Memorandum

Drainage District No. 43

To: Osceola County Board of Supervisors Acting as Trustees for Drainage District No. 43

From: Rachael Millage, EIT

Date: September 6, 2024

Subject: Drainage District No. 43 Lateral 2 Investigation

CC: Rochelle VanTilburg, Osceola County Auditor

Enc: Tile Capacity Calculations, District Plat Map

INTRODUCTION

Scope of Work

On August 8, 2024, a petition was filled with the Osceola County Board of Supervisors requesting that the Drainage District No. 43 (DD43) Lateral 2 Tile and associated Sub-Lateral Tiles, be investigated for improvement. The Board of Supervisors accepted the petition on August 8, 2024, and appointed ISG to perform an investigation and to report findings. As part of the preliminary investigation, a desktop and field review of District records, facilities, and previous projects was completed. A watershed developed for the DD43 Lateral 2 Tile as a part of a previous ISG project, with associated Sub-Lateral Tiles, was evaluated, and existing drainage capacity was calculated. This memo is intended to address the landowner's request for investigation around facility improvements associated with the DD43 drainage system.

Location & Description

WATERSHED

The watershed of DD43 lies within Osceola County, located generally West and Northwest of the City of Allendorf, Iowa. The combined DD43 and DD9 watershed is approximately 2,324 acres. The predominant land use within the watershed is agricultural row crops. The predominant hydrologic soil type in the system's watershed is type "C/D", which is considered a dual hydrologic soil group, is a wet soil that has the potential to be adequately drained. The "D" in this group corresponds to the soil having over 40 percent clay and restricted water movement. The "C" signifies the soil in its drained condition. C/D soils such as those found in DD43 are typical of drainage districts throughout Iowa as they require intensive artificial drainage to be productive for agricultural use.

FACILITIES

The primary facilities of DD43 consist of a Main Open Ditch, Original and Relief Tile Mains, two (2) Lateral Tile Systems, and five (5) Sub-Lateral Tile systems. Additionally, the DD43 Tile Main serves as the primary outlet for the DD9 tile system. The tile system of DD9 outlets through a junction structure to DD43.

MAIN TILE

The Main Tile of DD43 extends from its junction with the Tile Main of DD9 in the SW ¼ of the SW ¼ of Section 2 in East Holeman Township, West of Redwood Avenue. The DD43 Tile Main traverses in the southeasterly direction passing under 160th Street and continues in an easterly direction across Section 11 of East Holeman Township. The Main Tile crosses under Highway No. 59 in the NW ¼ of the NW ¼ of Section 12 in East Holman Township before discharging into the Open Ditch of DD43. The Open Ditch of DD43 then outlets to the Main Open ditch of Drainage District No. 11 (DD11).

LATERAL SYSTEMS

The DD43 tile system includes Lateral 2, which drains approximately 290 acres into the DD43 Main Tile in NE ¼ of the NW ¼ of Section 11 in East Holman Township. The Lateral 2 system includes five Sub-Lateral Tiles that discharge into Lateral 2, and eventually the Main Tile. Additionally, there are two (2) Sub-Lateral Branches, extending from Sub-Lateral 2C and 2E. The Sub-Lateral Tiles extend throughout the N ½ of Section 11 East Holman Township and reaches West of Redwood Avenue to the E ½ of the NE ¼ of Section 10 East Holman Township.

INVESTIGATION

History

ISG compiled historical records found at the Osceola County Courthouse for DD43. This information was gathered to better understand the drainage district's history. Based on county records, Drainage District No. 43 was established in 1919. From 1920 through 1983, DD43 underwent various small repairs, the DD43 Outlet was moved, and the DD43 Open Ditch was excavated from DD11 to HWY 59. In 1984 a broken 30" Tile was repaired. In 1991 a petition for the improvement of the DD9 outlet tile system was filed with the Osceola County Board of Supervisors approving the investigation, and a petition requesting repairs of DD9 and DD43 was filed. In 2014 the Osceola County Board of Supervisors acting as Trustees for Drainage District No. 9 (DD9) received a petition requesting investigation of DD9 and DD43 from landowners in the norther part of the district. The petition requested an investigation of the capacity of the District Tile facility for possible improvement. A joint improvement of DD9 and DD43 Main Tile and DD43 Open Ditch was completed in 2020. Review of records indicates that no significant work has been completed on the DD43 Lateral 2 Tile since construction in 1919.

Summary of Improvement

The DD9 and DD43 joint improvement began with the focus revolving around the improvement of DD9. As investigation around the DD9 improvement occurred, it was determined that the DD43 was not capable of handling the improved DD9 discharge. The DD43 system was then investigated for improvement, but it was found that the existing tile was in good condition. To prevent damaging the existing DD43 tile, a parallel relief Main Tile was installed. The historical improvement of the DD43 system was designed to meet a combined 0.375 and 0.5 inch per day drainage coefficient.

Tile Condition & Capacity Evaluation

ISG's investigation of DD43 involved the review of existing tile capacities. ISG determined the drainage capacity defined here by drainage coefficient. This unit describes the depth of water that can be removed by a subsurface tile over the full upstream area in a unit time, in this case being inches per day. Generally, for current farming practices in this portion of the state, a drainage coefficient of 0.5 inch/day is recommended for agricultural tile. The investigated existing facilities' capacity is depicted in Table 1 of the enclosed Tile Capacity Calculations.

The DD43 Main Tile drainage coefficient was determined based on the combination of the Original Main Tile and the Parallel Relief Main Tile that was installed from the previously discussed improvement. It was found that the combined drainage coefficient for the main tile at various stations along the alignment achieved a 0.375 inch per day drainage coefficient for the upstream portion of the main tile and a 0.5 inch per day drainage coefficient for the downstream portion of the tile. Based on the investigation, the DD43 Main Tile is working as intended.

Drainage coefficients were also determined for the DD43 Lateral 2 Tile and associated Sub-Laterals 2A, 2B,2C, 2E, and Sub-Lateral Branches 2C and 2E. Assumed grades of tile have been approximated using recorded burial depth and ground slope, since records of existing grades were not found during review of historical documents. It was found that the entirety of Lateral 2

does not achieve a 0.5 inch per day drainage coefficient. Additionally, an approximate 1,000-foot section of Sub-Lateral 2B does not achieve a 0.5 inch per day drainage coefficient.

PROPOSED IMPROVEMENT

ISG's investigation has confirmed the need for drainage relief in Drainage District No. 43. From the capacity analysis, it was determined that Lateral 2 and a portion of Sub-Lateral 2B are operating inadequately. It is ISG's recommendation that discussion and analysis occurs revolving around the following improvement options proposed below.

Option #1

It is ISG's recommendation that Lateral 2 and associated Sub-Lateral 2B are improved to meet a 0.5 inch per day drainage coefficient. This improvement option involves a full replacement of the existing tile facilities. Improvement Option #1 proposes the replacement of existing Lateral 2 and Sub-Lateral 2B tile facilities with the appropriate size to achieve a 0.5 inch per day drainage coefficient. The calculations to determine appropriate sizing of the replacement tile were done under the constraint of maintaining existing tile grade. Table 2 in the enclosed Tile Capacity Calculations illustrates the present and proposed tile sizing, slope, and drainage coefficient associated with this improvement option. Generally speaking, the improvement proposes that the existing tile be replaced with one size larger.

Option #2

It is ISG's recommendation that Lateral 2 and associated Sub-Lateral 2B are improved to meet a 0.5 inch per day drainage coefficient. This improvement option involves the installation of a parallel relief tile along all the existing tile facilities. Improvement Option #2 proposes this installation of a parallel relief tile with appropriate sizing to achieve a combined drainage coefficient of 0.5 inch per day. The calculations to determine the appropriate parallel relief tile sizing were done under the constraint of maintaining the existing tile grade. Table 3 in the enclosed Tile Capacity Calculations depicts the existing and proposed parallel relief tile sizing, slope, and drainage coefficient associated with this improvement option. Generally, the improvement proposes the parallel tile be a comparable size to the existing Lateral 2 and Sub-Lateral 2B.

DISCUSSION & RECOMMENDATIONS

Based on the evaluation of the existing tile system, it is apparent that there is a need to improve the capacity of the existing Lateral 2 and Sub-Lateral 2B tile system to provide drainage relief to the agricultural lands within DD43. Although historical improvements and repairs to the DD43 system have helped to alleviate inundation throughout the DD43 watershed, a large portion of the lands drained by the Lateral 2 and associated Sub-Laterals is inadequately sized to meet a 0.5 inch per day drainage coefficient recommended in today's agricultural practices. It is likely that the addition of pattern tiled lands West of the Lateral 2 system has increased flows through the system, which is contributing to the increase in water volume and inundation times that have been observed by landowners. The recommended improvements throughout this memo provide guidance in determining the appropriately sized facilities to accommodate for these additions. It is ISG's recommendation that the Board consider improvements to the DD43 Lateral 2 and Sub-Lateral facilities. ISG recommends that the Board of Supervisors schedule and hold an informational landowner meeting to gauge landowner support for the improvement options. After input is received from landowners at this informational meeting, the potential improvement options will be better understood, and a final engineer's report can be prepared.

Sincerely,

Rachael Millage, EIT
Project Manager
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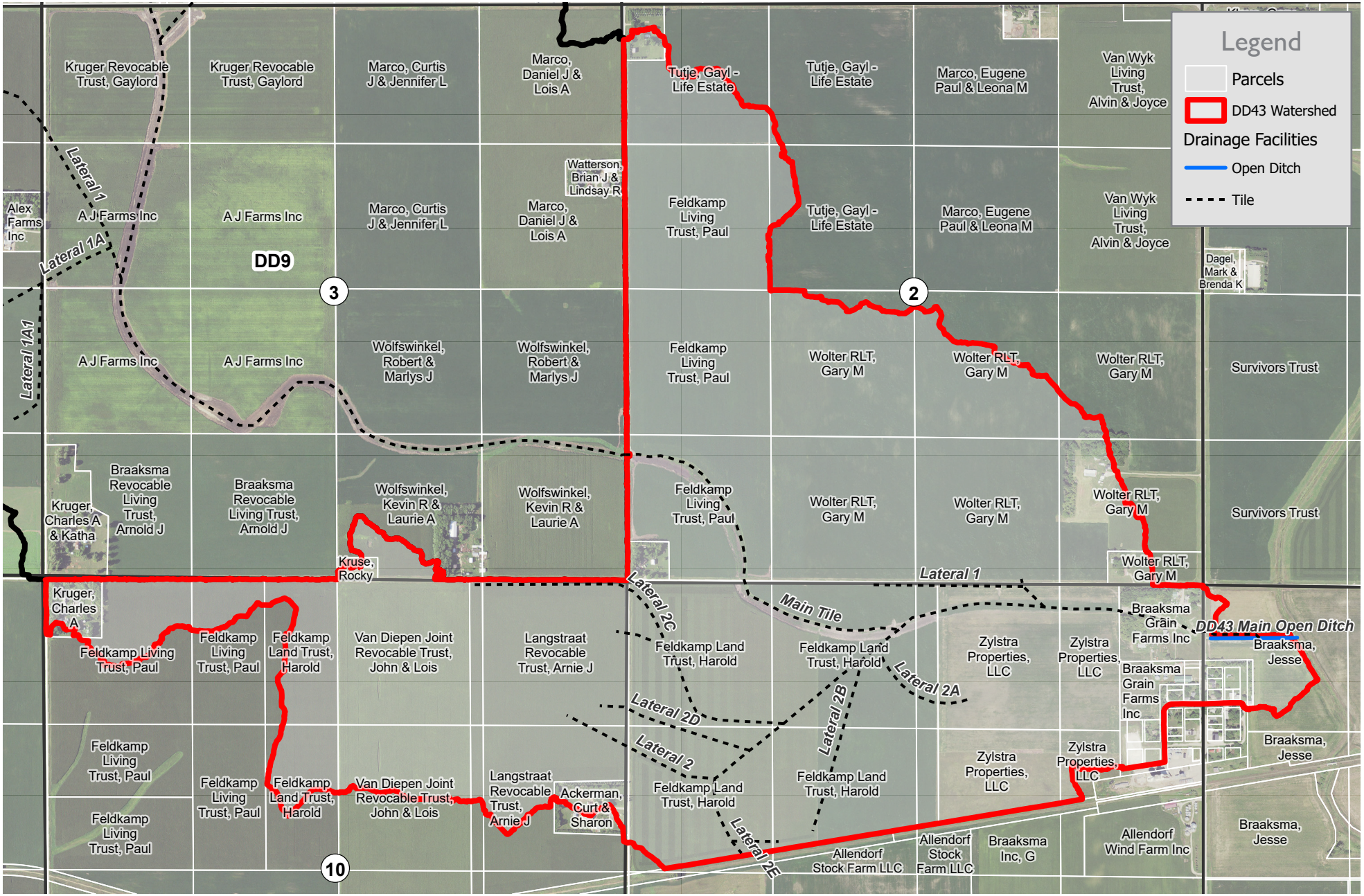
District Plat Map



Thursday, September 5, 2024

Project Number 24-31486

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DD43 District Plat

Osceola County, Iowa

Source(s):
Imagery (USDA, 2021)
Parcels (Osceola County, 2022)

ISG

Tile Capacity Calculations

Osceola County
Drainage District No. 43

ISG

EXISTING TILE SUMMARY

Area	Original Existing Size (in)	Relief Existing Size (in)	Original Existing Slope (%)	Relief Existing Slope (%)	Drainage Area (Acres)	Combined Existing Drainage Coefficient (in/day)
Original & Relief Main 3+60 to 8+30	28	36	0.35%	0.37%	2324.0	0.62
Original & Relief Main 8+30 to 9+30	28	42	0.35%	0.37%	2302.9	0.84
Original & Relief Main 9+30 to 16+80	28	30	0.35%	0.35%	2302.9	0.46
Original & Relief Main 16+80 to 39+00	28	24	0.35%	0.27%	2280.8	0.33
Original & Relief Main 39+00 to 53+00	24	24	0.33%	0.34%	2030.8	0.31
Original & Relief Main 53+00 to 70+00	24	24	0.33%	0.38%	1726.1	0.37

Area	Existing Size (in)	Existing Slope (%)*	Drainage Area (Acres)	Existing Drainage Coefficient (in/day)
Lateral 2 0+00 to 15+00	16	0.14%	287.4	0.24
Lateral 2 15+00 to 19+00	15	0.14%	218.1	0.26
Lateral 2 19+00 to 23+00	14	0.48%	198.3	0.45
Lateral 2 23+00 to 35+00	10	0.99%	175.5	0.30
Sub-Lateral 2A 0+00 to 11+00	6	0.29%	13.0	0.55
Sub-Lateral 2B 0+00 to 10+00	8	0.21%	42.6	0.31
Sub-Lateral 2B 10+00 to 16+00	6	0.48%	12.8	0.73
Sub-Lateral 2C 0+00 to 4+00	8	0.52%	30.2	0.69
Sub-Lateral 2C 4+00 to 14+00	7	1.01%	25.9	0.78
Sub-Lateral 2C 14+00 to 18+00	6	1.64%	12.6	1.36
Sub-Lateral Branch 2C 0+00 to 20+00	6	1.10%	3.9	3.60
Sub-Lateral 2D 0+00 to 12+00	6	0.85%	20.5	0.60
Sub-Lateral 2E 0+00 to 7+00	10	0.10%	22.0	0.75
Sub-Lateral 2E 7+00 to 9+00	8	0.10%	3.9	2.33
Sub-Lateral Branch 2E 0+00 to 5+00	8	0.10%	1.7	5.36

***Indicates an assumption made during the calculation process.**

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PROPOSED OPTION #1 TILE SUMMARY

Area	Present Size (in)	Proposed Size (in)	Present Slope (%)	Proposed Slope (%)	Drainage Area (Acres)	Present Drainage Coefficient (in/day)	Proposed Drainage Coefficient (in/day)
Lateral 2 0+00 to 15+00	16	24	0.14%	0.14%	287.4	0.24	0.69
Lateral 2 15+00 to 19+00	15	24	0.14%	0.14%	218.1	0.26	0.91
Lateral 2 19+00 to 23+00	14	15	0.48%	0.48%	198.3	0.45	0.54
Lateral 2 23+00 to 35+00	10	12	0.99%	0.99%	175.5	0.30	0.48
Sub-Lateral 2B 0+00 to 10+00	8	10	0.21%	0.21%	42.6	0.31	0.56

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PROPOSED OPTION #2 TILE SUMMARY

Area	Existing Size (in)	Proposed Size (in)	Existing Slope (%)	Proposed Slope (%)	Drainage Area (Acres)	Existing Drainage Coefficient (in/day)	Proposed Drainage Coefficient (in/day)	Combined Drainage Coefficient (in/day)
Lateral 2 0+00 to 15+00	16	18	0.14%	0.14%	287.4	0.24	0.32	0.56
Lateral 2 15+00 to 19+00	15	15	0.14%	0.14%	218.1	0.26	0.26	0.52
Lateral 2 19+00 to 23+00	14	10	0.48%	0.48%	198.3	0.45	0.18	0.63
Lateral 2 23+00 to 35+00	10	10	0.99%	0.99%	175.5	0.30	0.30	0.59
Sub-Lateral 2B 0+00 to 10+00	8	8	0.21%	0.21%	42.6	0.31	0.31	0.61