
230	Mobilization	LS	1	$34,600	$34,600
				Estimated Division 2 Subtotal	**$726,000**

Drainage District No. 34

Tile Improvements

Worth County, Iowa

OPINION OF PROBABLE COSTS

Thursday, October 5, 2023

Construction Division 3--County Secondary Roads

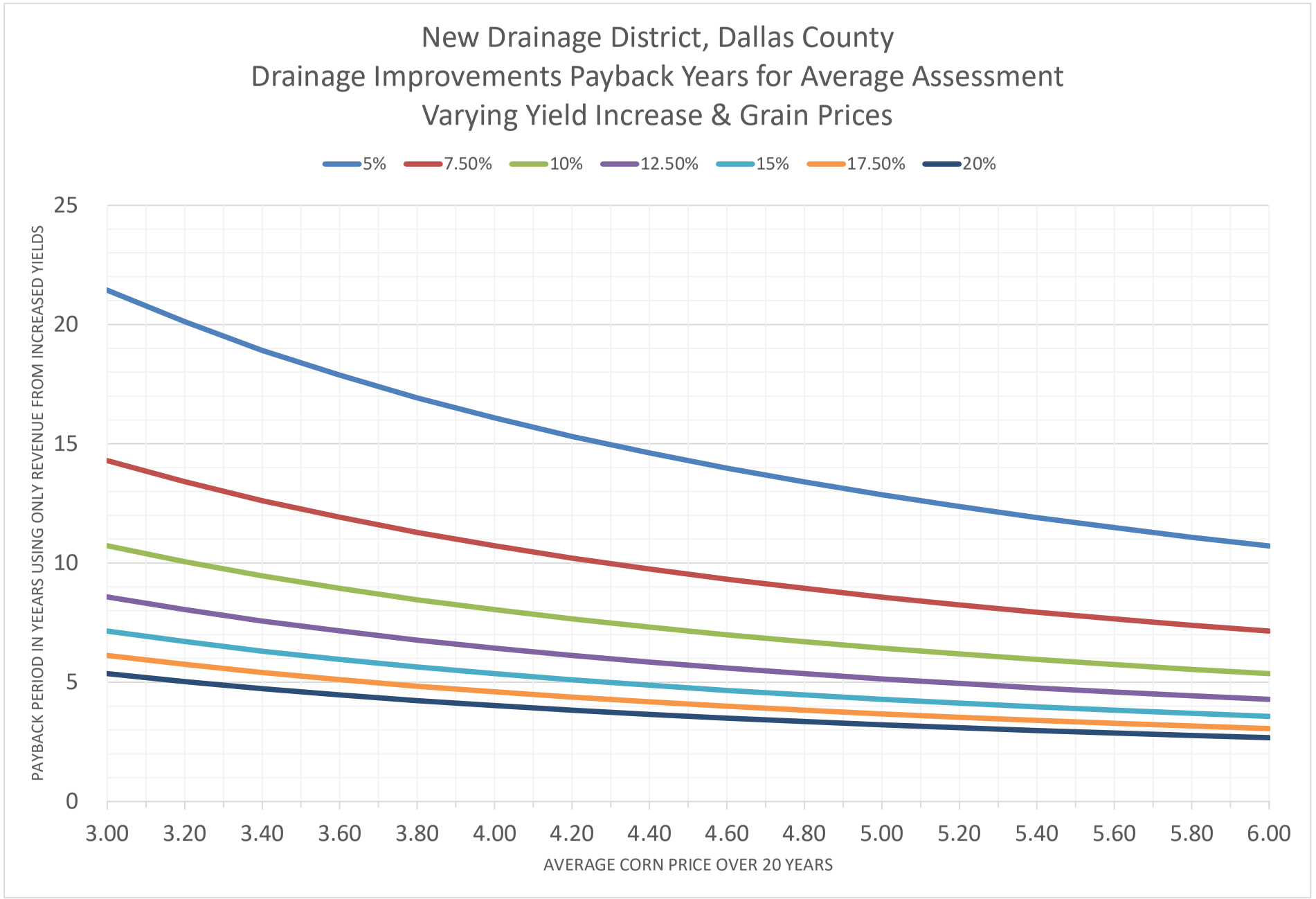
Item	Description	Unit	Quantity	Unit Price	Total
299	Drain Tile, Trenchless, Steel, 0.625" wall, 42" Dia.	LF	60	$750	$45,000
300	Drain Tile, Trenchless, Steel, 0.188" wall, 12" Dia.	LF	52	$250	$13,000
401	Class IV R.C.P., 42'' Dia.	LF	40	$136	$5,440
301	Class IV R.C.P., 36" Dia.	LF	66	$98	$6,468
302	Class IV R.C.P., 30" Dia.	LF	90	$74	$6,660
303	Class IV R.C.P., 12'' Dia.	LF	66	$36	$2,376
304	Hickenbottom Intake, 12" Dia.	EA	10	$800	$8,000
305	Tile Trench Stabilization and Cradling Rock	TN	115	$35	$4,025
306	Seeding and Fertilizing (Rural)	EA	5	$1,000	$5,000
307	Traffic Control	EA	5	$2,000	$10,000
308	Silt Fence-Install and Remove	LF	166	$3	$498
309	Exploratory Excavation	HR	5	$200	$1,000
310	Mobilization	LS	1	$3,100	$3,100
				Estimated Division 3 Subtotal	**$66,000**

Drainage District No. 34

Tile Improvements
Worth County, Iowa
OPINION OF PROBABLE COSTS
Thursday, October 5, 2023

Subtotal of Construction Divisions 1 - 3	**$1,932,000**
Construction Contingency	**$97,000**
Total Estimated Construction Cost	**$2,029,000**
Less Estimated Secondary Roads Construction Costs Paid by Others	**$66,000**
Total Estimated Assessable Construction Cost	**$1,963,000**
Construction Related Damages	
Work Area Rental (43.0 ac)	$43,000
Other Damages	$51,000
Basic Engineering Services	
Survey, Study & Report, Meetings & Hearing	$50,000
Construction Plans, Specifications, & Bid Letting	$15,000
Construction Engineering Services	$35,000
Legal Services, Publications, Mailings, Etc.	$22,000
Finance, Interest & Contingency	$174,000
Total Estimated Assessable Project Cost	**$2,353,000**
Estimated Average Cost Per Benefited Acre (3,533 ac)	$666
Estimated Average Cost Per Acre Per Year at 8% interest (10 years)	$32
Estimated Average Cost Per Acre Per Year at 8% interest (20 years)	$21

Appendix C - Payback Analysis of Drainage District System Replacement Costs



Assumed Rotation CCB: Soybean Price: 260% of Corn.

Appendix C

This worksheet is based upon one prepared by Dr. Stewart Melvin, ISU Extension Agricultural Engineer, Retired

Appendix C - Payback Analysis of Drainage District System Replacement Costs

Drainage District:		34	
ACRES IN DD	Enter>	3,593	ac
% Corn Acreage	Enter>	67	%
% Soybeans Acreage	Enter>	33	%
% Other (Roads, Etc)		0	%
Base Corn Yield	Enter>	193	bu/a
Base Soybeans Yield	Enter>	55	bu/a

Average Yield Improvement Due to Better Drainage Outlet, %	2.5	5	7.5	10	12.5	15	17.5	20
Total Increase in Yield, Corn (bu)	11,615	23,231	34,846	46,461	58,076	69,692	81,307	92,922
Total Increase in Yield, Soybeans (bu)	1,630	3,261	4,891	6,521	8,152	9,782	11,412	13,043

Enter Estimated Average Annual Yield Increase Over the Next 20 Years, % (See Footnote)	1.5%
Avg Price of Corn Next 20 Years	$ 5.87
Avg Price of Soybeans Next 20 Years	$ 14.08

<< The historic annual yield increase for corn in Iowa has been 2.1% since the 1930's, using less is a conservative assumption

Annual Increase in Revenue	2.5	5	7.5	10	12.5	15	17.5	20
From Corn	$ 68,182	$ 136,363	$ 204,545	$ 272,727	$ 340,908	$ 409,090	$ 477,271	$ 545,453
From Soybean	$ 22,955	$ 45,910	$ 68,865	$ 91,820	$ 114,775	$ 137,730	$ 160,685	$ 183,640
Total	$ 91,137	$ 182,273	$ 273,410	$ 364,546	$ 455,683	$ 546,820	$ 637,956	$ 729,093
Increased Revenue/acre	$ 25	$ 51	$ 76	$ 101	$ 127	$ 152	$ 178	$ 203
reased Revenue/acre over the anticipated life of the facility (100 years	$ 2,537	$ 5,073	$ 7,610	$ 10,146	$ 12,683	$ 15,219	$ 17,756	$ 20,292

Payback Period For Revenues From Only Yield Increase (Years)			2.5	5	7.5	10	12.5	15	17.5	20
Very High Assessment										
$1,665	per ac	250% of Avg	65.6	32.8	21.9	16.4	13.1	10.9	9.4	8.2
High Assessment										
$1,332	per ac	200% of Avg	52.5	26.3	17.5	13.1	10.5	8.8	7.5	6.6
Above Average Assessment										
$999	per ac	150% of Avg	39.4	19.7	13.1	9.8	7.9	6.6	5.6	4.9
Average Assessment										
$666	per ac	100% of Avg	26.3	13.1	8.8	6.6	5.3	4.4	3.8	3.3
Low Assessment										
$333	per ac	50% of Avg	13.1	6.6	4.4	3.3	2.6	2.2	1.9	1.6
Very Low Assessment										
$167	per ac	25% of Avg	6.6	3.3	2.2	1.6	1.3	1.1	0.9	0.8

Appendix C

This worksheet is based upon one prepared by Dr. Stewart Melvin, ISU Extension Agricultural Engineer, Retired

Appendix C - Payback Analysis of Drainage District System Replacement Costs

Drainage District Law Allows For Payment of Assessments in 20 Annual Installments

Assuming a 1.5% annual yield improvement over 20 years for corn currently priced at $5 and soybeans at $12

A **very high** cost assessment (250% of average) would be be paid off in	10.9	years on a 15% average yield increase.
A **high cost** assessment (200% of average) would be paid off in	10.5	years on a 12.5% average yield increase.
An **above avg** cost assessment (150% of average) would be paid off in	9.8	years on a 10% average yield increase.
An **average** cost assessment (100% of average) would be paid off in	8.8	years on a 7.5% average yield increase.
A **low** cost assessment (50% of average) would be paid off in	6.6	years on a 5% average yield increase.
A **very low** cost assessment (25% of average) would be paid off in	6.6	years on a 2.5% average yield increase.

Future Prices to Reflect Annual Yield Change Trend

Corn Today	$5.00	
Beans Today	$12.00	

Average Annual Yield Change	Price Adj. for Yield Change CORN 20-Year Avg. Price	SOYBEANS 20-Year Avg Price
0.0%	$5.00	$12.00
0.5%	$5.26	$12.63
1.0%	$5.55	$13.32
1.5%	$5.87	$14.08
2.0%	$6.21	$14.92
2.5%	$6.60	$15.83
3.0%	$7.02	$16.84
3.5%	$7.47	$17.94

Yield Improvements on 40 acres if Drowned Areas

Percent Increase over Current Conditions

Drowned Area ac	Percent of Average Yield Achieved by Improvements 50%	60%	70%	80%	90%	100%
1	1.3%	1.5%	1.8%	2.1%	2.3%	2.6%
2.5	3.3%	4.0%	4.7%	5.3%	6.0%	6.7%
5	7.1%	8.6%	10.0%	11.4%	12.9%	14.3%
7.5	11.5%	13.8%	16.2%	18.5%	20.8%	23.1%
10	16.7%	20.0%	23.3%	26.7%	30.0%	33.3%
15	30.0%	36.0%	42.0%	48.0%	54.0%	60.0%

Assumes Avg. Co. Yield on Non-Drowned Area

Existing Farm Yield vs. Potential Farm Yield

Average Field Yield with Improvement bu/ac	Current Average Corn Yield over Entire Field bu/ac 90	110	130	150	170	190
90	0.0%					
100	11.1%					
110	22.2%	0.0%				
120	33.3%	9.1%				
130	44.4%	18.2%	0.0%			
140	55.6%	27.3%	7.7%			
150	66.7%	36.4%	15.4%	0.0%		
160	77.8%	45.5%	23.1%	6.7%		
170	88.9%	54.5%	30.8%	13.3%	0.0%	
180	100.0%	63.6%	38.5%	20.0%	5.9%	
190	111.1%	72.7%	46.2%	26.7%	11.8%	0.0%
200	122.2%	81.8%	53.8%	33.3%	17.6%	5.3%

Appendix C

This worksheet is based upon one prepared by Dr. Stewart Melvin, ISU Extension Agricultural Engineer, Retired

Appendix C - Payback Analysis of Drainage District System Replacement Costs

Payback Years for Average Yield Improvements for Range of Average Grain Prices
New Drainage District & Proposed Improvements

Assumptions
Long-term Soybean/Corn price ratio is 2.6
Average assessment of $666/acre
1.5% average annual yield improvement due to causes other than better drainage.
A flat grain price is assumed in this analysis.

Average Current Grain Price Used Over Payback Period		Average Yield Response Due to Drainage Improvements						
Corn	Soybeans	5%	7.50%	10%	12.50%	15%	17.50%	20%
3.00	7.80	21.44	14.29	10.72	8.58	7.15	6.13	5.36
3.20	8.32	20.12	13.41	10.06	8.05	6.71	5.75	5.03
3.40	8.84	18.92	12.61	9.46	7.57	6.31	5.40	4.73
3.60	9.36	17.88	11.92	8.94	7.15	5.96	5.11	4.47
3.80	9.88	16.92	11.28	8.46	6.77	5.64	4.84	4.23
4.00	10.40	16.09	10.73	8.04	6.44	5.36	4.60	4.02
4.20	10.92	15.31	10.21	7.66	6.12	5.10	4.37	3.83
4.40	11.44	14.62	9.75	7.31	5.85	4.87	4.18	3.66
4.60	11.96	13.98	9.32	6.99	5.59	4.66	3.99	3.49
4.80	12.48	13.40	8.94	6.70	5.36	4.47	3.83	3.35
5.00	13.00	12.86	8.57	6.43	5.14	4.29	3.67	3.21
5.20	13.52	12.37	8.25	6.19	4.95	4.12	3.53	3.09
5.40	14.04	11.91	7.94	5.95	4.76	3.97	3.40	2.98
5.60	14.56	11.49	7.66	5.74	4.59	3.83	3.28	2.87
5.80	15.08	11.08	7.39	5.54	4.43	3.69	3.17	2.77
6.00	15.60	10.72	7.15	5.36	4.29	3.57	3.06	2.68

Footnotes:
It is important to note that after it is paid for, the drainage system will continue to foster improved crop yields for more than a century

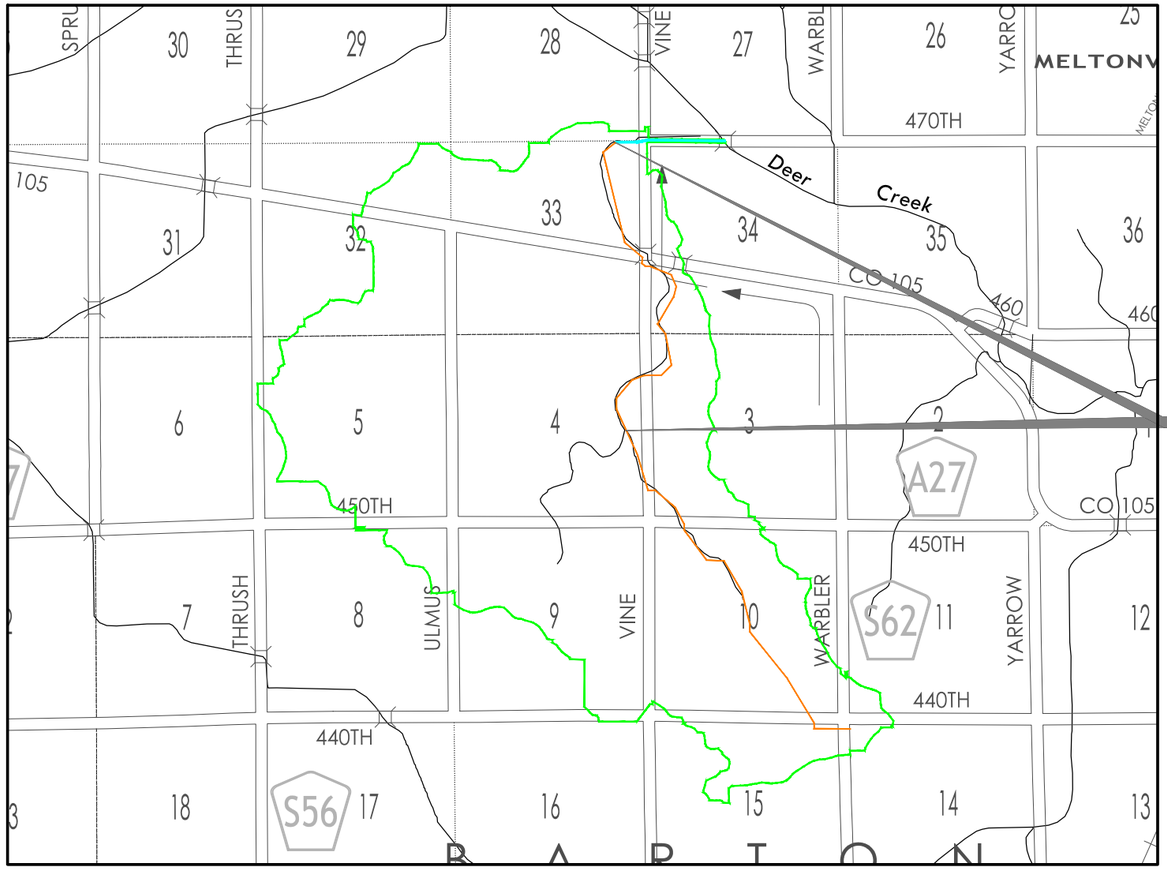
No credit is given in the above calculations for an immediate increase in land value resulting from the improved productivity

The average annual yield increase is intended to reflect through price adjustment the long term historic yield increase trend rather than to predict future grain price changes. In effect this analysis uses a stagnant current grain price tied to a reliable yield improvement trend. An entry of 0% assumes no average yield improvement or price increase over the next twenty years.

Proposed Plans

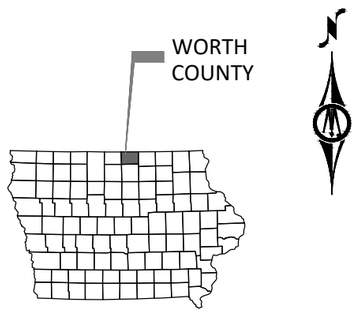
PRELIMINARY PLANS FOR

DRAINAGE DISTRICT NO. 34
DRAINAGE IMPROVEMENTS
WORTH COUNTY, IOWA
2023



IOWA ONE CALL
1-800-292-8989 | 811
www.iowaonecall.com

THE SUBSURFACE UTILITY INFORMATION IN THIS PLAN IS UTILITY QUALITY LEVEL D. THIS UTILITY QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA."



GOVERNING SPECIFICATIONS

THE 2023 EDITION OF THE "IOWA STATEWIDE URBAN STANDARD SPECIFICATIONS FOR PUBLIC IMPROVEMENTS" SHALL GOVERN.

IOWA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION",
SERIES 2023 AND ALL CURRENT GENERAL SUPPLEMENTAL SPECIFICATIONS AND MATERIALS INSTRUCTIONAL MEMORANDUM
SHALL GOVERN AS REFERENCED.

ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND ORDINANCES WILL BE COMPLIED WITH IN THE CONSTRUCTION
OF THIS PROJECT.

DATUM EQUATION	PROJECT DATUM: STATE PLANE
1912 DATUM + = NAVD 88	HORIZONTAL: IOWA NORTH
	VERTICAL: NAD 1988

HORZ. 0 1100 4200
SCALE FEET

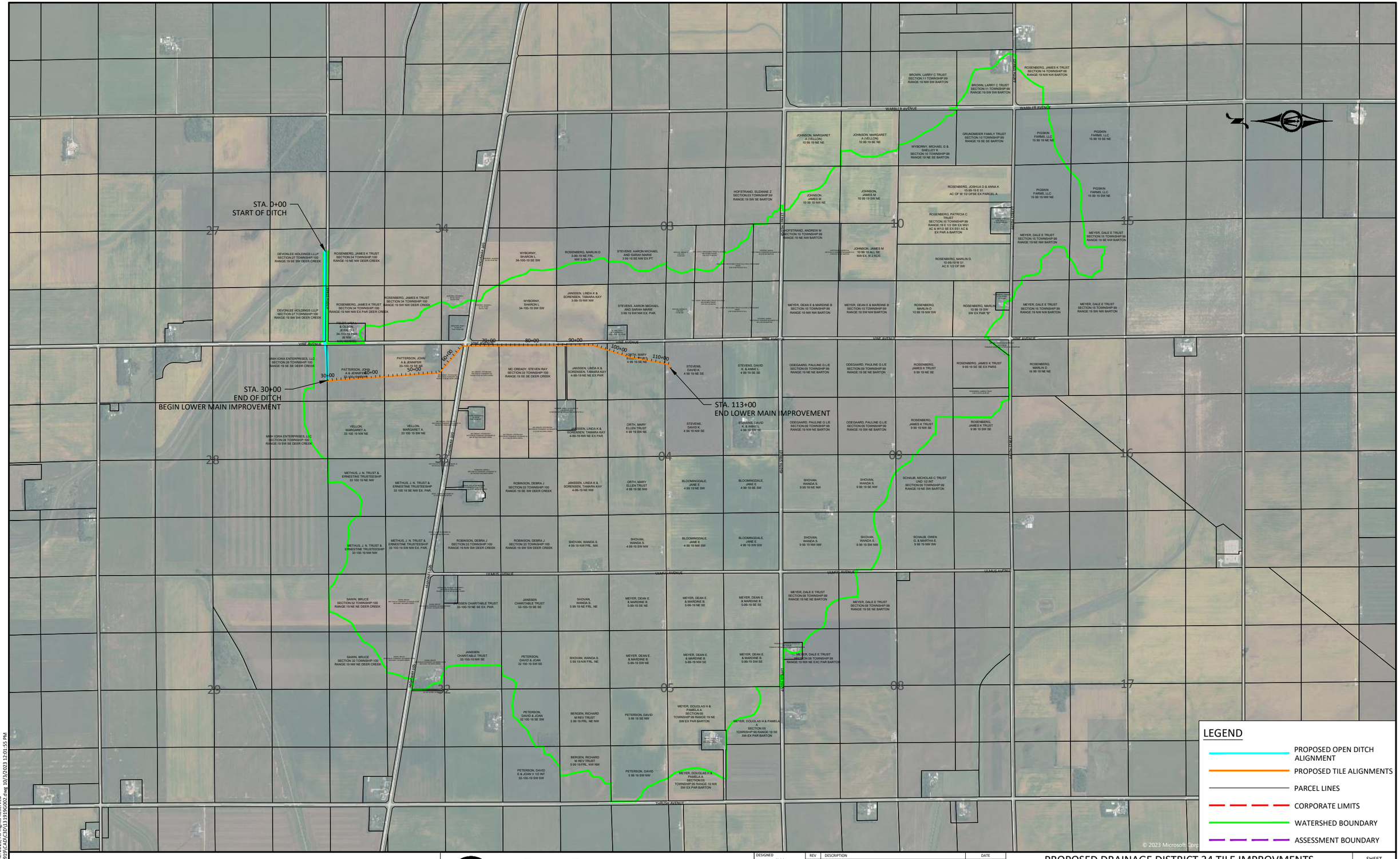
BOLTON & MENK
300 WEST MCKINLEY ST, P.O. BOX 68
JEFFERSON, IOWA 50129
Phone: (515) 386-4101
Email: Jefferson@bolton-menk.com
www.bolton-menk.com

DESIGNED	JLH
DRAWN	TJB
CHECKED	
CLIENT PROJ. NO.	

REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE IMPROVMENTS
WORTH COUNTY, IOWA
TITLE SHEET

SHEET
G0.01



HORZ. 0 1000 2000
SCALE FEET

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Phone: (515) 386-4101
Email: Jefferson@bolton-menk.com
www.bolton-menk.com

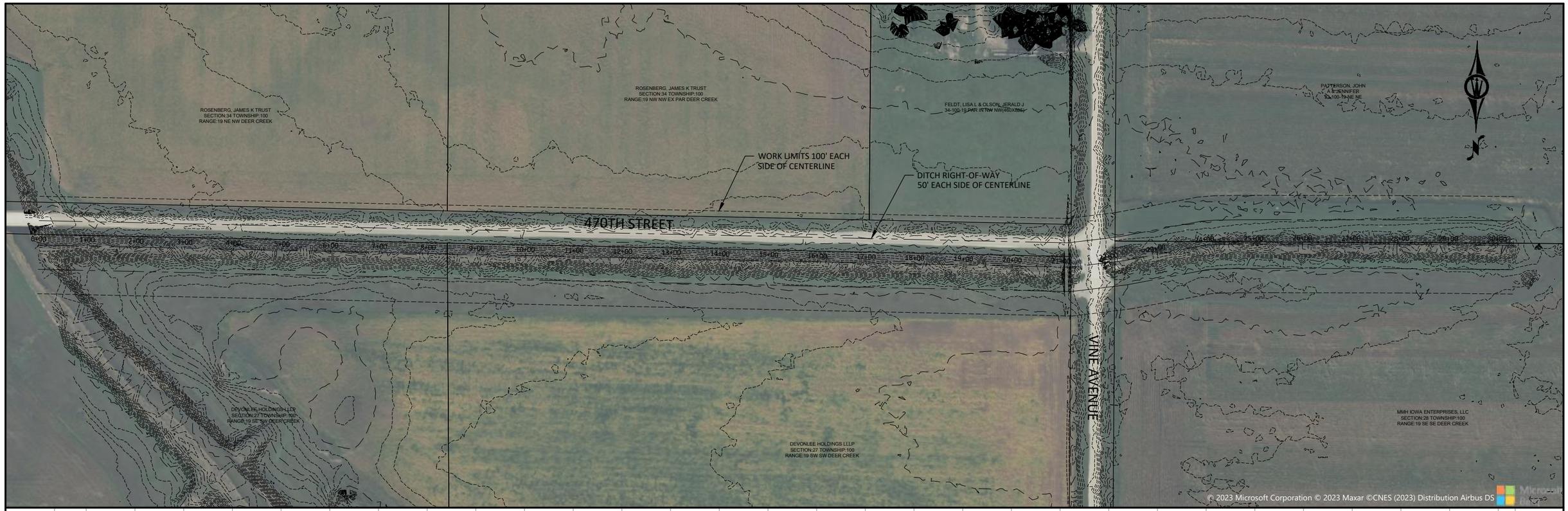
DESIGNED	REV	DESCRIPTION	DATE
JLH			
DRAWN			
TJB			
CHECKED			
CLIENT PROJ. NO.			

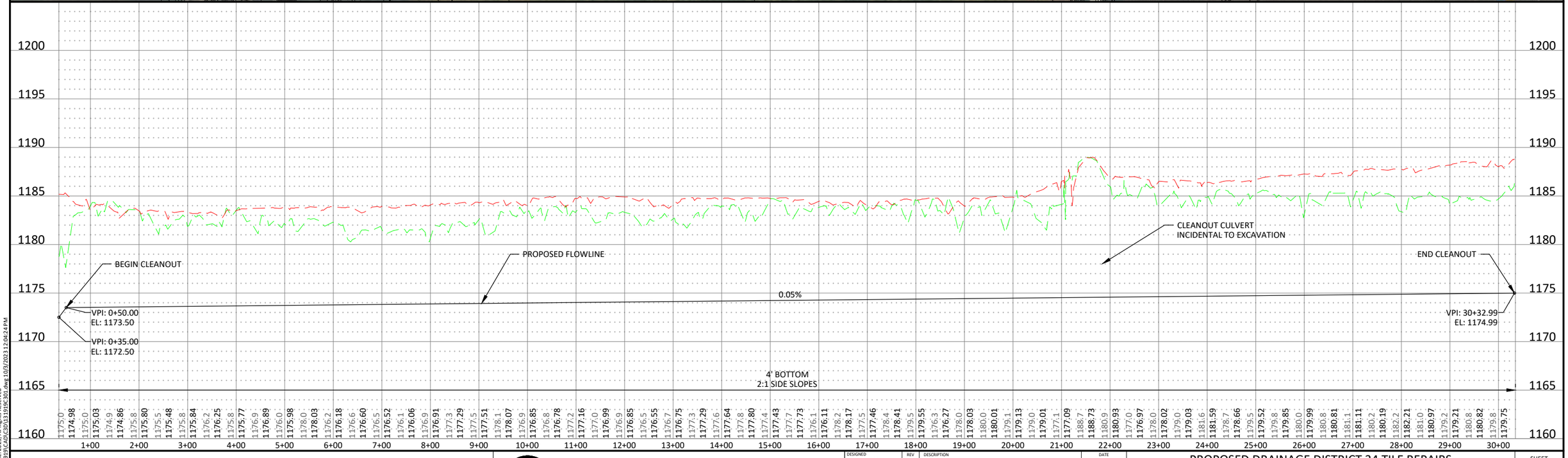
PROPOSED DRAINAGE DISTRICT 34 TILE IMPROVMENTS

WORTH COUNTY, IOWA

LOCATION SHEET

SHEET G2.01





HORZ. SCALE 0 100 200 FEET

VERT. SCALE 0 5 10 FEET

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300 WEST MCKINLEY ST, P.O. BOX 68
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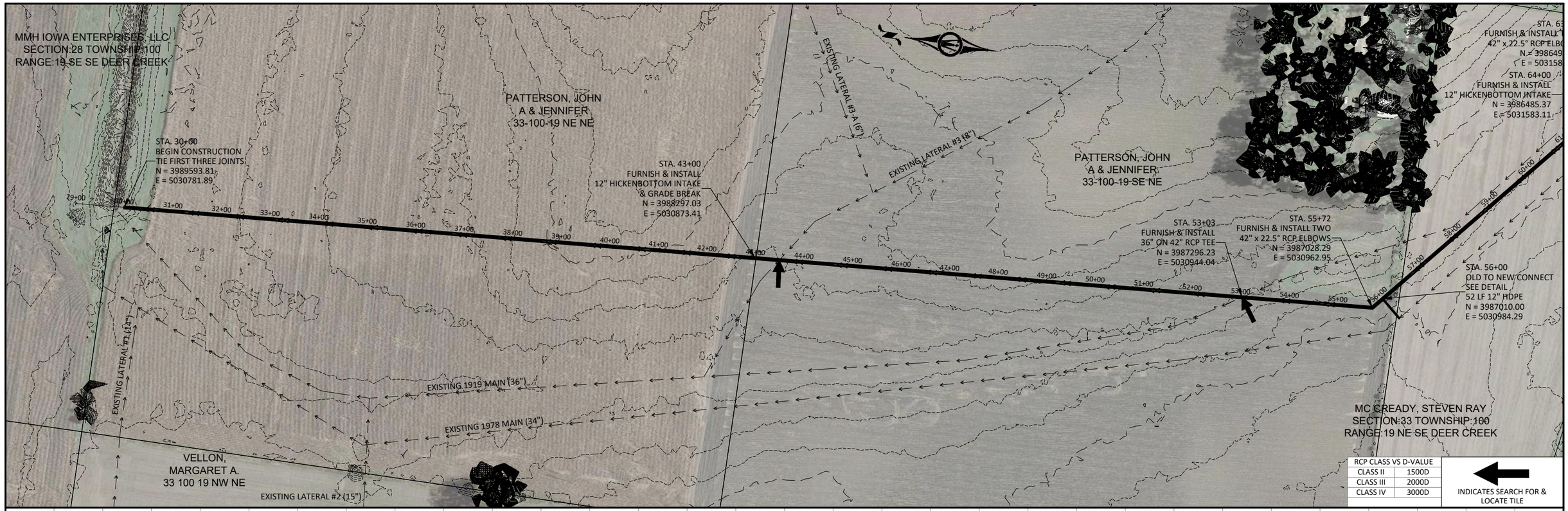
JLH			
DRAWN TJB			
CHECKED			
CLIENT PROJ. NO.			

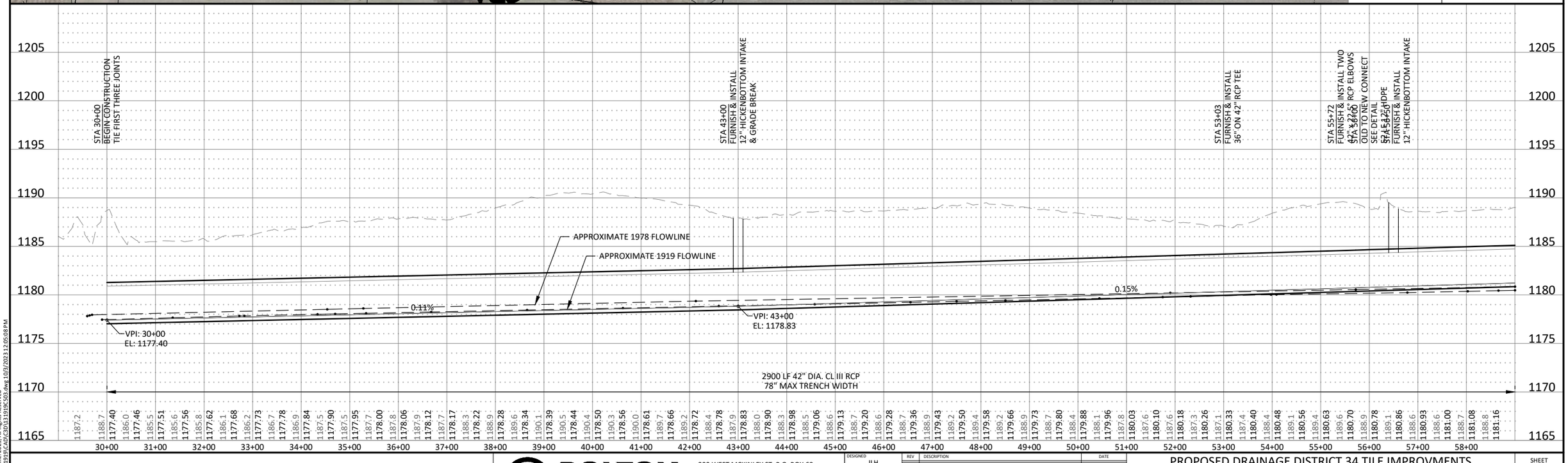
PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - DITCH CLEANOUT

SHEET C3.01



RCP CLASS VS D-VALUE	
CLASS II	1500D
CLASS III	2000D
CLASS IV	3000D

INDICATES SEARCH FOR & LOCATE TILE



HORZ. SCALE 0 100 200 FEET

VERT. SCALE 0 5 10 FEET

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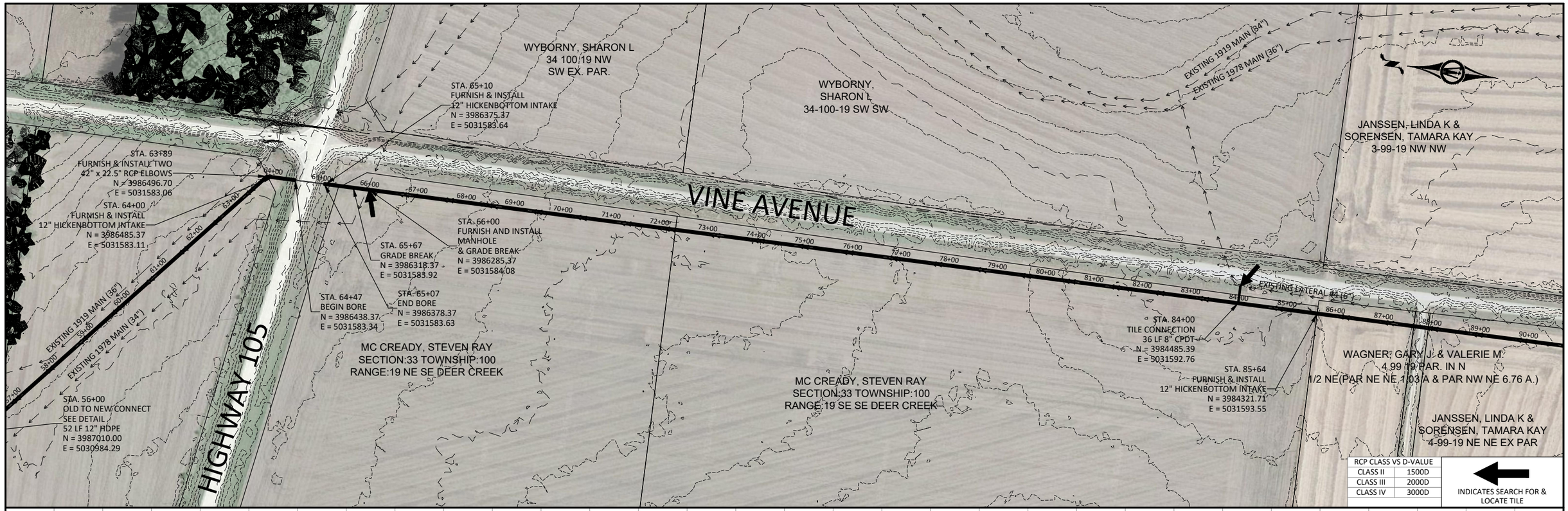
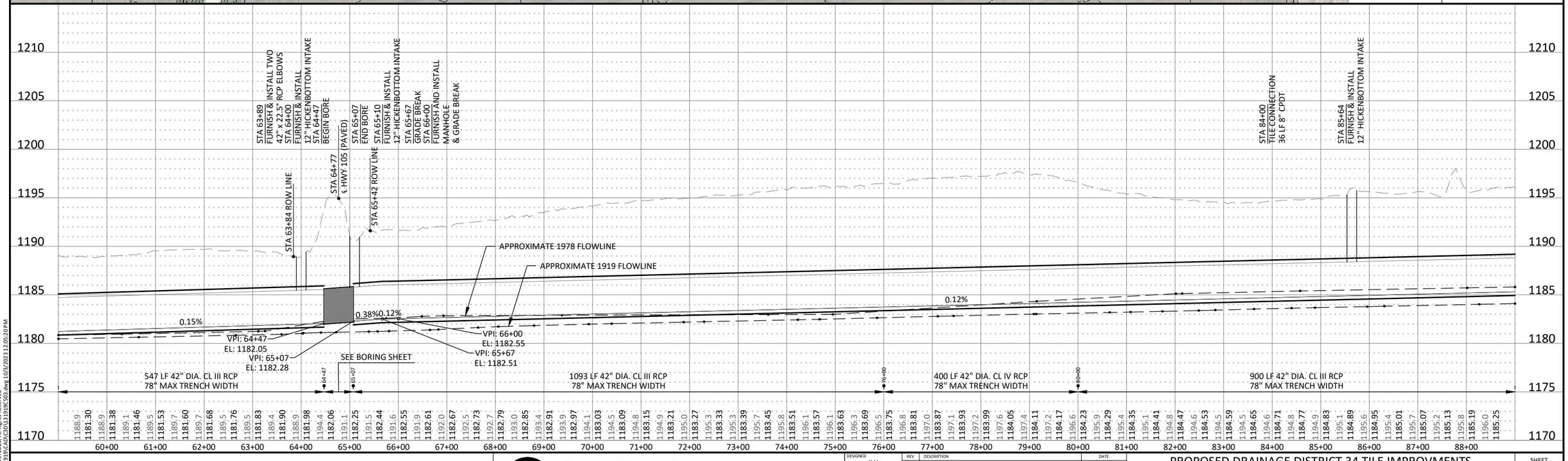
CLIENT PROJ. NO.	

REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE IMPROVMENTS
WORTH COUNTY, IOWA
PLAN & PROFILE - LOWER MAIN IMPROVEMENT

SHEET C5.01





HORZ. SCALE 0 100 200 FEET
VERT. SCALE 0 5 10 FEET

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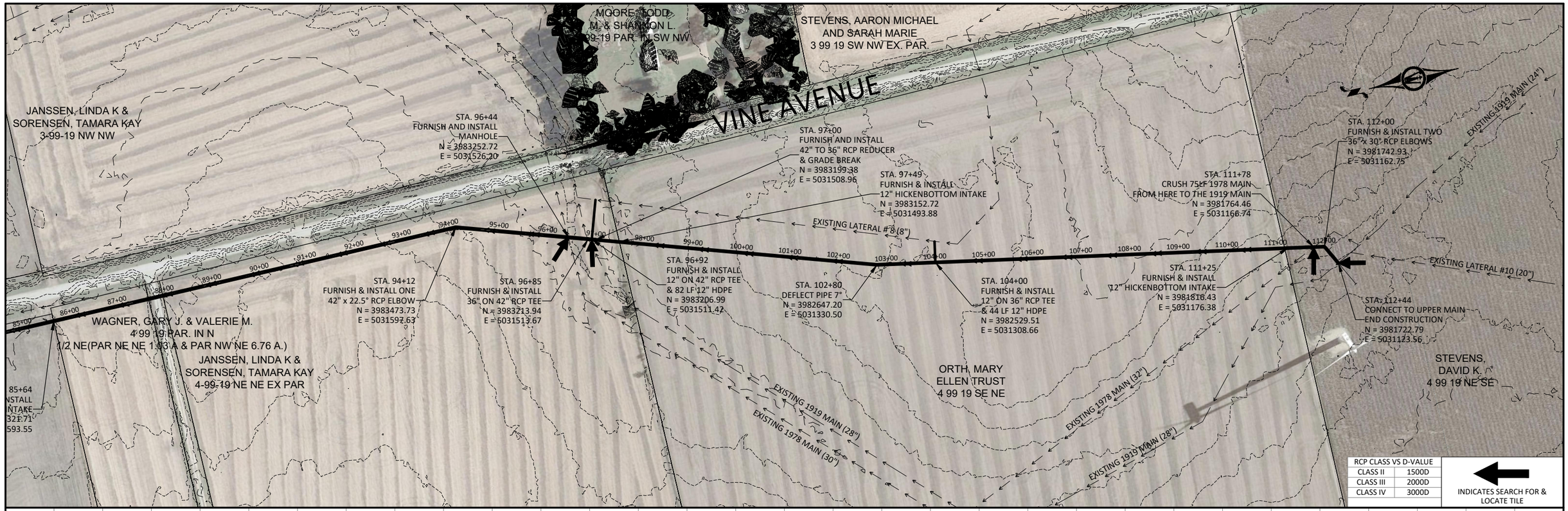
CHECKED
CLIENT PROJ. NO.

REV	DESCRIPTION	DATE

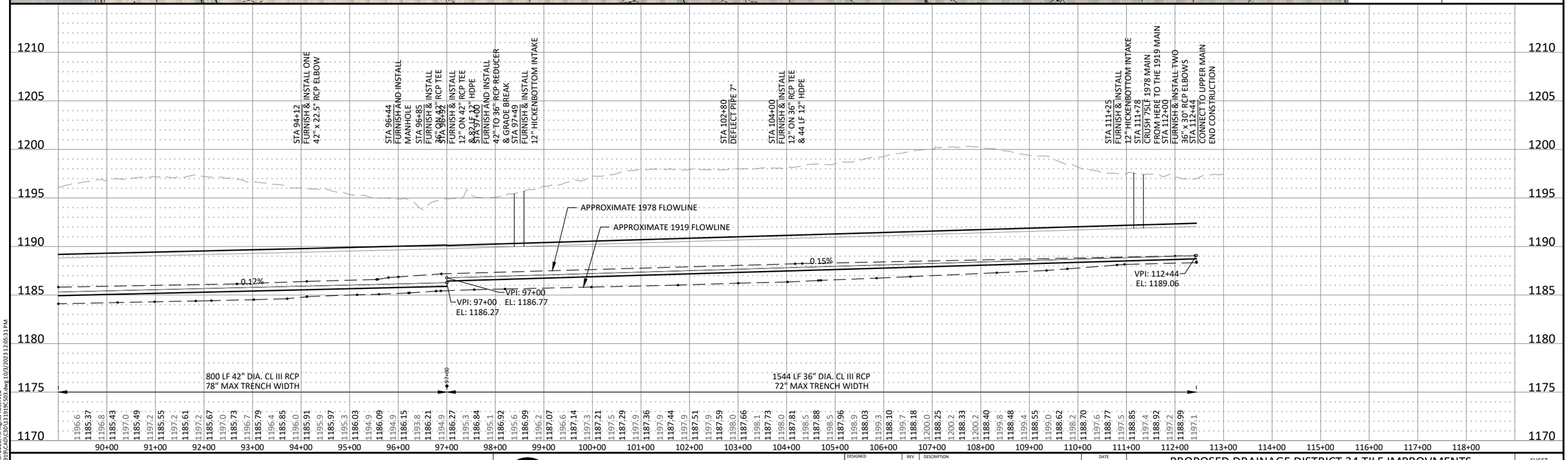
PROPOSED DRAINAGE DISTRICT 34 TILE IMPROVMENTS
WORTH COUNTY, IOWA
PLAN & PROFILE - LOWER MAIN IMPROVEMENT

SHEET C5.02



RCP CLASS VS D-VALUE	
CLASS II	1500D
CLASS III	2000D
CLASS IV	3000D

INDICATES SEARCH FOR & LOCATE TILE



HORZ. SCALE 0 100 200 FEET

VERT. SCALE 0 5 10 FEET

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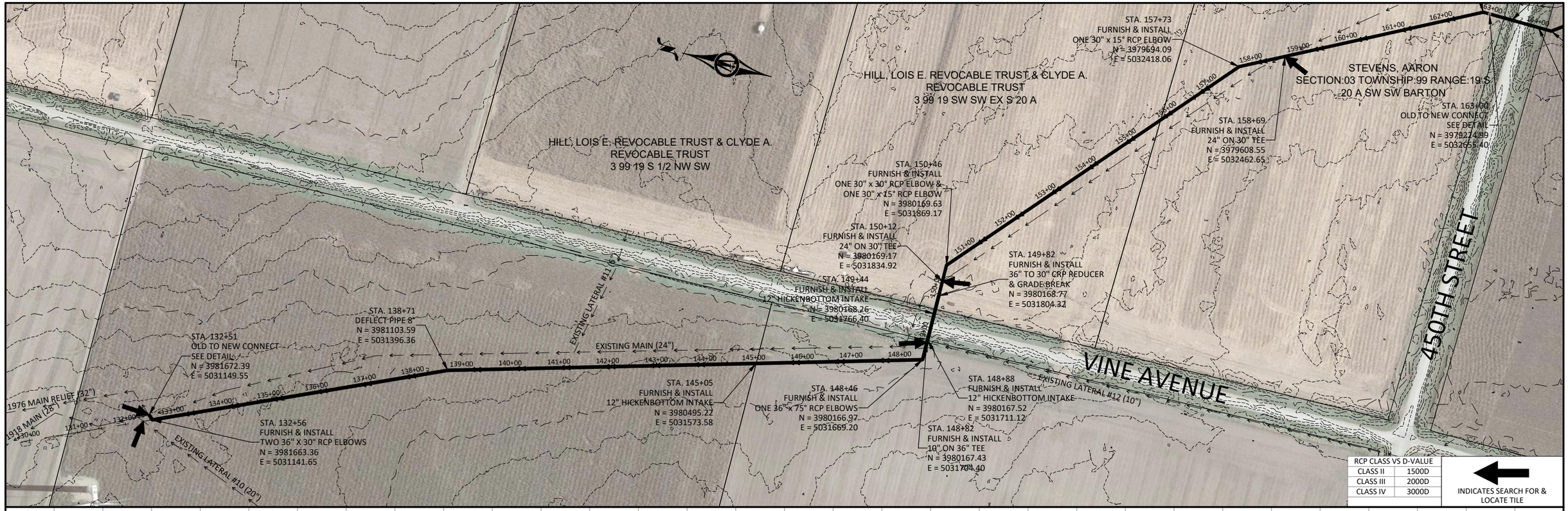
REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE IMPROVMENTS

WORTH COUNTY, IOWA

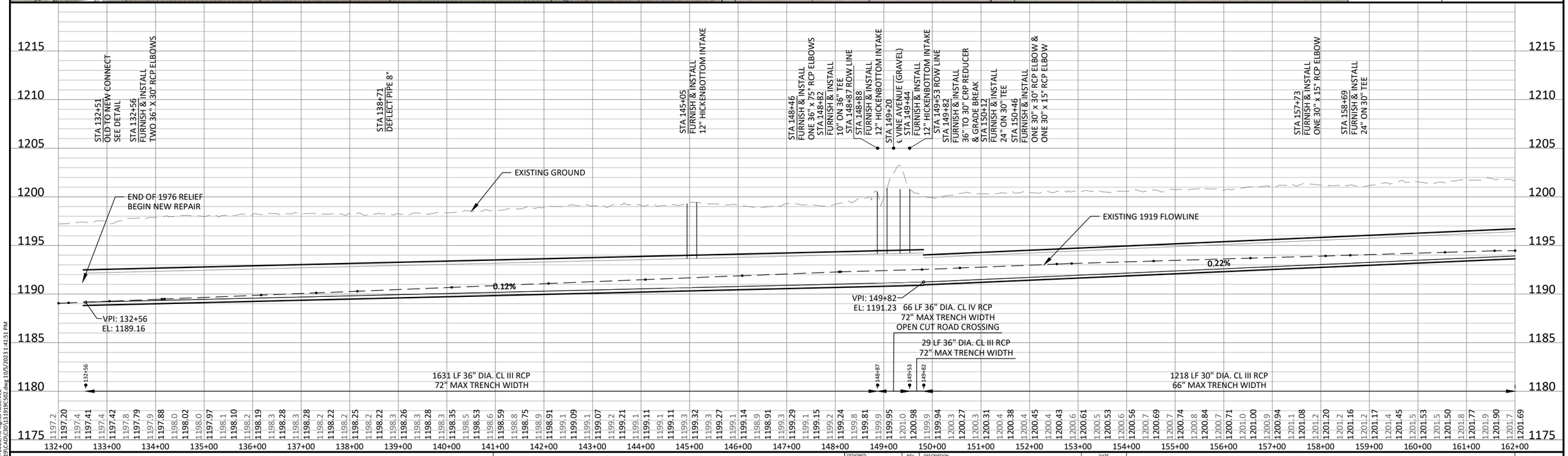
PLAN & PROFILE - LOWER MAIN IMPROVEMENT

SHEET C5.03



RCP CLASS VS D-VALUE	
CLASS II	1500D
CLASS III	2000D
CLASS IV	3000D

INDICATES SEARCH FOR & LOCATE TILE



HORZ. 0 100 200 SCALE FEET

VERT. 0 5 10 SCALE FEET

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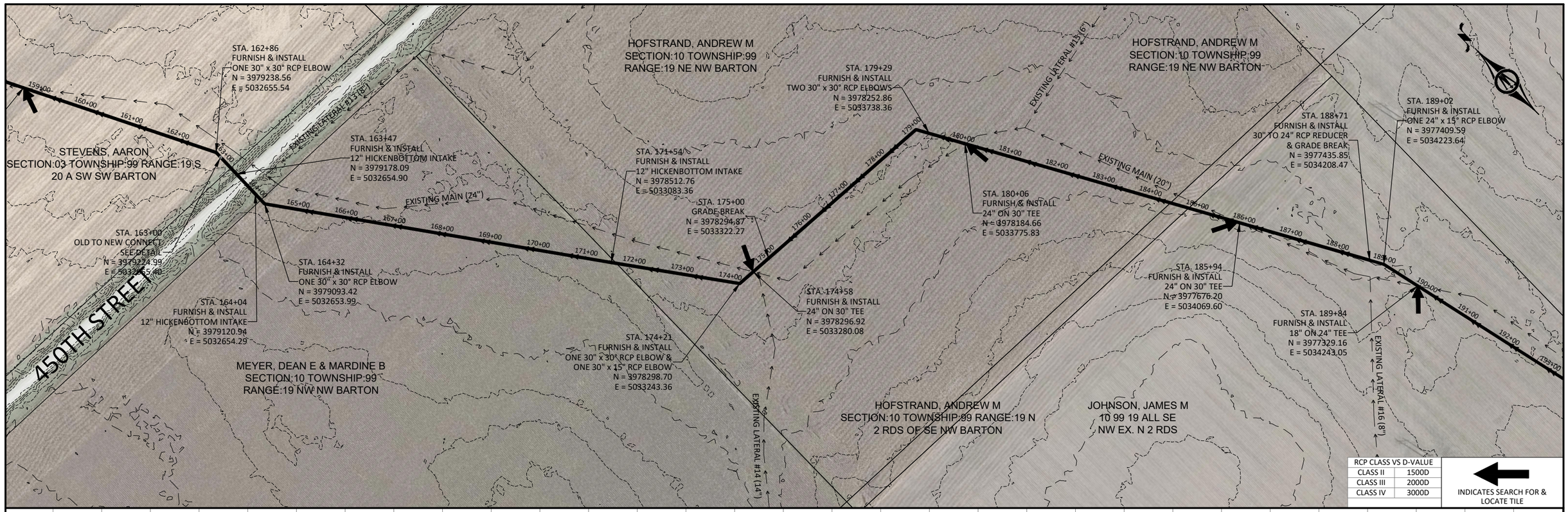
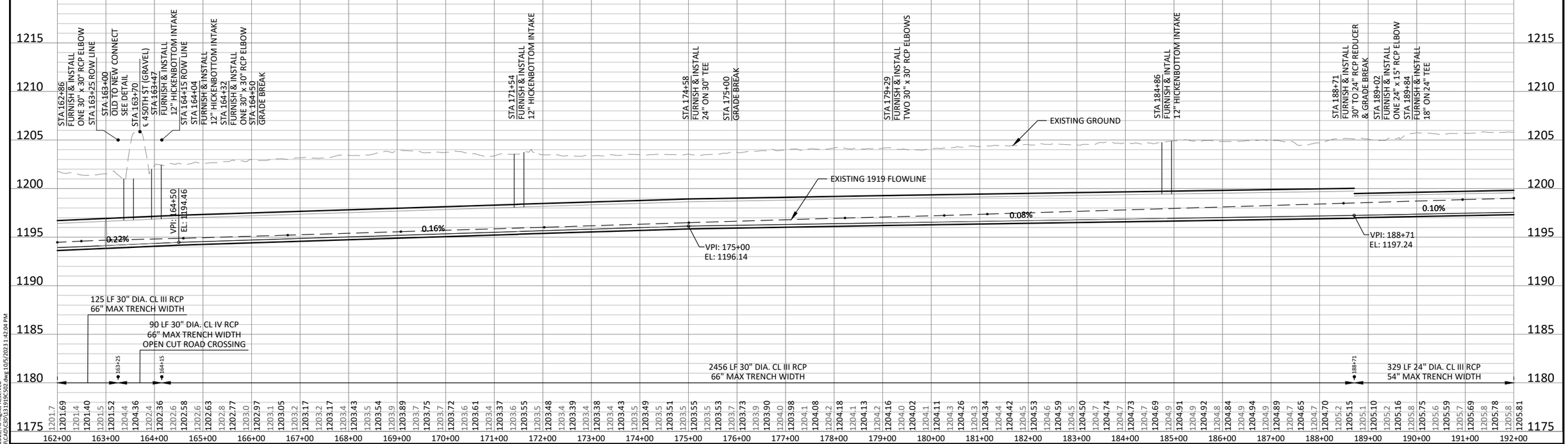
CLIENT PROJ. NO.

REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - UPPER MAIN IMPROVEMENTS

SHEET C5.04





HORZ. 0 100 200 SCALE FEET
VERT. 0 5 10 SCALE FEET

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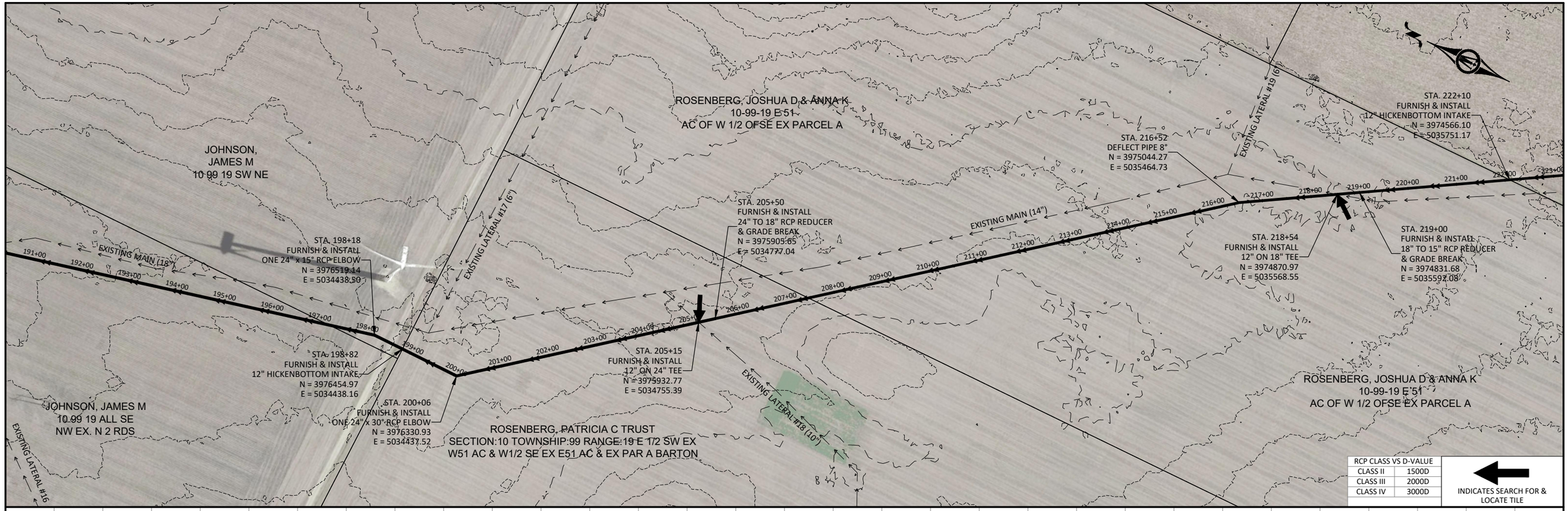
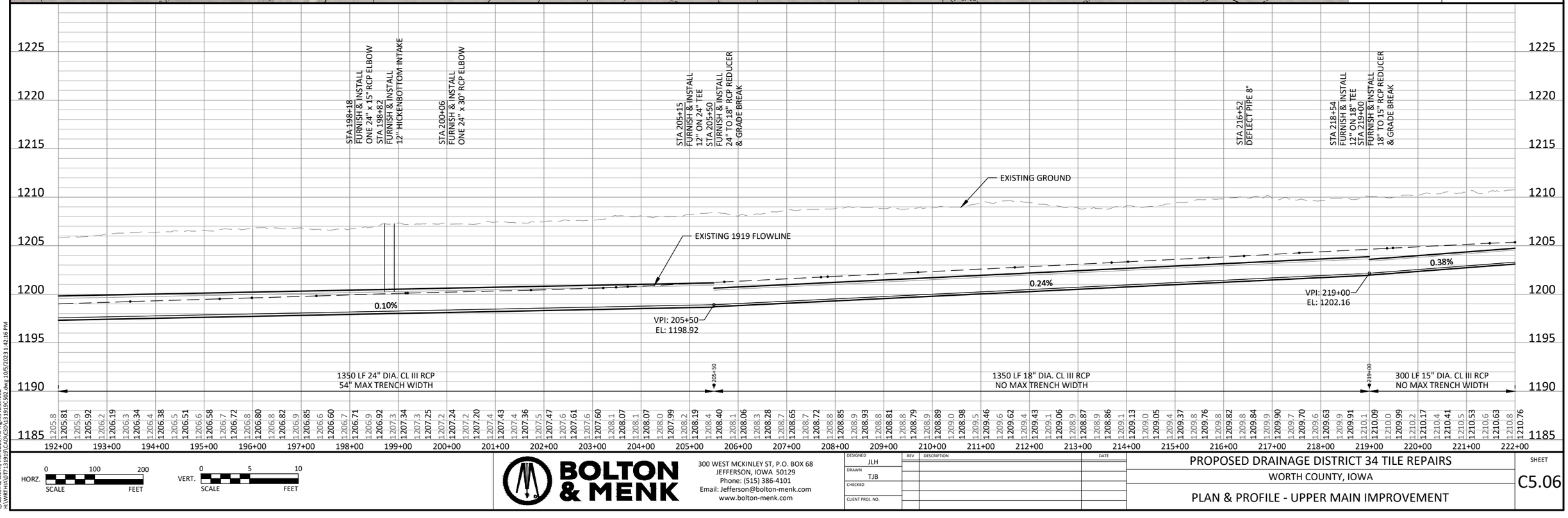
CLIENT PROJ. NO.

REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - UPPER MAIN IMPROVEMENTS

SHEET C5.05





HORZ. SCALE 0 100 200 FEET
VERT. SCALE 0 5 10 FEET

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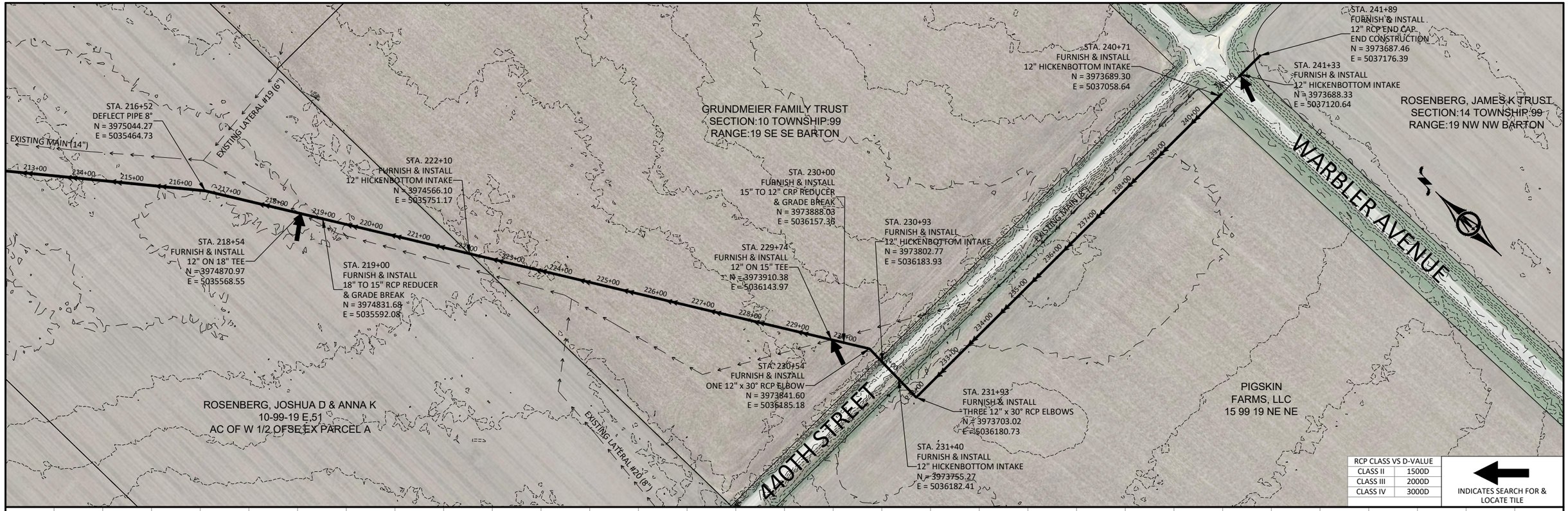
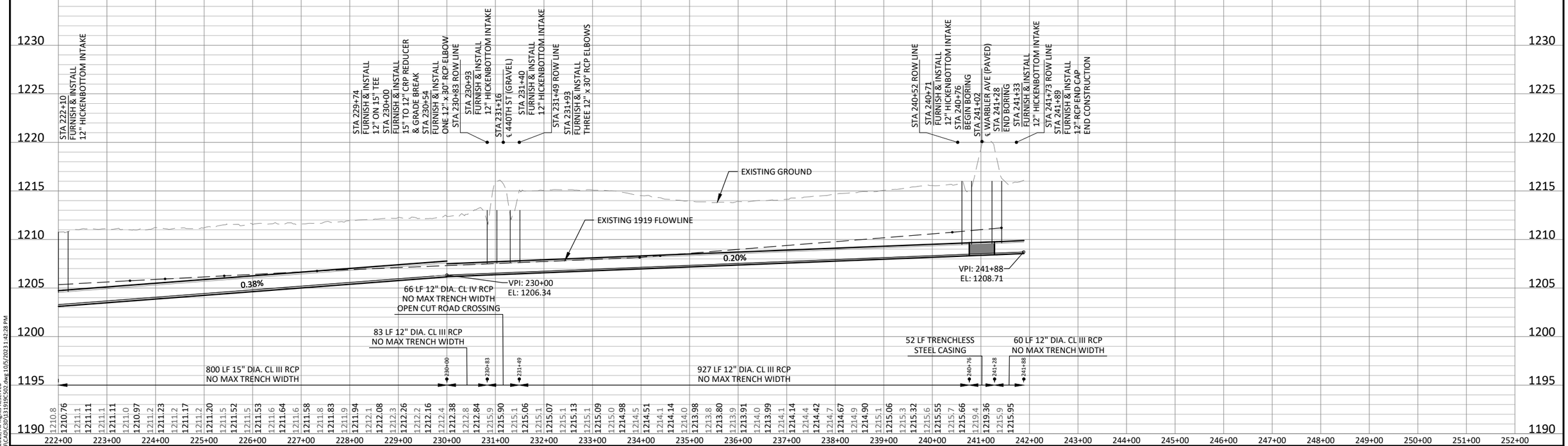
CLIENT PROJ. NO.

REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - UPPER MAIN IMPROVEMENT

SHEET C5.06





HORZ. 0 100 200 SCALE FEET

VERT. 0 5 10 SCALE FEET

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CHECKED	
CLIENT PROJ. NO.	

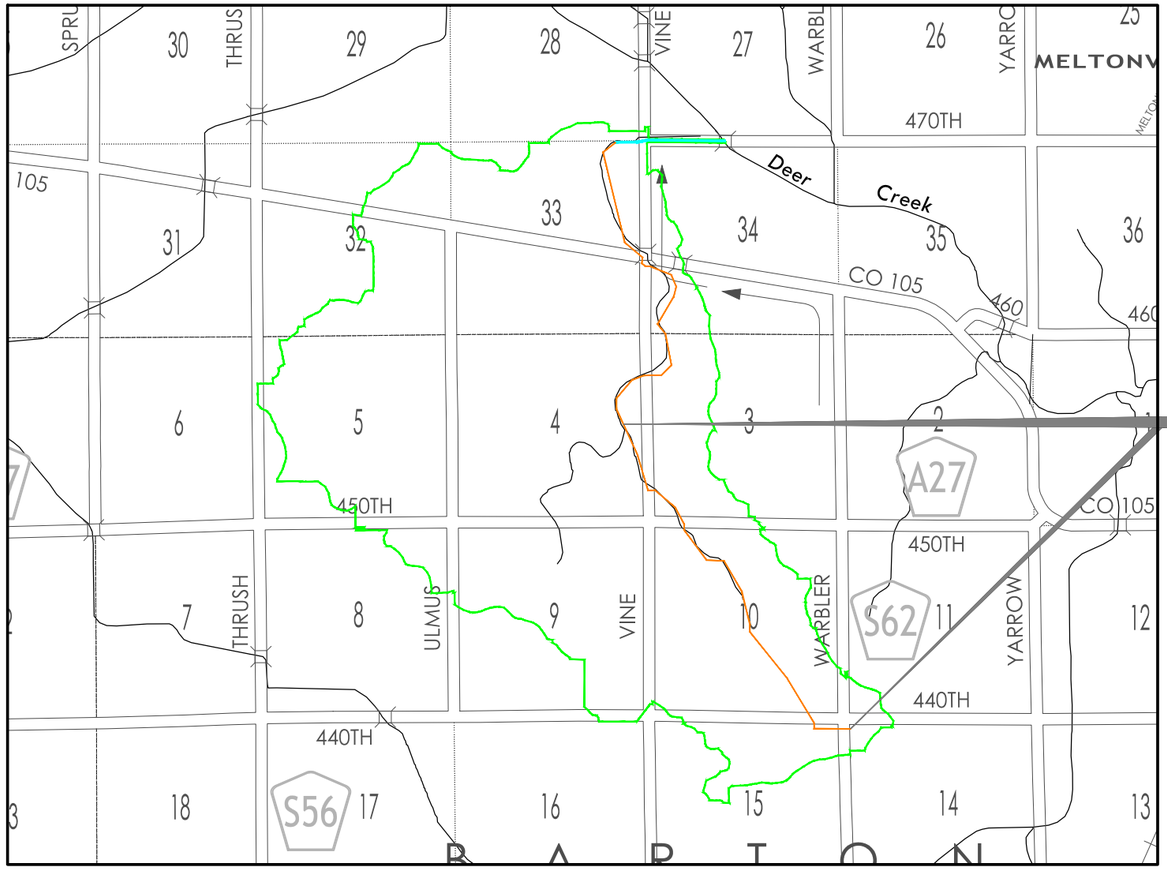
REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - UPPER MAIN IMPROVEMENT

SHEET C5.07

PRELIMINARY PLANS FOR

DRAINAGE DISTRICT NO. 34
DRAINAGE REPAIRS
WORTH COUNTY, IOWA
2023



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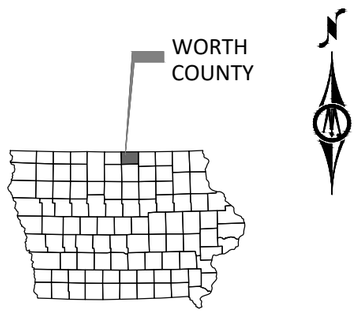
www.iowaonecall.com

THE SUBSURFACE UTILITY INFORMATION IN THIS PLAN IS UTILITY QUALITY LEVEL D. THIS UTILITY QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA."



GOVERNING SPECIFICATIONS

THE 2023 EDITION OF THE "IOWA STATEWIDE URBAN STANDARD SPECIFICATIONS FOR PUBLIC IMPROVEMENTS" SHALL GOVERN.

IOWA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION",
SERIES 2023 AND ALL CURRENT GENERAL SUPPLEMENTAL SPECIFICATIONS AND MATERIALS INSTRUCTIONAL MEMORANDUM
SHALL GOVERN AS REFERENCED.

ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND ORDINANCES WILL BE COMPLIED WITH IN THE CONSTRUCTION
OF THIS PROJECT.

DATUM EQUATION	PROJECT DATUM: STATE PLANE
1912 DATUM + = NAVD 88	HORIZONTAL: IOWA NORTH
	VERTICAL: NAD 1988

HORZ. 0 1100 4200
SCALE FEET

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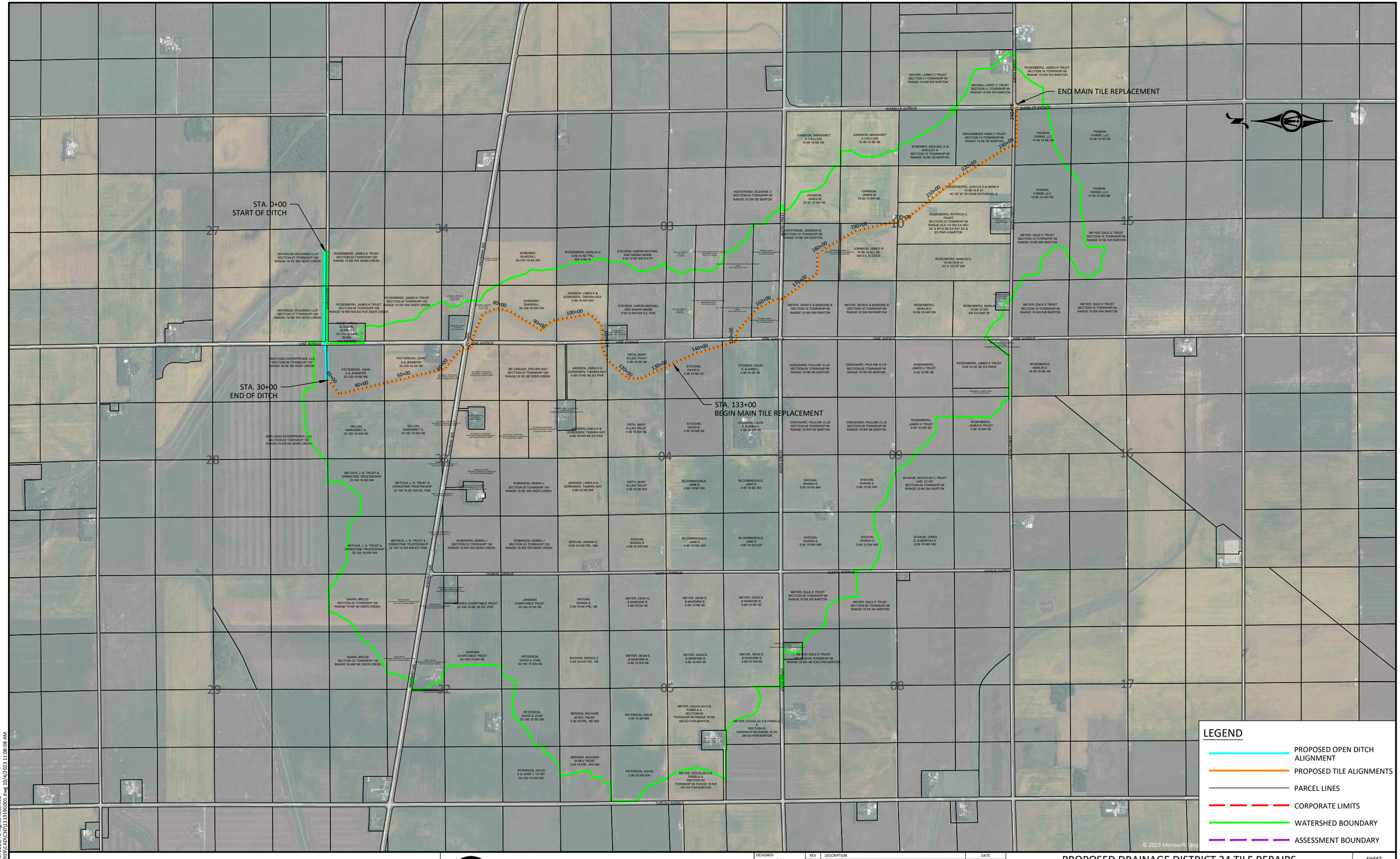
DESIGNED JLH
DRAWN TJB
CHECKED
CLIENT PROJ. NO.

REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
TITLE SHEET

SHEET G0.01



HORZ. 0 1000 2000
SCALE FEET

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JEFFERSON, IOWA 50129
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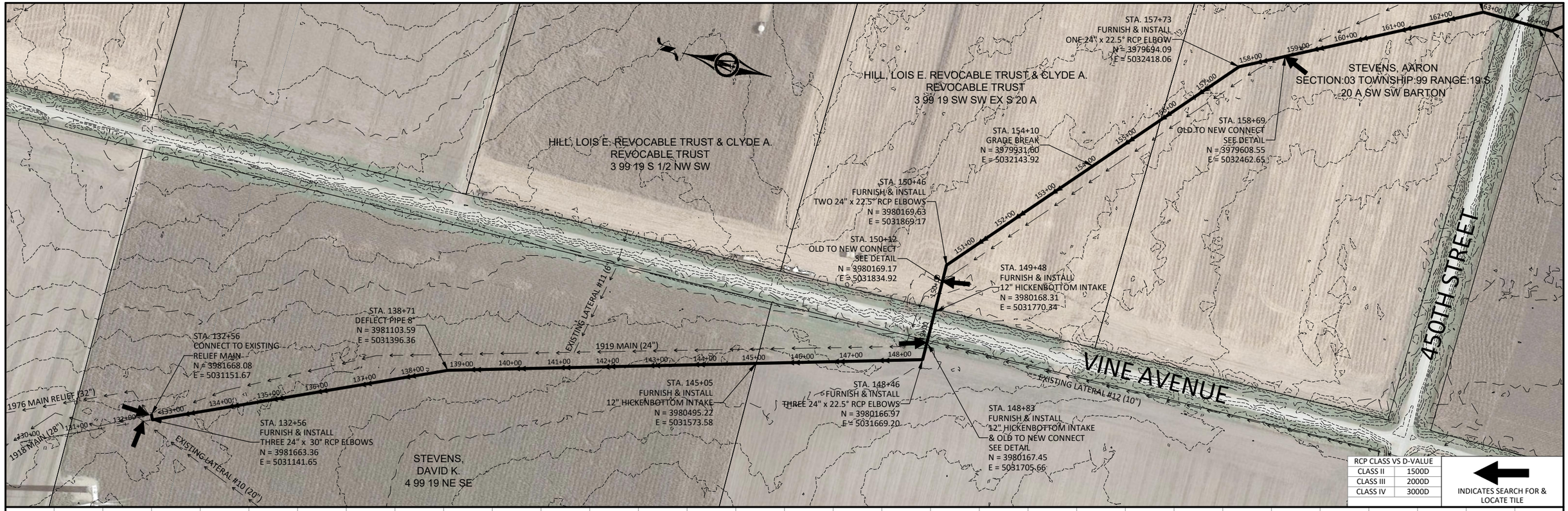
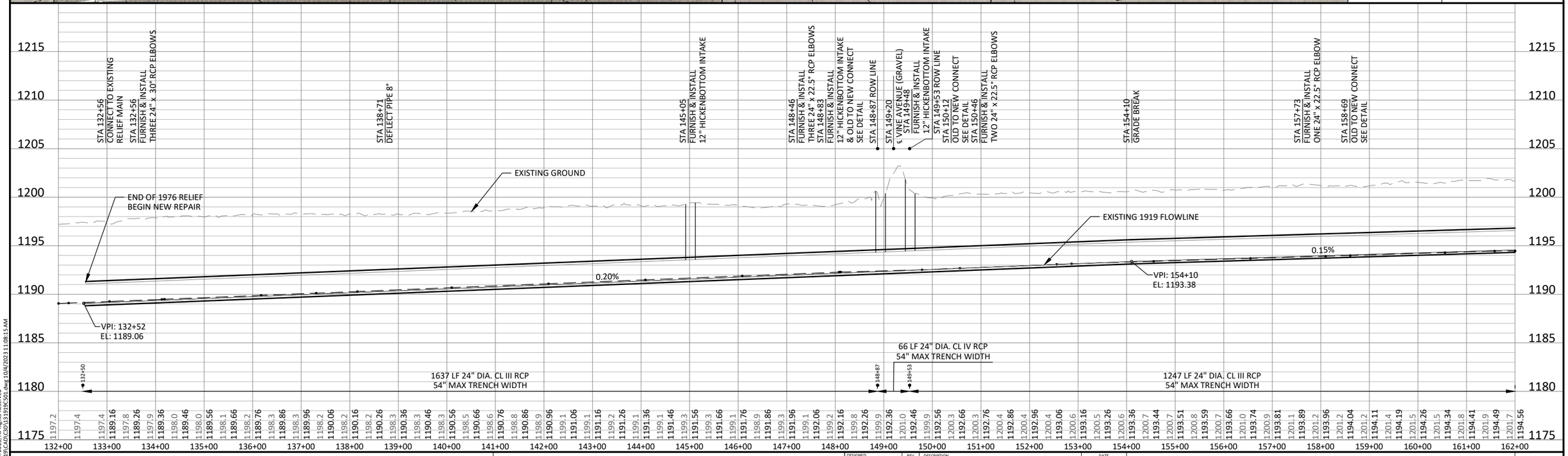
DESIGNED	REV	DESCRIPTION	DATE
JLH			
DRAWN			
TJB			
CHECKED			
CLIENT PROJ. NO.			

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
LANDOWNER PLAT

SHEET
G2.01





HORZ. 0 100 200 SCALE FEET
VERT. 0 5 10 SCALE FEET

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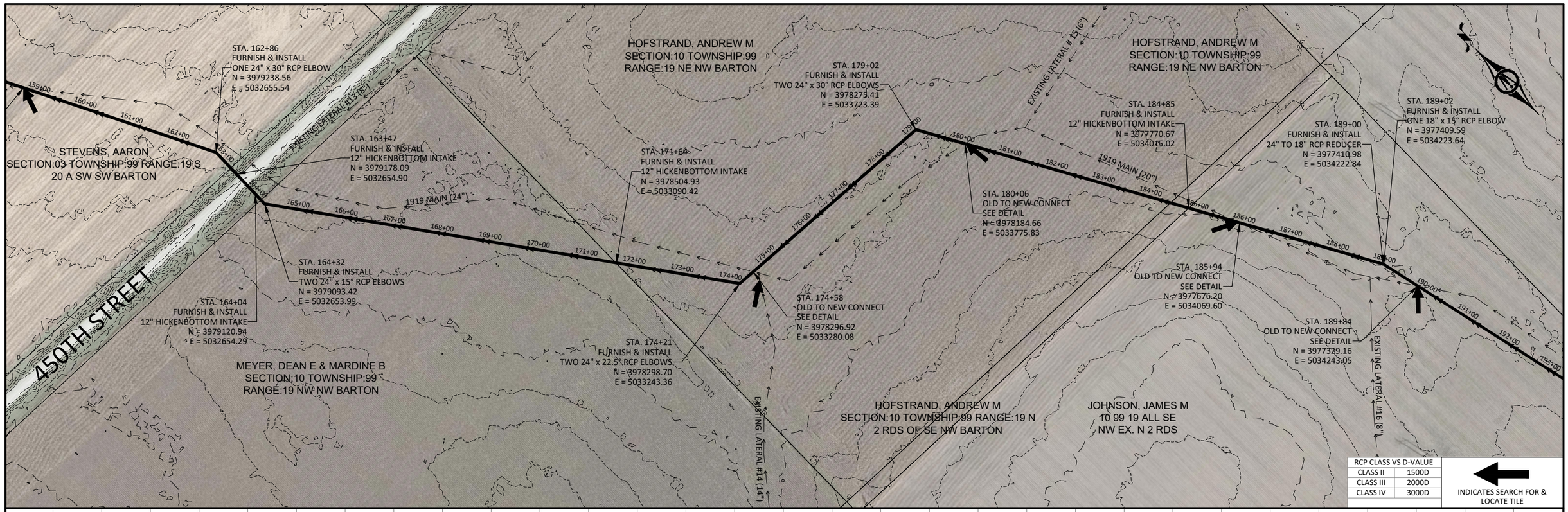
CLIENT PROJ. NO.	

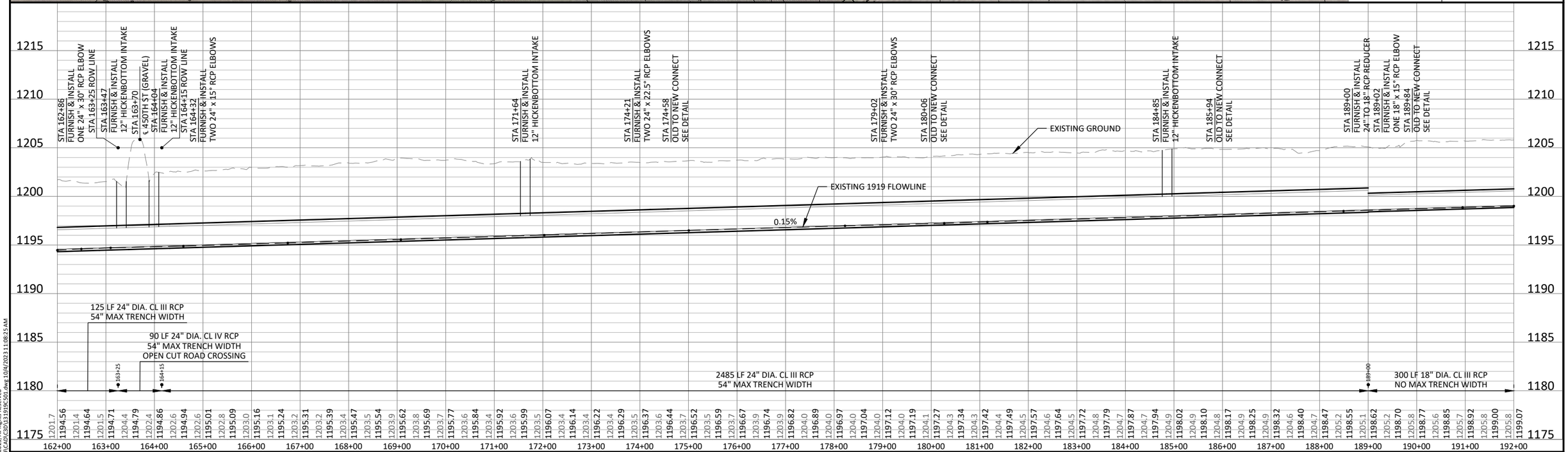
REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA

PLAN & PROFILE - MAIN REPAIR

SHEET C5.01





HORZ. 0 100 200 SCALE FEET
VERT. 0 5 10 SCALE FEET

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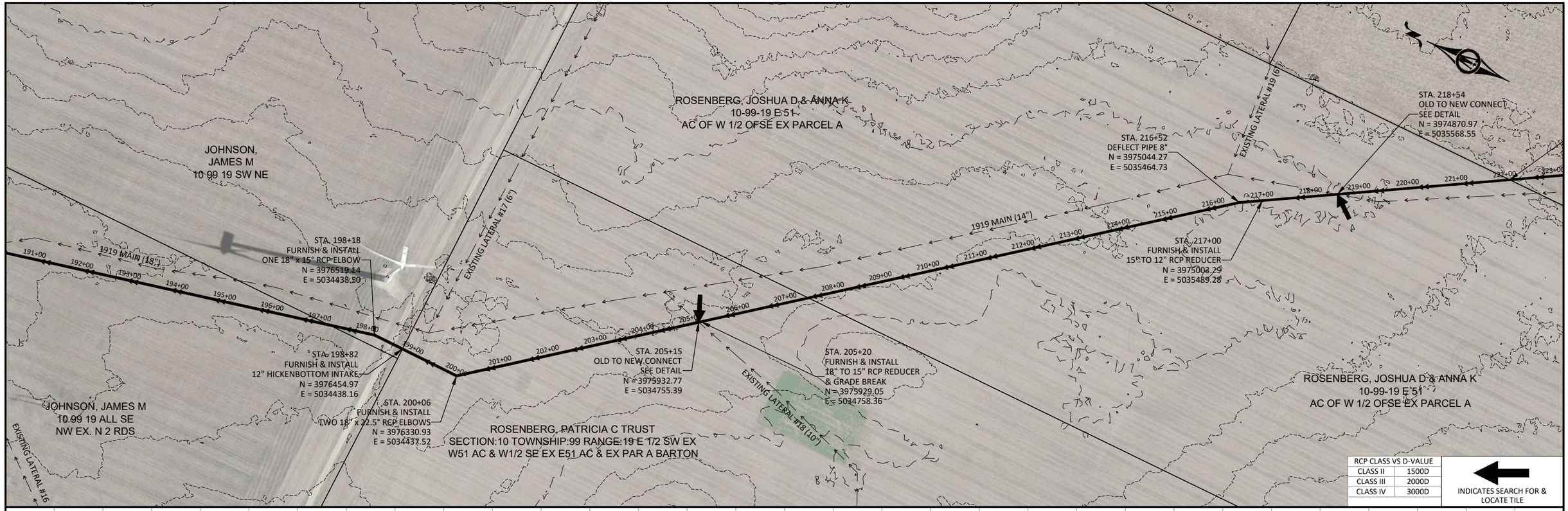
REV	DESCRIPTION	DATE

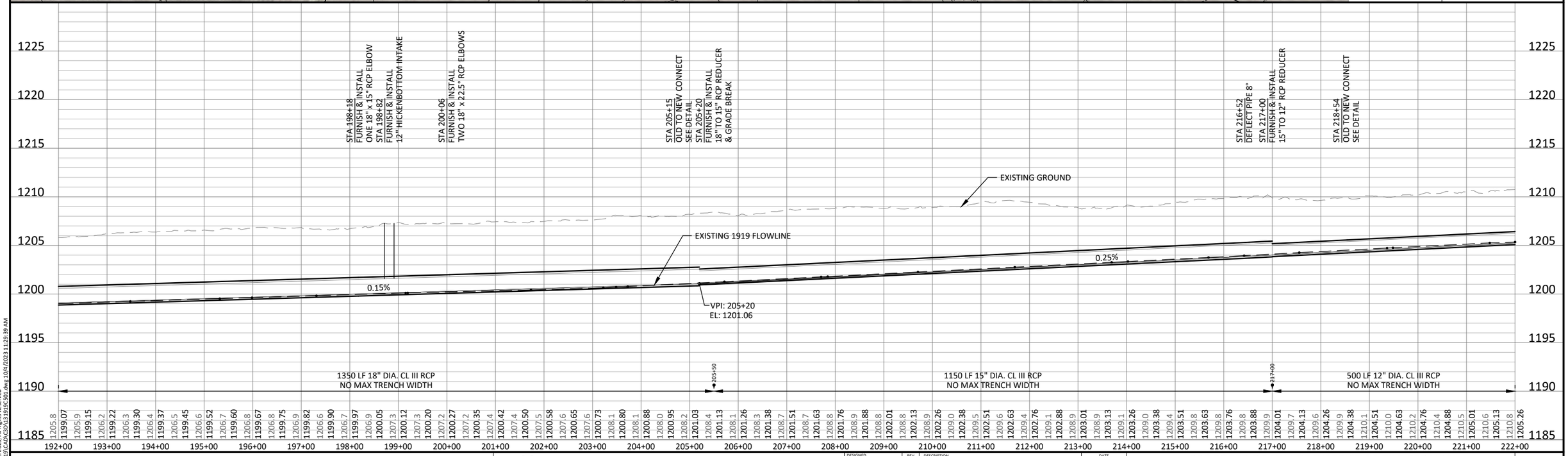
PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - MAIN REPAIR

SHEET C5.02



RCP CLASS VS D-VALUE	
CLASS II	1500D
CLASS III	2000D
CLASS IV	3000D

INDICATES SEARCH FOR & LOCATE TILE



HORZ. 0 100 200 SCALE FEET

VERT. 0 5 10 SCALE FEET

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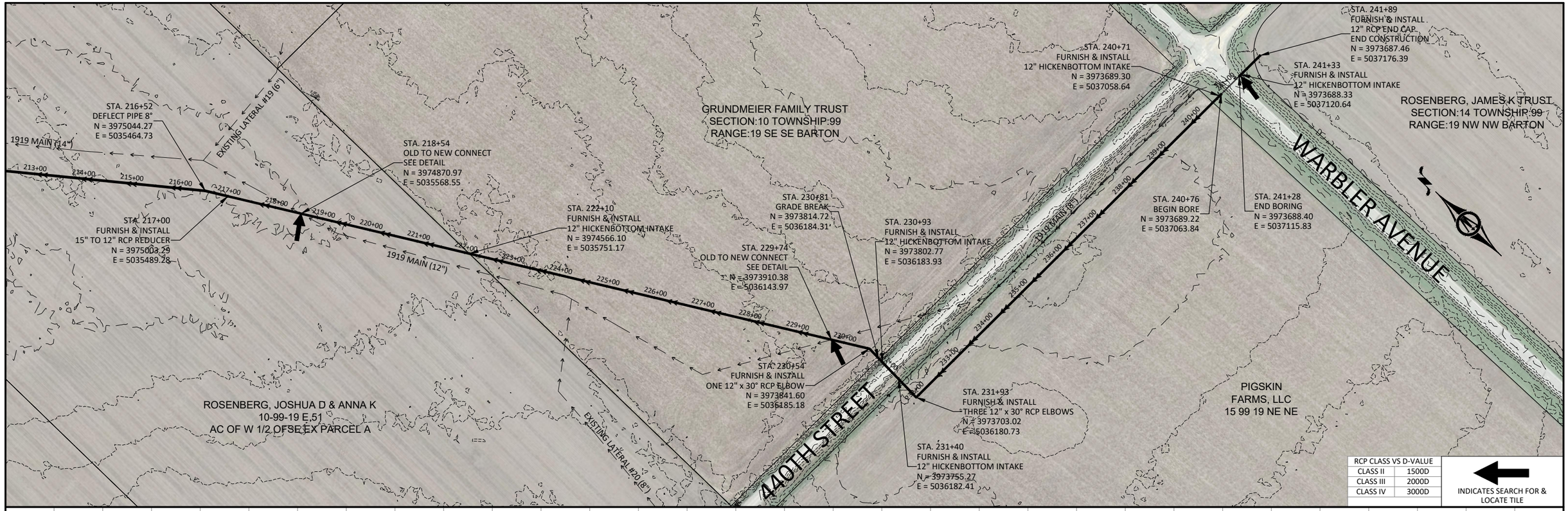
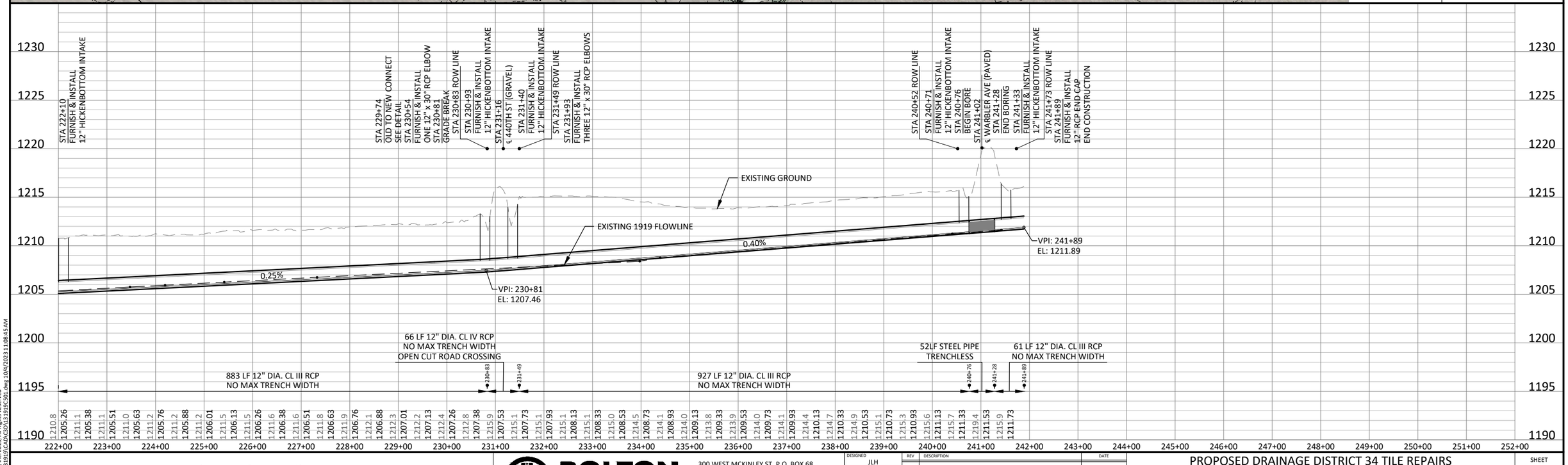
REV	DESCRIPTION	DATE

PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - MAIN REPAIR

SHEET C5.03





HORZ. SCALE 0 100 200 FEET
VERT. SCALE 0 5 10 FEET

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PROPOSED DRAINAGE DISTRICT 34 TILE REPAIRS
WORTH COUNTY, IOWA
PLAN & PROFILE - MAIN REPAIR

SHEET C5.04