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Engineer's Report
Tile Improvements
Drainage District No. 61
Lateral A & Lateral A4

Palo Alto County, Iowa
2026

PROFESSIONAL ENGINEER JACOB L. HAGAN 25738 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Jacob L. Hagan, P.E. 9/8/2026 (date) License No. 25738 My license renewal date is December 31, 2026. Pages or sheets covered by this seal: All
PROFESSIONAL ENGINEER TYLER J. BUMAN 30759 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Tyler J. Buman, P.E. 9-8-2026 (date) License No. 30759 My license renewal date is December 31, 2027. Pages or sheets covered by this seal: All

Project Nos. 2601-74 & 2618-74

Executive Summary

Introduction
Following a petition by landowners in Drainage District No. 61 Lateral A and Lateral A4, a comprehensive engineering study was conducted to evaluate the existing drainage infrastructure. This report summarizes the findings and presents a recommended plan to address long-standing drainage deficiencies and improve agricultural productivity across the district.

Problem Assessment
The investigation concluded that the Lateral A and A4 tile system, installed over 110 years ago, is inadequate for modern agricultural needs. The Lateral A tile is operating at only 12% of the recommended ½-inch per day drainage coefficient, and Lateral A4 at 30%. This insufficient capacity, combined with the fact that 82% of the district's soils are classified as somewhat poorly to very poorly drained and that 341 mapped depressional areas covering roughly 250 acres lack natural surface outlets, results in delayed field operations, waterlogged soil, and significant crop yield limitations. The Lateral A Surface Drain, constructed in the 1950s and repeatedly cleaned since, is again silting in and provides little effective relief.

Proposed Solution
The recommended solution is a full tile improvement project replacing both the Lateral A and Lateral A4 tiles. The proposed routes generally parallel the existing tile while straightening the alignment where feasible, which improves available grade and reduces cost. The new system is designed to meet the modern standard drainage capacity, providing a reliable, long-term solution for all landowners served. The existing tile will be connected to the new system approximately every 1,000 feet to serve as a collector but should no longer be maintained by the district. We further recommend abandonment of the Lateral A Surface Drain as a district facility if the new tile is constructed.

Project Cost
The total estimated cost for the proposed project is $5,249,000. The portion assessed to landowners for the Lateral A tile improvements is approximately $1,170 per acre and an additional $971 per acre for the lands benefiting from Lateral A4. Road and railroad crossing costs are the responsibility of the entities controlling those crossings.

Implementation and Landowner Considerations
If approved, the project will be publicly bid this winter, with a completion deadline of March 2028. Costs will be allocated to landowners through a reclassification process to ensure assessments are proportional to the benefits received.

Recommendation
The existing drainage system has surpassed its functional lifespan and is a primary limiting factor for agricultural production on the lands it serves. We recommend that the Board of Trustees accept this report and schedule a public hearing to present the findings to all landowners. Should there be sufficient support, we further recommend proceeding with the preparation of final plans and specifications for construction.

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Introduction

Overview
Many Iowa landowners benefit from drainage infrastructure without day-to-day consideration of its operation. These systems, managed through legally established drainage districts, construct, repair, and maintain improvements such as tile lines and open ditches, allowing farmland to remain productive by controlling excess surface and subsurface water.

Drainage District No. 61 in Palo Alto County, like many early 20th-century districts, was established to improve drainage in a wetter, less-developed landscape. The Palo Alto County Board of Supervisors serves as the Board of Trustees, overseeing maintenance and ensuring that improvements benefit all landowners within the district. Under Iowa Code Chapter 468, landowners have the right to petition for repairs or improvements. On December 23, 2025, two landowners submitted such a petition requesting an evaluation of the existing Lateral A and Lateral A4 tile system (Appendix A).

Once a valid petition is received, the Board hires a licensed engineer to conduct a preliminary study and prepare a report outlining possible improvements and associated costs. AgriVia was appointed on January 6, 2026. This report presents the findings and recommendations resulting from that study and survey. The process is deliberate and transparent, with all landowners entitled to receive notice, review findings, attend hearings, and raise questions before any project proceeds. The entirety of Drainage District No. 61 spans over 35,000 acres drained by the large Main Open Ditch and numerous lateral tile systems. For the purposes of this report in response to the specific petition for drainage relief, most of the analysis will be confined to the Drainage District No. 61 Lateral A (DD 61-A) and Lateral A4 tile system.

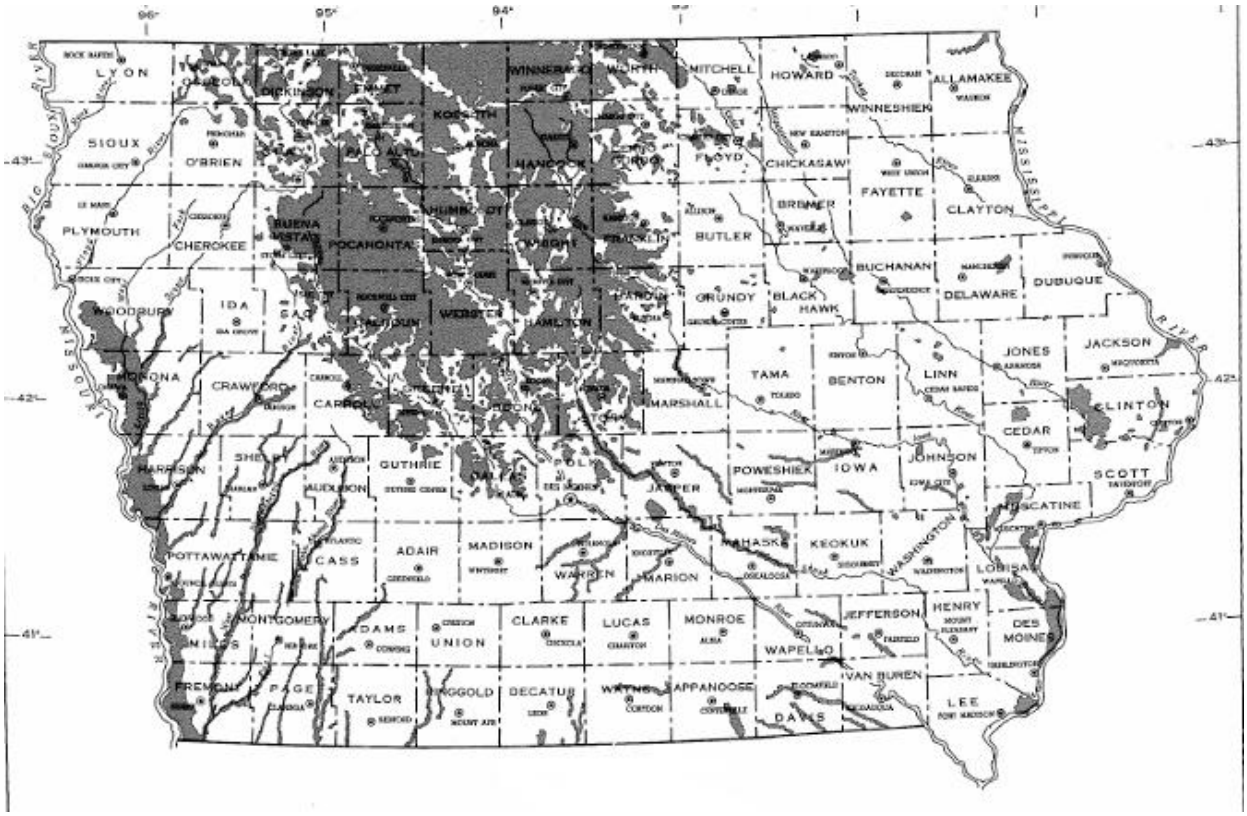
Location
DD 61-A spans lands in Sections 3, 4, 5, 6, 8, 9, 10, 14, 15, 16, 22, and 23 of Fern Valley Township and Sections 20, 29, 30, 32, and 33 of Fairfield Township. The district lies approximately two miles northeast of Rodman and one mile east of Cylinder. A map of the area of study is included in Appendix B.

Historical Considerations

Prehistoric and Geologic Background
Palo Alto County, Iowa, lies within the Des Moines Lobe, shaped by the Wisconsin glaciation 12,000–15,000 years ago. Glaciers deposited clay-rich till, a dense mix of clay, silt, sand, and boulders, over older bedrock. This till forms the foundation of the region's soils and strongly affects drainage.

The glacial landscape is relatively flat, featuring end moraines, kames, eskers, and knob-and-kettle terrain with prairie potholes, shallow depressions that collect water. Combined with the low permeability of the till and limited natural drainage, these features cause frequent surface ponding.

State-wide Drainage System Overview
Artificial drainage in Iowa began in the late 1800s as settlers converted wetlands into farmland. Steam-powered, and later gasoline-powered, machinery accelerated these efforts. A 1904 constitutional amendment enabled the creation of drainage districts, allowing landowners to fund and manage large-scale drainage projects. By 1930, more than 9 million acres of wetlands had been converted to farmland.



Iowa Drainage Districts (1950 US Census of Agriculture)

The scale of Iowa's drainage efforts is striking. By 1912, investments in drainage likely exceeded U.S. spending on the Panama Canal, highlighting the significant labor and engineering required to reshape the landscape. Today, approximately 3,800 drainage districts maintain networks of ditches and tiles statewide.

County-Wide Drainage System Overview

Palo Alto County is served by well over 200 drainage districts, encompassing thousands of miles of tile and ditches and covering most of Palo Alto County. Most districts were established before 1930 and are undersized to meet the needs of modern farming practices.

Drainage District No. 61 Historical Overview

Drainage District No. 61 in Palo Alto County was established to address persistent flooding and wetland conditions that limited agricultural productivity. Key events in the Drainage District No. 61 development found in the records include:

- August 4, 1912 — Petition filed to establish a drainage district, running from Section 28, Fairfield Township to Section 36, West Bend Township. Guy R. Campbell appointed engineer to survey.
- June 2, 1913 — Campbell engineer's report filed. Findings: a watershed of about 15,500 acres (7,500 in direct need of drainage), estimated cost of $150,000, and a design of 41.49 miles of tile and 6.35 miles of open ditch. Lateral A was designed as 30" tile for 14,300 feet with sub-laterals A-1 through A-11 (including A-4); Lateral B was designed as 30" tile for 13,100 feet with sub-laterals B-1 through B-18. About 28 square miles of upstream Fairfield Township land were excluded as too costly to drain.
- September 6, 1913 — Campbell's supplemental report filed, listing open-ditch right-of-way acreage required.
- September 13, 1913 — Guy R. Campbell, J.S. Martin, and Gene Kane appointed as appraisers to assess landowner damages.
- November 3, 1913 — Report of Appraisers filed, totaling $5,794.00 in damages.

- November 11, 1913 — Public hearing held; proposed Lateral D dropped and Lateral B-6 shortened. Drainage District No. 61 formally established.
- January 12, 1914 — Bid letting held. Contracts awarded to P.L. Rivard ($21,354.86, labor), Cement Products Company ($64,840.19, tile), Rude & Wold ($24,535.90, labor), and Ewing & Brockenbrough (Main Open Ditch excavation, approximately $10,854.54). Fixed-price contracts totaled $110,730.95.
- January 26, 1914 — Contract signed with the Rock Island Railroad for damages.
- April 13, 1914 — Hearing held on the original Benefit Classification Report.
- June 11, 1914 — Board ordered a levy of $134,000 to fund original construction.
- 1914 — Final settlement records show an as-built variance on Lateral A4: 8-inch tile came in 100 feet short, a $10.00 adjustment.
- January 12, 1917 — Chicago, Milwaukee & St. Paul Railroad ordered to install an 18" tile under its tracks for Lateral A in Section 5-95-31.
- August 1, 1923 — Additional levy of $18,763.87 ordered; combined with the 1914 levy, total original construction funding reached about $152,700.
- September 5, 1941 — Petition filed to clean out drain tile filled with silt and dirt.
- July 15, 1946 — Petition filed to examine the 30" Lateral A tile and Lateral A-5, stating the lines were not draining as they should.
- August 2, 1948 — Levy of $6,697.23.
- October 13, 1951 — Preliminary engineer's report on Lateral B-7 found tile off grade and operating at only 40% of design capacity; recommended a new line.
- November 10 – December 2, 1951 — Rowat & Murray, Engineers, conducted a field investigation of the Branch A and Branch B tile lines.
- January 14, 1952 — Rowat & Murray's report found the system now suffering faulty capacities from breakdowns, plugs, and small tile. Branch A was repaired in the field by relaying tile; Branch B was found generally fair-to-good but inadequate overall. Recommended a complete survey and a definite engineering plan for relief.
- March 2, 1953 — Levy of $4,018.23.
- August 10, 1954 — Petition filed for a new district to construct a surface drain over the Lateral B tile.
- August 16, 1954 — T.R. Martin appointed engineer to investigate the Lateral B surface drain.
- October 29, 1954 — Petition filed by 15 landowners for a new district to construct a surface drain over Lateral A.
- November 9, 1954 — T.R. Martin's report on the proposed Lateral B surface drain found the tile's capacity at only about 14% of adequate and recommended a surface drain costing about $12,000.
- December 15, 1954 — Engineer T.R. Martin died; G.D. Hart appointed to replace him.
- December 20, 1954 – May 16, 1955 — Hearing to establish a Lateral B surface-drain district opened and continued for months; the district was established February 1, 1955, but landowners appealed, and on May 16, 1955 the Court found the Board had lacked jurisdiction and voided the action. Laurence W. Murray was separately appointed engineer for the proposed Lateral A surface-drain district.
- October 3, 1955 — James Riggs hired to inspect the lands involved for both Laterals A and B; Marvin Kruse, E.B. Swanson, and Albert Kenyon appointed to determine benefits.

- October 7, 1955 — Riggs' report recommended construction of the open waterway and replacement of 100 feet of 30" tile, estimated at $6,539.14 plus $485.00. The Board obtained consent waivers of damages from landowners in exchange for a one-time $35.00 payment per required floodgate, and resolved that the Lateral B surface drain should be built.
- October 24, 1955 — Board approved the Lateral A surface drain contract to Peterson Brothers: $6,539.14 for excavation plus $485.00 for tile replacement, about $7,024 total. Condemnation proceedings approved for Branch B right-of-way, with a November 7 letting date set for the Lateral B surface drain.
- November 7, 1955 — Lateral B surface drain work let to Stolley Construction Co. for $5,040.00.
- November 30, 1955 — Report of the Classification Commission for Lateral A and Lateral B filed, covering 142 tracts and 3,823.6 acres benefited for Lateral A.
- Fall 1955 — Construction of the Lateral A surface drain completed.
- December 15, 1955 — Lateral B surface drain work behind schedule; contractor ordered to finish within 10 days.
- March 1, 1956 — Parcels in Section 33-96-31 annexed into the district.
- March 6 – May 24, 1956 — A series of hearings completed the Lateral A/B reclassification, including approval of the Section 33 annexation classification and approval of the Lateral A and Lateral B (with sub-laterals B-1 through B-18) classification schedules. Assessment schedules for B-1 through B-18 were adopted April 3, 1956.
- April 18, 1956 — Appraisers' report for the Section 33-96-31 annexation approved; assessment value fixed at $2,997.01.
- August 1956 — An error in the railroad's Lateral A classification for Section 5-95-31 corrected.
- March 14, 1958 — In Miller v. Board, the Board's right-of-way condemnation was found illegal by the court, which awarded extra damages to H.E. Miller.
- April 1, 1958 — Re-levy of $10,720.37 on Lateral B.
- November 7, 1961 — Kruse Engineering Service surveyed the Lateral A overflow ditch in Section 9-95-31, finding the bottom up to a foot above design grade, and recommended cleaning out 4,100 linear feet at an estimated cost of $800.
- November 15, 1961 — $17,803 levied on the Lateral A assessment schedule.
- November 28, 1961 — Follow-up inspection found the completed excavation closely matched the staked design; the contractor had excavated 2,796 cubic yards.
- 1967 — Tree-removal petition filed for Section 26, Fern Valley Township.
- December 15, 1967 — Contract awarded to Flannegan Conservation Service for $3,818.41 to clear brush, trees, and stumps in Section 26.
- March 17, 1969 (repeated March 17, 1973) — $13,693.79 levied on the Main Open Ditch.
- December 1, 1969 — $200.00 re-levy against Lateral A.
- March 21, 1973 — Petition filed by five landowners for removal of trees and brush from the open ditch near Section 23, Fern Valley Township.
- November 8, 1974 — County Engineer William W. Ellingrod circulated a petition for repair of the Lateral B surface drain.
- November 12–18, 1974 — Petition signed asking the Board to investigate restoring the Lateral B surface drain and the adjoining open ditch.

- December 16, 1974 — Board directed engineer Marvin O. Kruse to estimate the cost of a preliminary survey of the Main Ditch and Surface Drains A and B.
- December 20 & 27, 1974 — Kruse delivered a four-part cost estimate for the preliminary surveys, totaling about $2,300 (or $1,840 if done together).
- January 14, 1975 — Informal hearing held; a broader petition was signed asking the Board to investigate the Main Ditch, Lateral A, and Lateral B for cleanout and repair needs, and to identify unassessed lands draining into the system. The Board directed Kruse, Cate & Nelson to investigate.
- January 8, 1976 — Kruse, Cate & Nelson's Engineer's Report on the Main Ditch, Lateral A, and Lateral B filed. Recommended costs: Lateral A repair, $43,300; Lateral B repair, $5,700; Main Ditch repair, $56,300. Two larger alternatives — widening the Main Ditch to a 40-foot bottom ($251,000) or extending an improved ditch to the Des Moines River ($441,000) — were presented but not recommended.
- March 23 & April 20, 1976 — Public hearing on the Kruse report; the Board ordered cleaning of only the top 4,000 feet of the Main Open Ditch, with the remaining recommendations later dropped.
- April 23, 1976 — Board appointed Marvin O. Kruse, A.W. Schuller, and Robert Finnegan as Drainage Classification Commissioners to examine possible misclassification of upper Main Ditch lands.
- April 30, 1976 — Plan-and-profile drawing issued for the 1976 Repair of Open Ditch, covering Stations 0–40.
- June 13, 1976 — District attorney opinion confirmed Laterals A and B should each bear the full maintenance cost of their own tile and ditch.
- June 23, 1976 — The Reclassification Commission found the 1955 Classification Commission had been misinformed about the extent of Lateral A, determined the Main Ditch actually includes 4,000 feet of open ditch in Section 23, and recommended removing certain lands from the 1955 Lateral A reclassification — reducing Lateral A's total assessment units from 80,921 to 78,721.
- June 29, 1976 — Bid letting for the 1976 Repair of Open Ditch; awarded to Estherville Sand & Gravel, Inc. for $10,224.00.
- June 30, 1976 — Forty landowners petitioned against the assessment for the cleanout; the Board nonetheless confirmed and adopted the June 23 Reclassification Commission report.
- June 11, 1979 — Attorney Robert Boyd Griffith issued a legal opinion on DD 61's assessment methodology, concluding there are effectively twenty distinct cost-assessment accounts within the district and recommending the Board not avoid correct, lateral-by-lateral assessment.
- July 21, 1982 — Board hired Etler Engineering to investigate needed repairs to the Main Open Ditch and tree removal in Section 12, West Bend Township.
- September 29, 1982 — Informal hearing held on the requested tree removal; the Board decided not to act, and Etler's study was dropped.
- October 28, 1987 — Twelve landowners filed a request for drainage work on the upper 4,000 feet of the Main Open Ditch.
- November 3, 1987 — Donald D. Etler inspected the open ditch in Section 23, finding beaver dams and an undermined concrete bulkhead serving as the outlet for two surface drains and two 30" tile lines; recommended replacement.
- November 4, 1987 — Etler reviewed the Lateral A surface drain and found it filled with one to two feet of silt over its entire length.
- November 6, 1987 — Etler noted this was the third organized petition for drainage relief on the system in twelve years.

- December 1, 1987 — Petition filed by nine landowners requesting the Lateral A surface drain be cleaned.
- December 2, 1987 — Informal landowner meetings held; the Board decided to act only on removing a beaver dam.
- December 8–9, 1987 — Board formally hired Etler Engineering to prepare a report on Lateral A surface-drain repairs and investigate a possible open-ditch improvement.
- March 14-15, 1989 — Etler Engineering's Lateral A report certified and filed, covering 3,670.98 assessed acres. Found the Lateral A tile provided only about 10% of recommended drainage capacity, among the lowest Etler had encountered. The surface drain, unmaintained since 1955, was filled with an average of 1.25 feet of silt (about 22,000 cubic yards) and could pass only 27 of the 156 cfs needed. Three relief options were presented: Option A, surface-drain repair ($92,310 total, $72,310 net to Lateral A); Option B, a large relief tile ($1,327,836 total, $1,243,336 net); and Option C, converting the surface drain into a true open ditch (RECOMMENDED — $329,753 total, $298,076 net). The report also noted a Northern Natural Gas pipeline crossing the Lateral A4 and A5 tile in Section 9, estimated at $75,000 to lower if required.
- March 21, 1989 — Etler notified Lateral A landowners of the filed report, recommended Option C, and set a public hearing for April 26, 1989.
- April 26, 1989 — Public hearing held; the repair project was approved.
- August 9, 1989 — Bid letting for the Lateral A Surface Drain / Drop Spillway Replacement; low bid awarded to Jan Hjelmeland Excavating for $49,217.50.
- November 21–22, 1989 — Contract completed at $48,688.00; Donald Etler certified the contractor's completion.
- December 19, 1989 — Etler flagged several post-construction items, including below-spec concrete in the drop spillway's upper wall (recommended for acceptance), a private-drive culvert sitting above grade, missing culvert parapets, and a gas main running close beneath the drain bottom.
- January 9, 1990 — Petition filed by nine landowners requesting repair or improvement of the Main Open Ditch; the Board appointed Etler Engineering to investigate.
- February 20, 1990 — Etler estimated $150,000–$250,000 to repair the entire Main Open Ditch and flagged roughly 18,000 acres draining through the ditch from outside the district as a candidate for future annexation.
- September 1990 — Etler Engineering filed its Main Open Ditch report. Found the ditch had never been substantively repaired and the ditch could carry only about 30% of recommended flow. Of nearly 34,000 acres draining through the ditch, only 45% was assessed. Presented a Repair Option ($189,844, $12.43/acre) and a recommended Improvement Option ($218,325, $14.29/acre), and recommended pursuing annexation of the unassessed upstream acreage.
- October 25, 1990 — Published the resulting district-wide reclassification schedule, including a new standalone schedule for Lateral A4 Tile: 370.90 acres, $2,205.09 assessed.
- April 8 – May 22, 1991 — Report of Appraisers approved, appraising right-of-way easements taken from about 20 landowners for the Main Open Ditch project.
- 1994 — Lateral B surface drain was cleaned out.
- September 12, 2013 — Drainage petition filed by eight landowners requesting repair and cleaning of DD 61 Lateral A.
- December 5, 2013 — Jacobson-Westergard & Associates' preliminary engineering report on the Lateral A restoration found the surface drain, as restored in 1989, silted in along its entire length. Estimated cost: $58,847.25 ($15.43/acre).

- January 6, 2014 — Plan and profile sheet set issued for the Lateral A restoration.
- 2014 — Flooding damaged the Main Open Ditch.
- 2014 — Petition filed for tile improvements of Lateral B. Jacobson-Westergard was appointed to study and survey and prepare a report.
- 2015 — Jacobson-Westergard & Associates filed an engineering report on the Lateral B surface drain and tile capacity. The Engineer provided cost estimates for improving the tile at a cost of $3.34 million or constructing an open ditch at $1.59 million. The project did not move forward.
- January 19, 2016 — Bolton & Menk's first Engineer's Report recommended cleanout of the upper 5,000 feet of the Main Open Ditch and repair of the 2014 flood damages.
- March 1, 2016 — Hearing held; the Board approved the upper-5,000-foot repair and the FEMA flood-damage repairs.
- March 2, 2016 — Amendment No. 1 to the first report filed, correcting the Opinion of Probable Cost.
- August 16, 2016 — Bid letting for the upper-5,000-foot cleanout and FEMA repairs; awarded to Reutzel Excavating.
- 2016 — A landowner petitioned for further investigation of improvements to reduce flooding in Sections 12 and 13, West Bend Township.
- March 16, 2017 (filed May 16, 2017) — Bolton & Menk's second Engineer's Report, addressing the Section 12/13 reach, found the ditch bottom 1.5–2.0 feet below design elevation and the channel undersized against a 740 cfs design flow. Recommended a 50-foot-base improvement ($850,000) over a 40-foot-base alternative ($771,000).
- June 22, 2017 (filed July 11, 2017) — Amendment No. 1 added a downstream high-overflow-channel alternative ($321,240) and recommended annexing 20,660 acres draining to the Main Open Ditch.
- July 11, 2017 — Informational meeting; landowners requested the improvement be extended to the entire Main Open Ditch, and the Board directed further study.
- July 24, 2017 — Amendment No. 2 extended the recommended improvement the length of the Main Open Ditch, bringing the combined project total to $2,494,500.
- August 1, 2017 — Continued hearing; the Board directed further study of downstream impacts.
- February 26, 2018 — Amendment No. 3 recommended a Prairie Creek cleanout combined with a shorter overflow channel, estimated at $429,767, bringing the combined project total to $2,256,267.
- February 26–27, 2018 — Continued hearing; the Board eliminated the downstream channel improvements from the project, and the annexation area was reduced to 35,278 acres.
- 2018 — Lateral B surface drain was cleaned out.
- 2018–2021 — USACE issued Nationwide Permit No. 41 and the Iowa DNR issued the companion floodplain construction permit for the ditch reshaping work north of 475th Street.
- February 4, 2021 — Amendment No. 4 updated the project scope and costs following the permits obtained, setting a Total Estimated Assessable Project Cost of $1,668,000 ($113/acre in-district).
- May 16, 2024 — Bolton & Menk reviewed a petition for voluntary annexation of about 320 acres from Drainage District No. 3 into DD 61's Main Open Ditch schedule, prompted by a new tile outlet near the West Bend/Section 13 bridge.
- August 20, 2024 — Public hearing held on the voluntary annexation, and Amendment No. 1 to Voluntary Annexation issued. The same day, Martin & Doris Zaugg Farm LLC filed a separate petition requesting

cleaning of the bridge at 475th Street, installation of two 72-inch culverts, and improvements downstream of the district outlet.

- September 23, 2024 — Bolton & Menk proposed cleaning out about 4,600 feet of the downstream creek to improve capacity, at a tentative construction cost of $230,000. Project shelved.
- August 26, 2025 — Board of Trustees appointed AgriVia to prepare an Engineer's Report addressing the downstream-outlet portion of the August 2024 petition.
- September 4, 2025 — Jacobson-Westergard & Associates filed an Engineer's Report recommending further study on the Lateral B surface drain if a petition is filed.
- September 16, 2025 — AgriVia's Engineer's Report on Downstream Outlet Improvements certified and filed. Recommended a limited cleanout and reshaping project along 9,400 feet of creek at an estimated cost of $405,000. Proposed acquiring about 17.53 acres of right-of-way across 13 parcels.
- December 23, 2025 — Petition filed by two landowners requesting an evaluation of the existing Lateral A and Lateral A4 tile system (Appendix A).
- January 6, 2026 — Board of Trustees appointed AgriVia to prepare this Engineer's Report on the petitioned Lateral A and Lateral A4 tile improvements.
- January 20, 2026 — Informational meeting held with landowners to discuss the proposed downstream outlet improvement project. Following the meeting, it was found that there was not sufficient landowner interest to move forward, and the project was shelved.

Historical Agricultural Demands

In the early 20th century, farms in Palo Alto County were smaller and more diversified. They included a mix of row crops, small grains, hay, pasture, and livestock. Early drainage systems helped convert poorly drained land into pasture and upland areas into productive cropland.

Since then, agriculture in the county has changed dramatically. Drainage has become much more intense and widespread. Most farms today span several hundred acres and operate in a corn–soybean rotation, which now accounts for over 90% of row-cropped land. For context, looking at the 1930s aerial photo, there were twenty farmsteads within the DD 61-A boundary. Today, only eleven farmsteads remain.

Notably, recent growth in the organic sector in Palo Alto County has made Palo Alto County the leading county in Iowa for total organic sales according to the 2022 US Census of Agriculture, accounting for nearly 14.5% of all organic sales in the state. Organic farming is highly dependent on favorable soil conditions for timely tillage and weed control.

Environmental Considerations

Flooding and Subsurface Drainage

Subsurface drainage, while primarily installed to improve agronomic performance and soil workability, also plays a role in broader hydrological outcomes. A 2014 study conducted by the University of Iowa's IIHR (Hydroscience & Engineering Institute) concluded that modern subsurface tile drainage systems can reduce peak flow rates during storm events. By gradually drawing down the water table and drying out soils, tile systems allow the soil to soak in more rainfall and delay the timing of runoff compared to surface flow, thereby attenuating flood peaks in receiving streams. This contradicts the common theory that tile drainage always increases flood risk.

Research completed by Iowa State University comparing conditions before and after drainage district improvement projects found that drainage improvements reduced annual evapotranspiration by 2% and increased annual drainage flow out of the district by 4%. These results indicate that improved subsurface drainage can more

efficiently convey excess water from the soil profile through the drainage system, slightly reducing the amount of water lost to evapotranspiration while modestly increasing the amount of water discharged through the district outlet.

Nutrient Loading and Subsurface Drainage
DD 61 lies in the Des Moines River watershed, where tile drainage supports row crops on heavy, poorly drained soils by removing excess water. However, tiles create direct paths for soluble nutrients, especially nitrate-nitrogen (NO_3^--N), to reach streams. Long-term monitoring by the Iowa DNR and USGS shows elevated nitrate levels in the Des Moines River during high tile flow periods. Tile drainage does not create nutrients but accelerates their movement, making nutrient management and conservation practices essential alongside drainage improvements to reduce nutrient loading and protect water quality.

Climate and Weather Patterns
Long-term weather records dating back to 1895 provide insight into shifting precipitation patterns, temperature trends, and drought cycles, all of which affect how water moves through fields and drainage systems.

Historically, Palo Alto County has received 20 to 40 inches of rainfall per year, averaging around 31 inches (Appendix C). Since 1985, five years have exceeded 40 inches (1991, 1993, 2007, 2010, 2015). That is more years exceeding 40 inches in the past forty years than in the previous nine decades combined, when only four years (1902, 1951, 1965, 1973) did so. In addition to rising totals, rainfall has become more intense and unevenly distributed. Short, high-intensity storms delivering 2 to 4 inches in a single day are increasingly common, especially in spring and early summer.

The Palmer Drought Severity Index (PDSI) reflects this variability. While Palo Alto County experienced major droughts in the 1930s, 1950s, and 2012, recent decades show more frequent wet periods and positive PDSI values (Appendix D), indicating above-normal soil moisture. At the same time, temperature records show moderate warming, especially in winter and early spring, leading to earlier snowmelt, altered freeze-thaw cycles, and longer growing seasons.

Watershed Characteristics

District Landscape
DD 61-A serves a mostly flat watershed with poorly defined or non-existent drainage paths. The boundaries are well defined in most areas with ridges and hills on the east and west sides. The general flow of water is toward the southeast in the direction of the Main Open Ditch, following a very shallow natural swale. The average natural fall over the length of the Lat. A tile is approximately 4.2 feet per mile.

We used LiDAR (Light Detection and Ranging) to map the surface topography of the district. This technology uses laser pulses from aircraft to create highly accurate elevation maps of the ground surface. These maps help us identify where water naturally collects and how it moves across the land. An elevation map is included in Appendix E.

The surface watershed of DD 61-A covers approximately 3,712 acres that naturally drain to the tile via surface flow. However, not all tile-drained land lies within this area. Some acres are tile-drained out of the district, while others outside the surface watershed are tile-drained into it. In total, we have mapped 3,648 acres that benefit from the Lateral A tile. These 3,648 acres are what will be considered moving forward in this report. Completing the same methodology, we mapped the benefited area of DD 61-A4, which covers approximately 378 acres.

A detailed topographic analysis using 6-inch LiDAR contour data identified 341 depressional features within the DD 61-A watershed, covering approximately 250 acres. These low-lying areas collect water and lack natural surface outlets, significantly impacting drainage. They contribute to surface ponding during rain events, alter

runoff patterns, and increase reliance on subsurface tile or surface inlets for effective water management. These depressions are mapped in Appendix F.

Historical aerial photos provide valuable insight into long-term drainage patterns and problem areas within the district. By examining past images, we can identify recurring issues such as drown-out spots, standing water, or poor crop growth, all of which are indicators of inadequate drainage.

Soils

Nearly all the soils in DD 61-A are classified as clay loams, which tend to retain water and pose natural drainage challenges. The eight dominant soil types in decreasing order, Canisteo clay loam, Nicollet clay loam, Harps clay loam, Clarion loam, Talcot clay loam, Crippin loam, Okoboji silty clay loam, and Mayer loam cover about 84% of the district. While highly fertile, these soils often lack natural drainage due to their fine texture and landscape position. The far northern 74 acres of the district have larger grained, sandier soils which are able to move water through them quicker.

The USDA classifies Canisteo, Nicollet, Harps, Talcot, Crippin, Okoboji, and Mayer soils as somewhat poorly to very poorly drained, typically found in flat or depressional areas where water accumulates and moves slowly through the soil. Without artificial drainage, these areas are especially prone to saturation and waterlogging.

A detailed soil drainage class table is included below, and supporting soil type and soil drainage class maps are provided in Appendices G and H. 82% of the soils in the watershed fall into the very poorly drained, poorly drained, or somewhat poorly drained categories. This highlights the critical need for artificial drainage to maintain productivity.

Soil Drainage Class		
Drain Class	**Acres**	**Percentage of Watershed**
Very Poorly Drained	204	6%
Poorly Drained	1,950	53%
Somewhat Poorly Drained	842	23%
Moderately Well Drained	359	10%
Well Drained	182	5%
Somewhat Excessively Drained	36	1%
Excessively Drained	74	2%
Not Rated	1	0%

Subsurface and Surface Water Flow Behavior

Subsurface drainage works by collecting water through perforated pipes or the gaps between clay tiles installed below ground. As the soil becomes saturated, water moves laterally through the soil's pore spaces until it reaches the tile line, then enters through small openings and is conveyed to the district main. This process lowers the water table, improves soil aeration, and reduces surface runoff.

A key factor in drainage system design is saturated hydraulic conductivity (Ksat), a measure of how quickly water moves through saturated soil. Sandy soils have high Ksat values and drain quickly with fewer laterals needed; clay soils, like most of those in DD 61-A, have lower Ksat values and drain more slowly. Most soils in the district are clay loams with moderate to low Ksat values (Appendix I). These values are used to determine tile spacing and depth for effective system design.

Surface water flow occurs when rainfall or snowmelt exceeds the soil's infiltration capacity, causing water to move downslope into channels or depressions. To model this, we use Curve Numbers (CN), a standard method for estimating runoff based on land use, soil type, and moisture conditions. In DD 61-A, CN values typically

range from 82 to 85 for cultivated agricultural land with poorly drained soils. These values help in designing surface inlets, sizing ditches, and evaluating erosion control needs.

A map of seasonal high-water tables (Appendix J), based on USDA NRCS data, provides a general overview of how close groundwater may rise to the surface during wet periods for undrained soils.

Private Drainage
The primary purpose of a drainage district is to provide a legal and reliable outlet for both surface and subsurface drainage, allowing coordinated water management across multiple properties. While the district maintains shared infrastructure, such as main tile lines, individual landowners are responsible for installing and maintaining private tile systems to connect their land to the district outlet.

To better understand how private tiling interacts with the district system, we requested tile maps from landowners. Several responded with helpful documentation, which we reviewed and incorporated into our analysis (Appendix K). We also examined the original engineer's notes, which indicate that some private tile lines existed even before the district was formed. Additional information was gathered from historical and recent aerial imagery, and field surveys were conducted to locate surface tile intakes.

Through this combined effort, we were able to map approximately 315,000 feet of private tile. The true extent is likely far greater, as many older or undocumented tile lines are not visible or recorded, and most landowners did not provide maps. Two-thirds of properties within the benefited area contain visible private tile. It is extremely likely that every single farmed parcel has some amount of private tile, all draining to the district main.

Existing Infrastructure

Field Survey
The initial field survey of DD 61-A and A4 was completed in March of 2026. As part of this effort, we collected photographs of all major visible components and areas of interest throughout the district. Using high-accuracy GPS equipment, we measured the flowline elevations of the district tile at accessible points. These elevation measurements help us compare existing conditions with the original engineering plans and serve as reliable reference points moving forward.

We also documented the condition of major features including the upstream portion of the Main Open Ditch, tile intakes, and the concrete bulkhead. Many private surface intakes (where surface water enters the tile system) were also observed and recorded during the inspection. Photos taken during the field visit are included in Appendix L.

Existing Facilities
For the purposes of this report, only the facilities pertinent to the petition will be listed in detail below. There are eight other DD 61 branch tile systems and four other drainage districts (Nos. 25, 38, 128, and 167) discharging into the DD 61 Main Open Ditch.

Main Open Ditch
The DD 61-A tile system outlets into the DD 61 Main Open Ditch. The ditch is approximately 34,100 feet long extending to the bridge at 475th Street immediately west of West Bend. At this bridge, the ditch turns into a natural creek downstream. This ditch has had extensive work done in the last ten years, with both the upper end cleaned out and repaired after 2014 flooding, and the lower mile and a half improved to a bottom width of 50 feet between 475th St and 460th St. At the time of our survey in March 2026, the upper end of the open ditch appeared to be in satisfactory condition to improve the tile.

Lateral A Tile

The Lateral A tile outlets into the Main Open Ditch in the NW NW of Section 23 in Fern Valley Township. From there, the tile runs upstream generally northwest for approximately 27,500 feet, crossing the following roads as it progresses upstream: 560th Ave, 555th Ave, 410th St, 400th St, 540th Ave (N60), the Canadian Pacific Railroad, and US Hwy 18. It connects to a private system approximately 300 feet north of the center of Section 32 in Fairfield Township. We do not have extensive information on the historical condition of this tile, other than that as far as we can tell from records, there have not been any major repairs or improvements on it besides the bulkhead structure at the outlet in 1989.

Because of the district's shape and natural slope, the Lateral A tile begins as a 30" before progressively downsizing to 28", 22", 20", 18", 16", and 14". In general, the lower half of the tile has about half the grade of the upper half. The tile is over 110 years old and severely undersized to meet modern farming needs. The 30" outlet reach only has a drainage coefficient of approximately 0.06 inches per day for the acres served, 12% of the recommended 0.5 inches per day according to Iowa State University. This is one of the lowest coefficients we have seen anywhere in Iowa.

Lateral A Branches

In addition to the Lateral A tile, the system includes eleven smaller lateral tiles that connect into the system. Each lateral tile is listed below:

- **Lateral A1**
  A small 8" tile connecting to Lateral A in the SE SE of Section 15 Fern Valley Township. The lands of the NE quarter of Section 15 are presently drained via a new private main to the north and east, out of the district and effectively abandoning the upper half of Lateral A-1.

- **Lateral A2**
  A small 12" tile connecting to Lateral A in the NW NW of Section 15 Fern Valley Township. It was apparent during the survey that a new private line had just been installed alongside or in place of this lateral to drain the large pothole on both sides of 410th St. Unfortunately, this new line is still limited by the very low capacity of the Lateral A main which it relies on.

- **Lateral A3**
  A small 10", 8", and 6" tile connecting to the main in the SW SE of Section 9 Fern Valley Township. This tile was intended to drain a large depression in that area. Evidently, it has not performed satisfactorily as a large private surface drain has been cut through the ridge to the south of this pothole to achieve further drainage.

- **Lateral A4**
  A medium size, 16", 15", 12", 10" and 8" tile that connects to Lateral A near the center of Section 9 in Fern Valley Township. As with all the tiles in this system, it is old and grossly undersized. The petition prompting this investigation specifically requested drainage relief on Lateral A4 as well. Its lower reach 16" tile is designed to a drainage coefficient of 0.15 inches per day, or 30% of the ISU recommended standard. Extensive private pattern systems and surface drains have been installed on this branch in an attempt at relief. The petitioner stated that water regularly bubbles up out of the ground on the upper reach of this branch after rain events.

- **Lateral A5**
  A medium size 18" tile connecting to Lateral A near the center of Section 9 in Fern Valley Township. It runs northwest to the intersection of 540th Ave and 400th St where it collects an extensive network of private tile systems.

- **Lateral A6**
  A small 8" tile connecting to Lateral A in the NE NW of Section 9 in Fern Valley Township. It runs northwest, across 400th St to collect private tiles in that area.

- **Lateral A7**
  A small 8" tile connecting to Lateral A in the NE NW of Section 9 in Fern Valley Township. It runs northeast, across 400th St, ending in a potholed area north of that road.

- **Lateral A8**
  A small 10" tile connecting to Lateral A in the SE SW of Section 4 in Fern Valley Township. It runs north, connecting to a private system and draining several significant potholes.

- **Lateral A9**
  A small 10", 8", and 6" tile connecting to Lateral A in the SE SE of Section 32 in Fairfield Township. Aerial photographs show this tile has likely either had a parallel relief or replacement installed privately at some point.

- **Lateral A10**
  A small 8" tile connecting to Lateral A-9 NE SE of Section 32 in Fairfield Township. This short branch runs northwest to the property line to connect with a private system.

- **Lateral A11**
  A small 10" tile connecting to Lateral A in the SE SE of Section 32 in Fairfield Township. It runs west to the next property line, connecting to a private tile system.

Every single one of these Laterals is over 110 years old, and grossly undersized by modern standards. It is important to note that lands draining through these laterals will still be limited by their capacity, even with the improved Lateral A tile. For the purposes of this report, we will only examine the capacities of Lateral A and A4 in full detail below.

- **Lateral A Surface Drain (Waterway)**
  The Lateral A Surface Drain is a district facility first constructed in the 1950s to gain some surface relief for the low-lying lands in the central and lower portion of the district that are near the Lateral A tile. Since that time, this surface drain has required regular maintenance.

  A study was conducted in 1961, finding the surface drain significantly silted in around Section 9 of Fern Valley Township.

  A petition was filed in 1975 asking for the waterway to be cleaned out. The records do not show that this was done.

  A report on the Lateral A system in 1989 by Etler Engineering found the surface drain in terrible condition, barely able to convey any water and providing very limited relief to only those lands which can surface drain directly to it. It was noted at the time that no funds for ongoing maintenance and upkeep had been allocated, and even though the surface drain was cleaned out at that time, it would certainly need maintenance again relatively soon. This 1989 report recommended abandonment of the waterway if the Lateral A tile were either improved, or if an open ditch was constructed instead.

  Another report by Jacobson-Westergard in 2013 found the surface drain silted in and non-functional, requiring an extensive cleanout again.

A cursory analysis suggests that most of the waterway has silted in again by approximately 0.5' since the 2013 repair. Significant water was observed standing in the waterway during our survey.

Existing Sizes and Capacities

The overall utility of the system is defined by the hydraulic performance for each section, which includes pipe diameter, grade, drainage coefficient, and the percentage relative to the modern standard drainage coefficient (½ in/day). The table below provides a summary of these key attributes for each section of the tile system.

DD 61 Lateral A and Lateral A4 Existing Tile Capacity				
Section Name	**Diameter (inches)**	**Grade (%)**	**Drainage Coefficient (in/day)**	**Percentage of Modern Standard**
Lateral A (Stations 0+00 → 143+00)	30	0.04	0.06	12%
Lateral A (Stations 143+00 → 148+00)	28	0.04	0.07	14%
Lateral A (Stations 148+00 → 164+00)	22	0.11	0.10	20%
Lateral A (Stations 164+00 → 188+00)	20	0.12	0.09	18%
Lateral A (Stations 188+00 → 205+00)	18	0.14	0.09	18%
Lateral A (Stations 205+00 → 242+00)	18	0.10	0.11	22%
Lateral A (Stations 242+00 → 244+00)	16	0.10	0.10	20%
Lateral A (Stations 244+00 → 274+00)	14	0.14	0.10	20%
Lateral A4 (Stations 0+00 → 24+50)	16	0.08	0.15	30%
Lateral A4 (Stations 24+50 → 32+00)	15	0.08	0.16	32%
Lateral A4 (Stations 32+00 → 37+00)	12	0.08	0.14	28%
Lateral A4 (Stations 37+00 → 55+00)	10	0.12	0.11	22%
Lateral A4 (Stations 55+00 → 63+00)	8	0.30	0.15	30%

DD 61 Lateral A Other Laterals Existing Lateral Tiles Capacity				
Section Name	**Diameter (inches)**	**Grade (%)**	**Drainage Coefficient (in/day)**	**Percentage of Modern Standard**
Lateral A1 [1]	8	0.40	0.26	52%
Lateral A2 [2]	12	0.12	0.16	32%
Lateral A3	10	0.10	0.10	20%
Lateral A5	18	0.12	0.13	26%
Lateral A6	8	0.10	0.14	28%
Lateral A7	8	0.16	0.14	28%
Lateral A8	10	0.15	0.18	36%
Lateral A9	10	0.13	0.11	22%
Lateral A10	8	0.10	0.10	20%
Lateral A11	10	0.08	0.15	30%

[1] Coefficient increased due to nearly 100 acres tiled east, out of the district.

[2] Appears to have been paralleled or replaced privately in spring 2026.

Proposed Project

Project Design

As the engineer tasked with designing the drainage district tile system, we followed established standards from the American Society of Agricultural and Biological Engineers (ASABE), the Natural Resources Conservation Service (NRCS), and Iowa State University Extension and Outreach.

The drainage coefficient, the amount of water in inches per day that the system is designed to remove from the land, is the key factor in tile main design. Typical recommended values range from ⅜ to 1 inch per day, depending on soil type, topography, and crop needs. This system was designed to achieve a drainage coefficient of ½ inch per day, which is the standard recommendation for Iowa's mineral soils under row crop production, as outlined in the Iowa Drainage Guide. A 1" drainage coefficient was considered due to the number of depressional areas with surface intakes within the watershed; however, practically this would require the construction of an open ditch.

Pipe grade (or slope) is crucial in determining the correct tile size. A steeper grade allows for greater flow capacity, enabling the use of smaller diameter pipes, while flatter grades require larger pipe to maintain the same capacity. Manning's equation, using a roughness coefficient of 0.012 (consistent with SUDAS, NRCS and ASABE standards for smooth-walled plastic pipe and RCP), was used to size the tile based on this relationship.

Proposed Improvements

We are proposing a tile improvement project designed to bring the Lateral A tile up to the modern ½ inch per day Drainage Coefficient (D.C.) standard that it needs. In addition, a plan is proposed to upgrade Lateral A4 as requested by the petition.

Lateral A Tile

The proposed Lateral A tile will outlet into the open ditch in the NW¼ NW¼ of Section 23 of Fern Valley Township at elevation 1160.00, which is approximately 1.0 feet above the flowline of the ditch in this area, and about equal with the existing Lateral A tile outlet. From the outlet, the tile runs westerly, generally parallel to the existing district tile. It continues west to northwest to near the center of Section 9 before turning north to 400th St. Here it turns northwesterly again, generally following the existing tile, crossing the railroad and highway before terminating near the center of Section 32 in Fairfield Township. The proposed route generally follows the natural surface drainage pattern of the district, paralleling the existing tile while straightening the alignment where feasible to improve grade and reduce construction costs.

Lateral A4

The proposed Lateral A4 connects to the proposed Lateral A tile at Station 132+76 and proceeds in an east-northeast direction, closely following the private surface drain. Its terminus is at the same location as the existing Lateral A4. Once again, the route generally follows the natural drainage pathway, straightening the alignment where feasible to reduce costs.

The tile sizes and grades of the proposed tiles are listed in the table below:

Proposed Tiles Size and Grade		
Section Name	**Diameter (inches)**	**Grade (%)**
Lateral A (Stations 0+00 → 47+00)	60	0.070
Lateral A (Stations 47+00 → 82+00)	60	0.058
Lateral A (Stations 82+00 → 113+00)	60	0.042
Lateral A (Stations 113+00 → 132+76)	60	0.040
Lateral A (Stations 132+76 → 151+00)	48	0.055
Lateral A (Stations 151+00 → 173+00)	36	0.155
Lateral A (Stations 173+00 → 207+50)	36	0.115
Lateral A (Stations 207+50 → 220+00)	36	0.060
Lateral A (Stations 220+00 → 232+50)	30	0.150
Lateral A (Stations 232+50 → 259+12)	24	0.200
Lateral A4 (Stations 0+00 → 20+00)	24	0.110
Lateral A4 (Stations 20+00 → 34+00)	18	0.120
Lateral A4 (Stations 34+00 → 40+00)	15	0.240
Lateral A4 (Stations 40+00 → 50+91)	15	0.150

Existing Tiles

The existing Lateral A and A4 tiles are proposed to be replaced in their entirety by the proposed Lateral A and A4 tiles. If replacement tiles are built, we recommend formal abandonment of the existing Lateral A and A4 tiles. A Board resolution would abandon them, transferring ownership to the individual landowners on whose ground they rest. The new tile is designed and sized as a complete replacement of the 110-year-old existing tile. In our opinion, the district would be better served by not funding maintenance of a tile so old and undersized.

Lateral A Surface Drain

If the new tile is built as proposed, we recommend abandonment of the Lateral A Surface Drain, pending discussion from landowners. As noted by Etler Engineering in their 1989 report, the surface drain is contributing very little overall to the effective drainage of Lateral A. That report also recommended abandonment if a new tile was constructed. If a large new main tile with 0.5" per day coefficient is built, it is our opinion that the waterway would be superfluous and an unnecessary ongoing maintenance burden, and it should be abandoned as a district facility.

In addition, the waterway already presents issues with adequate cover over the proposed tile in certain places where they cross. It would be inadvisable to deepen the waterway more than it already is if this proposed tile is installed.

Alternate Open Ditch

An open ditch would be less expensive from a pure construction cost perspective, however ancillary costs such as right-of-way acquisition, farm severance payments, new road crossings, permitting delays, future cleanouts and maintenance would likely bring the cost to a roughly comparable level with the proposed tile. In addition, the district has considered extending the Main Open Ditch several times in the past 100 years and each time has elected not to do so.

If there is interest in pursuing an open ditch, we can provide plans and an itemized cost estimate.

Preliminary Plans

The proposed construction plans are enclosed with this report. These plans serve as a guide for the contractor and outline the expectations and standards for construction. Included in the plans are the proposed work limits and specific work expected to take place on each landowner's property. The plans also contain profile views showing

the proposed depth of the existing and proposed tile. These plans are considered preliminary and may be refined prior to final bidding.

Construction Considerations

Pipe Construction Methods
Drainage district pipe will be installed using open-cut excavation and follow Iowa SUDAS standards for storm sewers and culverts. Either reinforced concrete pipe (RCP) or plastic dual-wall pipe (HDPE) may be used, depending on cost, size, and conditions.

Topsoil will be stripped and set aside for final backfill. For RCP, where possible, a shaped "spoon bed" will be used for support without requiring rock. For large HDPE, crushed stone will be placed around the pipe per SUDAS standards.

RCP will be laid in sections and curved using slight joint offsets. Large HDPE will be installed in straight runs with elbows for turns, and joints fused or coupled. Grade and alignment will be controlled using laser or GPS equipment.

Trenches will be backfilled to match the original ground level, and the topsoil will be replaced and seeded with a cover crop to prevent erosion. No compaction testing is required for open-trench backfill outside of road crossings. At road crossings, backfill will be placed in 8-inch lifts and compacted to 95% Standard Proctor density, with density testing and engineer spot-checks as required by the plan notes.

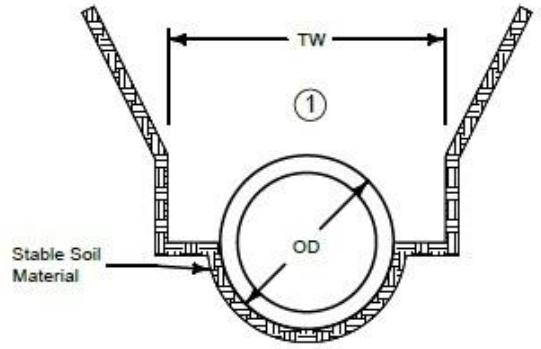
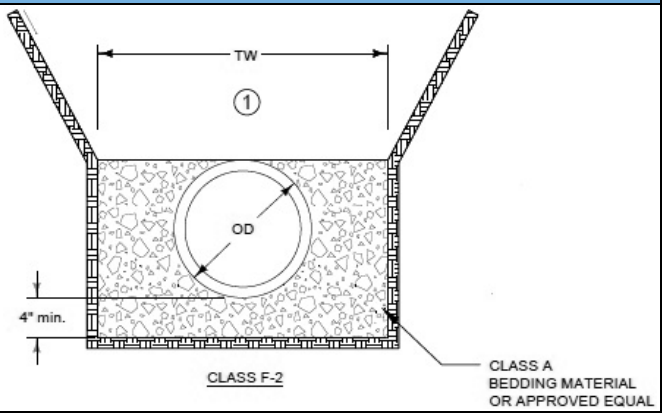
HDPE pipe will be tested after backfilling to ensure it has not deformed beyond 5%. RCP will be visually inspected for joint tightness and alignment. All work will be documented and final as-built plans provided.

Pipe Material Comparison
For the drainage district project, both reinforced concrete pipe (RCP) and plastic dual-wall pipe (HDPE) will be included in the bid package so the final selection can balance cost and performance based on site conditions, following Iowa DOT and SUDAS specifications.

- **Reinforced Concrete Pipe (RCP):**
  - Stiff and durable, supporting heavy loads in poor soils.
  - Expected design life over 100 years, resistant to corrosion and abrasion.
  - Can be installed using native soil for bedding, reducing material costs, and simplifying construction.
  - Can handle gentle curves without extra fittings.

- **HDPE Plastic Pipe:**
  - Lightweight, easier to handle, with a design life of about 50 years.
  - Requires granular (rock) bedding, increasing trucking, compaction, and quality control needs.
  - Prefabricated elbows and straight runs limit alignment flexibility.

While RCP has a higher material cost, it can reduce installation complexity and long-term maintenance. HDPE may be cheaper initially but demands more oversight and bedding materials. The final choice will depend on soil conditions, alignment requirements, and balancing initial versus long-term costs.

Typical RCP Installation	Typical HDPE Installation
	

Related Construction Methods
The following are common additional items for a tile project:

- **Tile Connections**
  Private tiles will be connected to the new district tile using Inserta-Tees for a secure fit. Disturbance will be minimized, with 3 tons of rock used for backfilling. Each connection will be documented with a photo and marked on the final plans.

- **Elbows**
  HDPE requires elbows for changes in direction, as it must be laid in straight runs. RCP can curve slightly without fittings. Elbows have a slightly reduced flow capacity by comparison.

- **Reducers**
  Reducers connect pipes of different sizes. RCP reducers will be precast; HDPE reducers will be fused or coupled. All will be bedded in rock.

- **Intakes**
  15" Hickenbottom or Bar Guard intakes will be placed in road ditches, and 15" Bar Guard intakes on property lines. These intakes let ponded surface water enter the system and allow visual inspection of the tile.

- **Bedding Rock**
  HDPE pipe requires rock bedding (crushed stone or gravel) from 4 inches below the pipe to the top. RCP will use shaped native soil ("spoon bed") and typically will not need rock. Rock is used in poor soil conditions and to bed fittings and connections.

- **Pollution Control**
  The contractor will be responsible for minimizing pollution and erosion during construction, under the engineer's direction.

- **Seeding**
  The 100-foot-wide work area will be seeded with a cover crop after construction to reduce erosion, improve soil health, and break up compaction. Landowners may terminate the cover crop at their discretion.

- **Tile Exploration**
  Existing district tiles will be located and exposed to ensure proper alignment and connections. Each will be measured, marked, and documented.

- **Removal of Fence**
  Fences crossed during tile installation will only be replaced if used for pasture. Four pasture fences are known; others will not be replaced unless landowners submit a written request before project approval.

- **Single Wall Corrugated Plastic Tile**
  If a private tile connection is far from the main line, single-wall plastic tile will be installed to reach it. These extensions will be noted on the plans and photographed.

- **Driveway Restoration**
  If a landowner's driveway is used for access, approximately 12 tons of rock will be placed to protect it during construction. Once the project is complete, the driveway will be regraded to its original condition. Photos will be taken before and after to document the work.

- **Mobilization**
  Mobilization includes transporting equipment and materials to the site, setting up access, and preparing staging areas. After work is complete, all equipment will be removed and the site cleaned up.

Proposed Road Crossings

The proposed Lateral A Tile will cross four gravel roads, two pavement roads, and one railroad. Typically, gravel roads are crossed by open cutting and repairing the road rather than boring. We propose including a 15" intake in each road ditch and at the ROW lines beside the railroad. These will intake water, function as inspection ports, and allow pressure relief. Under Iowa Code §468, the cost of road crossings is the responsibility of the entity that controls the road. A table of all crossings is provided below.

Proposed Road Crossings				
Control Entity	**Road**	**Facility**	**Tile Size (inches)**	**Method**
Palo Alto County	560th Ave	Lateral A	60"	Open Cut
Palo Alto County	555th Ave	Lateral A	60"	Open Cut
Palo Alto County	410th St	Lateral A	60"	Open Cut
Palo Alto County	400th St	Lateral A	36"	Open Cut
Palo Alto County	540th Ave (N60)	Lateral A	38"	Trenchless
Canadian Pacific Railroad	Railroad	Lateral A	32"	Trenchless
Iowa DOT	US Hwy 18	Lateral A	32"	Trenchless

The proposed Lateral A4 tile does not cross any roads.

Existing District Tile

If a new tile system is installed, we recommend that the old district tile being replaced remain in place, but no longer be maintained by the district. It will be connected to the new tile about every 1,000 feet to serve as a collector, which reduces the number of connections needed and saves the district money. Because the old tile would no longer be a district responsibility, individual landowners will take over ownership and maintenance on their properties.

Utility Conflicts and Coordination

A Design One Call was completed on August 5, 2026, identifying electrical, telecom, and gas pipeline utilities within the project area as shown on the preliminary plans. All are located within existing public road rights-of-way except the gas pipeline in Section 9.

Under Iowa Code §468.186, utilities within a drainage district's right-of-way must accommodate drainage work. The district's tile system predates the utilities, so any necessary utility relocation must be done at the utility's expense.

Before construction begins, the contractor will complete a Construction One Call to ensure all utilities are properly located and marked, helping prevent conflicts and maintain a safe worksite.

Construction Timeline
If approved, we anticipate the work to bid this winter with a completion date of likely March 2028. While contractors must finish all work by this deadline, they are free to choose their own construction schedule.

The timeline is intentionally flexible to attract more qualified contractors and encourage competitive bidding, which can lower project costs. Some contractors prefer summer work due to better weather, while others choose winter work to avoid crop damage when fields are dormant.

Estimated Costs and Analysis

Cost Estimate
The total estimated cost for all proposed work is $5,249,000. This figure includes all anticipated construction activities, damages, engineering services, and administrative expenses. The breakdown is as follows:

Activity	Cost
Lateral A Construction	$3,558,000
Lateral A4 Construction	$300,000
Palo Alto County Secondary Roads	$239,000
Iowa DOT	$164,000
Canadian Pacific Railroad	$210,000
Engineering, Admin, & Legal	$212,500
Construction Damages	$159,000
Reclassification	$17,500
Interest	$389,000

This is a preliminary engineer's estimate, prepared for planning purposes. Costs are based on recent bid tab data from comparable projects and include allowances for contingency and administrative expenses. Final construction costs will depend on market conditions at the time of bidding and may vary from this estimate.

A detailed itemization of costs for Lateral A and A4 is provided in Appendix M.

Historical Cost Comparison
The estimated project cost to landowners for the proposed Lateral A tile is approximately $1,170 per acre. We provided a table below comparing that cost to historical estimated costs of construction assessed to landowners.

Drainage District No. 61-A Historical Cost Comparison					
Year	Avg. Assessment Per Acre	Avg. Land Value Per Acre	Assessment Relative to Land Value	Avg. Revenue Per Acre for Corn Crop	Assessment Relative to Yearly Corn Revenue
1914*	$9	$89	10%	$16	56%
1989	$339	$1,446	23%	$293	116%
2025	$1,170	$12,504	9%	$899	130%

*1914 prices estimated using statewide corn yield, and 1913 land values.

For a true apples-to-apples comparison, we evaluated the estimated landowners' pipe-only construction costs for the proposed main tile improvements using modern materials, methods, and cost data for the 1914 and 1989 design in comparison to the current proposed design. The proposed design today achieves the 0.5" drainage coefficient by straight-lining the plan to shorten the overall length. This shortening increases the grade available allowing for a smaller pipe size than the 1989 design that was intended to parallel the original design.

Modern Cost Figures Comparison (Lateral A Tile Construction Only)		
Year	**Pipe Construction Costs as Percent of 2026 Proposed**	**Drainage Coefficient Percent of Recommended**
1914	52%	12%
1989	137%	100%
2026	100%	100%

Assessment Schedule Review

Any costs to the district are shared by landowners based on the benefit their property receives. To ensure fairness, an assessment schedule is maintained so all expenses are allocated proportionally to the level of benefit each parcel gains from the drainage system.

The current assessment schedule was adopted in 1990. As is now customary, all major laterals were given independent schedules. If landowners choose to move forward with an improvement project, Iowa law requires the district to be reclassified so costs are shared fairly based on the benefits each parcel receives. Maintenance schedules for laterals not improved will remain unchanged. The original schedule is included in Appendix N.

Under Iowa Code §468.38, the Board of Trustees will appoint an engineer and two neutral landowners to serve as reclassification commissioners. This team evaluates all land in the district and assigns a value based on the drainage benefit, not on market value, ownership, or acreage. For example, low-lying and wet farmland near the tile typically receives the highest value (set at 100), while steeper or more distant land receives proportionally lower values. Roads, farmsteads, and non-farm areas are also evaluated based on how much they benefit from drainage.

Today, tools like LiDAR mapping, soil surveys, aerial photos, and GIS data make this process much more accurate and fairer than when the original schedule was created. Field checks and on-site visits may also be used. Once complete, the proposed classification is shared with landowners and reviewed at a public hearing before it is finalized.

As part of reclassification, we also identify any land outside the current district boundary that benefits from the system but is not being assessed. If surface or subsurface drainage from nearby land flows through district tile, those parcels are benefiting and may be annexed into the district under Iowa Code § 468.119. Annexation ensures all landowners who benefit share in the cost. Affected landowners will be notified and have a chance to speak at a public hearing before any changes are made.

Estimated reclassification maps for Lateral A and A4 are included in Appendix O to provide an updated view from the existing 1990 schedule. These maps are for planning and estimation purposes only and are not a formal reclassification. The commission may adjust, modify, or reject this estimate, and it should not be considered a guarantee of final assessments.

Installment Payment Options
Under Iowa drainage law, landowners who are assessed for substantial improvements may be eligible to pay their assessment over time. The Board of Trustees may authorize an installment payment plan with interest, allowing landowners to repay the assessment in annual installments of not less than ten nor more than twenty years.

To take advantage of this option, a formal waiver request must be submitted. There is no penalty for early repayment, and landowners who wish to avoid interest may pay the full amount up front or consider private financing alternatives.

Economic Benefit
Every farm is different, and each landowner's financial situation is unique. This section is meant to provide a starting point, not a guarantee, so landowners can evaluate whether drainage improvements make sense for their operation. We have reviewed reliable university research and used available tools to estimate the potential benefits, but actual results will depend on individual field conditions.

Most of the economic benefit from tile drainage comes from higher yields and increased land value. According to Iowa State University Extension's Understanding the Economics of Tile Drainage (2023), tile drainage can increase corn yields by 10–20 bushels per acre and soybean yields by 4–8 bushels per acre, depending on soil and weather.

Using ISU's Excel-based calculator, we estimate a blended annual return of roughly 8.3% on a $1,170/acre drainage investment under a 50/50 corn and soybean rotation, assuming $4.51 corn and $10.96 soybean commodity prices. This calculator, along with our example, is available in Appendix P, and the tool itself may be accessed at: extension.iastate.edu/agdm/wholefarm/xls/c2-90tilinganalysis.xlsx. We have included a table summarizing the estimated returns assuming a 50/50 corn and soybean rotation below:

Drainage District No. 61 Lateral A Economic Analysis (Iowa State University Calculator)		
Avg. Assessment Per Acre	**Avg. Increased Revenue per Year**	**Estimated Annual Rate of Return**
$1,170	$97	8.3%

The publication also notes important secondary benefits such as earlier planting and harvesting windows, reduced compaction, and more timely field operations. These factors can improve efficiency and reduce risk, especially in wetter growing seasons.

We also reviewed a 1983 ISU study (Drainage Needs and Returns in North-Central Iowa). It found that very poorly and poorly drained soils, like those covering about 59% of District No. 61, can lose up to 32% of their yield potential without proper drainage. Installing tile in these areas often showed strong economic returns, with benefit-cost ratios greater than 1. However, returns were lower in somewhat poorly drained soils, so prioritizing the worst-drained areas offers the best value. We included the estimated yield table below. Please note corn and soybean yields were much lower in the 1980s than they are today.

	Poor Drainage (Less than ¼" Drainage Coefficient)		**High Drainage (½" Drainage Coefficient)**		**Percent Increase**	
Soil Drainage Class	**Corn Yield (bu/acre)**	**Soybeans Yield (bu/acre)**	**Corn Yield (bu/acre)**	**Soybeans Yield (bu/acre)**	**Corn Yield**	**Soybeans Yield**
Very Poorly Drained	28	12	123	48	339%	300%
Poorly Drained	80	31	121	47	51%	52%
Somewhat Poorly Drained	90	34	124	48	38%	41%

The Iowa State 1983 study also points out that many existing drainage systems in the region, installed between 1900 and 1915, are outdated and inadequate by modern standards. These aging district mains are often the bottleneck of the drainage system: the study estimated that while 69% of private on-farm drainage in the region was adequate, the district outlets those systems depend on were not.

To estimate the potential crop yield benefits of the proposed drainage improvement, a hydrologic analysis was performed using the Drain Tool developed by Michigan State University (https://dsiweb.cse.msu.edu/DrainToolApp/). This tool runs DRAINMOD simulations over a 31-year climate record (1995–2025), calculating crop yield impacts from three stress factors: planting delay, excess soil water stress, and drought stress, each expressed as a percentage of maximum potential yield. The existing condition was modeled at a drainage coefficient of 0.06 inches per day, representing the current district tile capacity, and compared against a design coefficient of 0.5 inches per day. Using potential yields of 250 bushels per acre for corn and 70 bushels per acre for soybean, the model estimates an average yield increase of 63 bushels per acre for corn and 13 bushels per acre for soybean. The year-by-year results, included as a chart in Appendix Q, show that gains are concentrated in wet years when excess soil water is the dominant stress. The revenue figure in the table below reflects the Drain Tool's own internal yield and price weighting applied across the simulation period, and is therefore lower than a simple average of the corn and soybean yield gains multiplied by current commodity prices.

Drainage District No. 61 Lateral A Economic Analysis (Michigan State University Calculator)		
Avg. Assessment Per Acre	**Avg. Increased Revenue per Year**	**Estimated Annual Rate of Return**
$1,170	$177	15.1%

A 2026 Iowa State University study looked at five drainage districts in north-central Iowa that recently upgraded their main outlets to modern standards. Using satellite images taken after major rainstorms, the researchers compared improved districts to nearby unimproved ones. Ponded acres dropped by an average of 87% after the upgrades, and the projects paid for themselves in about 18 years on average based on reduced ponding alone, before accounting for the broader district-wide yield gains the researchers also documented (up to 10% for corn and 12% for soybeans).

We used the same satellite method to look at DD 61-A on June 29, 2018 after a 5” rain in the previous 10 days. The satellite image showed 24 acres of ponding. An MNDWI (Modified Normalized Difference Water Index) map (Appendix R) illustrates the analysis. Areas with higher MNDWI values, even those still below the ponding threshold, indicate wetter surface conditions, including saturated soils and stressed crop canopies where wet ground shows through thin or struggling stands. These are the acres where outlet capacity improvements are most likely to drive yield gains. The Iowa State researchers stressed that most of the yield benefit from improvements comes from these less-visible effects spread across the entire district, not just from eliminating the few obvious ponded spots.

Long-term research from Ohio State University (1984–2009) showed the value of tile drainage. Corn yields rose by 24–39% and soybeans by 12–45% on tiled fields. Benefit-cost ratios ranged from 1.7:1 to 3.1:1, with newer models suggesting returns as high as 3:1 to 4:1. This means $3–$4 in value for every $1 spent on tile.

Taken together, these four sources bracket the expected return rather than contradict one another. The Iowa State Extension figures (10–20 bushels per acre for corn) reflect typical new tile installed on ground that already has a functioning outlet, and produce the most conservative estimate at roughly an 8% annual return. The Michigan State model returns a substantially higher figure (63 bushels per acre for corn, roughly a 15% annual return) because it models the district's actual situation, moving from an outlet delivering 0.06 inches per day to a designed 0.5 inches per day, rather than a modest incremental upgrade. The 2026 Iowa State satellite study and the long-term Ohio State research fall between these bounds, indicating payback periods of roughly 18 years from reduced ponding alone and benefit-cost ratios of 1.7:1 to 3.1:1 once district-wide yield gains are included. We have

included “Twenty Benefits of Drainage” prepared by the Ohio State Extension highlighting yield and non-yield benefits of drainage in Appendix S.

Drainage is a major investment, and the decision is personal. The data and tools in this report are meant to help landowners get started. We encourage landowners to use the Iowa State calculator or Michigan State Drain Tool with their own numbers and consider how improved drainage could benefit their farm’s productivity, value, and long-term resilience. To get a better sense of their own farm’s potential, we recommend comparing yield maps of well-drained and poorly drained areas. These maps can help estimate potential gains from new tile. If landowners are interested, we can help create overlays that combine yield data, soil types, and proposed tile layouts. These tools help guide a landowner’s decision but should be viewed as estimates, not guarantees.

Taxes
While the district is not authorized to provide tax advice, landowners are encouraged to consult with their accountant or tax advisor to determine whether drainage assessments or related improvements may be deductible or eligible for depreciation under current tax laws.

Permitting

US Army Corps of Engineers (USACE)
A Section 404 permit is required only when work places dredged or fill material into a "water of the United States," which is limited to relatively permanent streams, lakes, and wetlands directly connected to them. The receiving channel here is a constructed agricultural drainage ditch and does not qualify as a federally regulated water. The proposed work therefore does not require a Section 404 permit from the Army Corps of Engineers or a related Section 401 water quality certification.

Iowa Department of Natural Resources (DNR)
The new drainage district tile is a buried linear utility, which is exempt from Iowa DNR floodplain permitting under 567 IAC 71.4(4) as long as the natural channel contours are restored after construction. Any minor outlet work falls well below the regulatory thresholds for excavations and obstructions in rural areas, and the receiving channel is not a designated Protected Stream. No state floodplain permit is therefore required for the proposed work.

USDA Wetland Conservation Compliance (Swampbuster)
As part of federal conservation compliance requirements under the Food Security Act of 1985, any landowner participating in USDA programs including crop insurance, commodity payments, or CRP must obtain a valid Certified Wetland Determination from the Natural Resources Conservation Service (NRCS) before undertaking drainage improvements that may affect wetland areas. These determinations identify areas that meet federal criteria for wetland protection based on hydric soils, vegetation, and hydrology.

It is the landowner’s responsibility to ensure their compliance with NRCS requirements. Affected landowners have been encouraged, via letter sent on February 18, 2026, to request a determination as early as possible. This proactive step helps avoid future conflicts, particularly if a tile improvement project affects areas that may qualify as wetlands under federal definitions.

Water Quality Recommendations

Conservation Practices
Farmers in Palo Alto County have made steady progress in adopting conservation practices that protect soil health and improve water quality. While most conservation measures aim to reduce in-field erosion, they also provide well-documented benefits to downstream water systems.

As of 2025, about 26,000 acres, roughly 7% of the county's farmland, are enrolled in the Conservation Reserve Program (CRP). These areas are planted with perennial vegetation to reduce erosion, slow runoff, and filter nutrients before they reach nearby waterways. Many include riparian buffers, filter strips, or wetland restorations, which help protect drainage outlets and reduce the movement of sediment and nutrients downstream.

In-field practices like no-till and cover crops have also expanded steadily. Between 2017 and 2022, no-till acres increased from 10,455 to 16,430 acres, while cover crop use grew from 3,777 to 7,653 acres. These practices improve water infiltration, limit erosion, and help retain nutrients in the soil, particularly during snowmelt and heavy rains.

Iowa Nutrient Reduction Strategy

Iowa's Nutrient Reduction Strategy (NRS) aims to reduce nitrogen and phosphorus runoff from farmland using a combination of in-field practices (cover crops, nutrient management, reduced tillage) and edge-of-field practices (wetlands, bioreactors, controlled drainage).

Effectively designed drainage works with the NRS by moving water efficiently while allowing nutrient-reducing practices to function effectively. For example, drainage paired with controlled outlets or bioreactors can capture and treat nutrients before they leave the field. Appendix T includes a table of potential practices that can be used alongside drainage improvements, showing options to meet nutrient reduction goals while maintaining productivity and soil health. If any landowner is interested, we can provide a copy of the spreadsheet for use on their farm.

Edge-of-Field Practices

- **Buffer Strips**
  Grass buffer strips along streambanks and ditches are one of the most effective ways to intercept runoff. These vegetated zones filter sediment, absorb nutrients like nitrogen and phosphorus, and reduce pesticide transport. They also stabilize stream banks, minimize erosion, and provide habitat for pollinators and wildlife.

- **Grassed Waterways**
  For fields with concentrated flow paths, grassed waterways help prevent gully formation and safely carry runoff away from cropland. Their dense vegetation reduces water velocity, limits soil loss, and improves downstream water quality. University of Illinois research (2018) showed that grassed waterways decreased gully erosion by up to 75%.

- **Constructed Wetlands**
  Constructed wetlands are engineered systems designed to intercept surface or subsurface drainage before it enters ditches or streams. By slowing water flow, they promote the natural removal of nitrates through microbial activity in the soil. In addition to improving downstream water quality, these systems provide valuable habitat for aquatic life, waterfowl, and other wildlife.

- **Saturated Buffers and Bioreactors**
  Saturated buffers and woodchip bioreactors are designed to treat water from subsurface tile outlets before it reaches open water. Saturated buffers route tile water through vegetated riparian areas where soil microbes and plants naturally reduce nitrate levels. Bioreactors use buried woodchips to create an anaerobic zone that encourages denitrification.

  Research from Iowa State University (2016–2020) found that saturated buffers reduced nitrate concentrations in drainage water by 40–80%, while bioreactors achieved 20–40% nitrate reduction. Both options are effective tools for addressing nitrogen loss from tile-drained fields.

In-Field Practices

- **Cover Crops**
  Cover crops, such as cereal rye, clover, or radish, are planted after harvest to protect the soil during the off-season. Their root systems reduce erosion, improve soil structure, promote microbial activity, and capture residual nutrients, particularly nitrogen, before they leach into tile systems.

  A 2017–2021 University of Minnesota study found that cover crops reduced nitrate leaching by 30–60% in tile-drained fields and increased soil organic matter by 0.5–1% over five years, supporting both environmental and agronomic benefits.

- **Conservation Tillage or No-Till**
  Reducing tillage helps maintain soil structure, increase organic matter, and reduce erosion and runoff. Better soil structure improves water infiltration, and crop residue left on the surface protects the soil during rainfall events.

  An Ohio State University study examining conventional tillage, no-till, and strip-till systems found that conservation tillage performed best when paired with subsurface drainage. No-till and strip-till fields retained higher soil structure and moisture balance, reduced erosion, and improved crop trafficability. In drained fields, corn-soybean rotations under no-till produced the highest yield benefit, while continuous corn also showed consistent improvements. The study concluded that subsurface drainage not only improved yields directly but also enhanced the effectiveness of conservation tillage systems by improving field conditions.

- **Precision Nutrient Management**
  Precision agriculture tools like soil sampling, yield mapping, and variable rate technology (VRT) allow targeted application of fertilizers and pesticides. This approach reduces the risk of nutrient runoff, improves fertilizer use efficiency, and increases profit margins by applying inputs only where they are needed.

- **Diversified Crop Rotations**
  Rotating corn and soybeans with small grains (e.g., oats or wheat) or forage crops can improve soil health, break pest and disease cycles, and reduce nitrogen imbalances. These rotations increase biological diversity in the field and may open fresh marketing opportunities or enhance farm resilience. A 2019 Kansas State University study reported that diversified rotations reduced nitrogen leaching by 20–30% and improved soil health metrics by 15–25%.

- **Split Nitrogen Applications and Stabilizers**
  Applying nitrogen in multiple smaller doses throughout the growing season, instead of a single application, reduces the chance of leaching. Using nitrogen stabilizers or inhibitors further minimizes loss by keeping nutrients in forms more available for plant uptake.

Cost-share funding is often available to help implement these practices. The Iowa Agriculture Water Alliance hosts an online tool- https://costsharecompare.com/ where landowners can search for financial assistance by ZIP code, compare multiple programs, and identify opportunities to stack funding sources for greater return on investment.

Well-maintained drainage systems improve field conditions for conservation by reducing compaction and allowing timely planting, while conservation practices help drainage systems by limiting sediment buildup and nutrient loading. Although the Drainage District cannot require conservation measures, we strongly encourage landowners to work with their local NRCS office to explore available options. In-field and edge-of-field practices

can reduce erosion, improve water quality, lower input costs, and support long-term soil health. Many are backed by research and may qualify for financial assistance through programs like EQIP, CSP, and the Iowa Water Quality Initiative.

Maintenance and Long-Term Management

Warranty Period
It is common for tile connections to be missed or for other issues to arise during or shortly after construction. To address this, the drainage district will maintain a one-year warranty with the contractor to cover construction-related errors or unforeseen problems. If a landowner observes an issue during this period, they should contact the county Drainage Admin so the district can investigate and coordinate any necessary repairs.

Work Orders
After the one-year warranty period expires, any repairs must be initiated through a formal work order. A landowner may submit a work order to the county Drainage Admin to request repairs to the district system. Common issues include tile blowouts, collapsed outlets, bank erosion, or obstructions such as beaver dams.

Once a work order is reviewed and approved, a contractor will be assigned to complete the repair. The drainage district will pay the contractor's invoice, and the cost will be shared among landowners based on the existing assessment schedule. This process ensures that maintenance is handled in a timely, fair, and consistent manner.

Landowner Considerations

Public Input
On February 18, 2026, a letter was mailed to all landowners in the district notifying them of the ongoing improvement study, inviting them to a public informational meeting, and requesting any information relevant to drainage conditions within the district. A public informational meeting followed on March 24, 2026, at the Election Center, 1302½ Broadway St, Emmetsburg, Iowa, where landowners had the opportunity to meet with the engineer, ask questions, and provide input. A copy of the letter for that meeting is included in Appendix U.

Public Hearing on Report
A public hearing will be scheduled to review this engineer's report and the proposed improvements. Per Iowa Code § 468.14, all landowners in the district will be notified by mail, and notice will also be published in a local newspaper. At the hearing, we will present our findings, proposed plans, and cost estimates, and will be available to answer questions and address concerns. Topics such as construction impacts and crop damages may also be discussed.

The Board of Trustees will conduct the hearing and may continue it to a later date if more discussion or information is needed. No decision can be made until the hearing is held and all landowner input is considered. This report may be amended as needed in response to feedback received during the hearing, ensuring transparency and meaningful participation.

Objections and Remonstrance
Landowners with concerns about the proposed improvements are encouraged to submit written objections before or during the hearing. Written submissions become part of the official record and help guide any revisions to the report.

Additionally, landowners may formally oppose the project through a remonstrance under Iowa Code § 468.126. A valid remonstrance requires written objections from a majority of landowners who collectively own more than 70% of the total land in the district, submitted before the hearing concludes. If a valid remonstrance is filed, the

Board cannot proceed with the project. Landowners pursuing this option should include their land holdings and clearly state their opposition in writing.

Landowner Construction Considerations
If the project is approved, construction will proceed through the standard public bidding process. A bid letting will be conducted to solicit competitive proposals, with the lowest responsible bid submitted to the Board of Trustees for approval. Prior to the start of construction, all affected landowners will be notified of the anticipated timeline and project scope. Work areas will be staked in the field and marked on the plans, and landowner cooperation, including preserving survey stakes and allowing access, will be essential to support efficient project execution.

Throughout construction, we will coordinate directly with the contractor and act as the primary point of contact for all landowners. To ensure clear and consistent communication, landowners will be asked to direct any questions or concerns to us rather than contacting the contractor directly.

Right-of-Way and Work Areas
Drainage districts have the legal authority to enter private lands to construct, maintain, or improve drainage systems, including both open ditches and subsurface tile. Landowners must allow reasonable access, and the district is responsible for minimizing disturbance and compensating for any damages, such as crop loss or soil compaction.

Open ditches require a formal ROW to allow for construction, future maintenance, and spoil placement. Subsurface tile mains, however, are usually installed and maintained without a formal ROW, relying on the district's statutory access rights. Landowners retain ownership of the land, but the district can access tile routes for maintenance, inspection, or improvements. The temporary construction work area is shown on the plans covering approximately 76.5 acres across 40 parcels (Appendix V). While work limits are shown in the engineering plans, they may shift slightly depending on final alignments. The actual area affected will be surveyed and documented after construction.

Construction Damages
In accordance with Iowa Code § 468.103, landowners are entitled to compensation for damages resulting from construction activities, including crop loss, soil disturbance, and impacts to land use.

The following recommendations are provided regarding crop damage compensation:

- **Yield and Price Calculation**
  For crops damaged during the growing season, we recommend using 110% of the five-year average county yield for the affected crop, multiplied by the average price received over the past 12 months. Both the yield data and average price are to be sourced from the Iowa State University Extension and Outreach and USDA-NASS databases.

- **Field Repair Work Compensation**
  In addition to crop losses during the growing season, we recommend payment for the following field work at rates consistent with the most recent Iowa State University Custom Rate Survey (per acre):
  - One pass of rock pickup
  - Two passes of tillage: one deep tillage and one shallow tillage

- **Soil Disturbance Compensation**
  Any construction activity will result in some degree of soil compaction and mixing between topsoil and subsoil. Preventative measures will be taken to minimize long-term impacts, including separating topsoil

from subsoil during excavation and seeding a diverse cover crop to promote soil recovery and health. However, we recognize that it will take time for the soil to fully heal.

To account for potential yield reductions during this recovery period, we recommend compensating landowners for 10% of the estimated yield loss over a five-year period. This compensation should be calculated using the same method applied for determining yield and price used elsewhere in this project.

- **Other Damages**
  Landowners may submit claims for any additional damages not accounted for in this recommendation prior to the completion hearing.

Crop damages and other construction-related compensation will be paid by the drainage district and funded through the assessment schedule. As a result, all landowners within the district, including those who incur damages, will share in the cost of these payments through their proportionate assessments. The Board of Trustees retains the authority to amend, approve, or deny any such claims. Final decisions regarding crop damages will be made at the completion hearing.

Completion Hearing
Upon completion of construction, a Completion Hearing will be held in accordance with Iowa Code § 468.101. This hearing gives landowners the opportunity to review the finished work, raise concerns about field conditions or project compliance, and submit any remaining claims for damages not previously addressed.

At the hearing, the Board of Trustees will consider all landowner input, evaluate whether the work has been completed in substantial compliance with the approved plans and specifications, and determine final compensation for any valid damage claims. The Board also has the authority to amend, approve, or deny claims based on the evidence presented.

All landowners within the district will be notified of the hearing in advance, as required by law, and are encouraged to attend to ensure their concerns are heard and properly documented before the project is closed out.

Conclusion and Recommendations

Conclusion
The Drainage District No. 61 Lateral A and Lateral A4 tiles have been found to be very restrictive and severely undersized, ultimately providing only 12% of the recommended drainage capacity, and failing to provide a quality outlet. To address this, we have developed a tile improvement plan for both tiles at an estimated total cost of $5,249,000. This plan is designed to meet the recommended drainage capacity and offers a long-term solution to improve drainage across the district.

Recommendations
We recommend that the Board accept the filing of this report and schedule a public hearing to formally present the findings and proposed improvements to all affected landowners. The hearing will provide an opportunity for landowners to raise objections, ask questions, and express concerns.

If there is sufficient support from the landowners at the hearing, we further recommend that the Board proceed with appointing an engineer to prepare detailed plans and specifications for the construction work.

If the Board of Trustees or landowners have any questions or concerns, please feel free to contact AgriVia at the phone numbers or emails listed.

Sincerely,

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DRAINAGE PETITION

TO: THE BOARD OF TRUSTEES OF PALO ALTO COUNTY, IOWA, ACTING ON BEHALF OF DD 61 Lat A & A4 DISTRICT IN PALO ALTO COUNTY, IOWA

COMES NOW, the undersigned Petitioners, being owners of the real estate in this drainage district and in making this petition for drainage relief for the drainage of said lands respectfully state to the Board of Trustees of Palo Alto County, Iowa:

1. That the lands of these petitioners are a part of and are included in DD 61 Lat A+A4 District, Palo Alto County, Iowa, and that said lands are assessed for drainage tax by virtue of the improvements in said district.

2. That the drainage facilities in their present condition in this district are not sufficient to properly drain the water from the lands of these petitioners as well as other lands; that such lands are subject to overflow, too wet for cultivation, and are subject to erosion and flood danger; that if the improvements in said drainage district were properly repaired or otherwise properly constructed to correct the current situation, the public benefit, utility, health and welfare would be promoted.

3. That these petitioners do not have exact knowledge or information as to the exact nature of the work to be done to correct the situation, but that these petitioners are of the belief that an investigation of the situation by a qualified independent engineer would determine the exact nature of the work required to provide adequate drainage for the lands of these petitioners and adjoining lands.

4. That these petitioners respectfully request that the Board of Trustees of Palo Alto County, Iowa, acting on behalf of DD 61 Lat A+A4 District, in Palo Alto County, appoint an independent qualified engineer to make the necessary investigation, report and survey in this situation.

5. That these petitioners, being the owners of lands which are a part of this drainage district, are entitled to adequate drainage from improvements in this drainage district for such lands.

6. That these petitioners are signing this petition pursuant to Section 468.126 of the Code of Iowa.

WHEREFORE, these petitioners respectfully request that the Board of Trustees of Palo Alto County, Iowa, acting on behalf of DD 61 Lat A +A4 District appoint an independent qualified engineer to investigate the drainage situation herein referred to with respect to petitioners' land and other lands; and that the board of trustees order that district facilities be improved, reconstructed, or repaired to provide adequate drainage relief for the lands of these petitioners and adjoining lands as above described.

Dated this 23rd day of December, 2025.

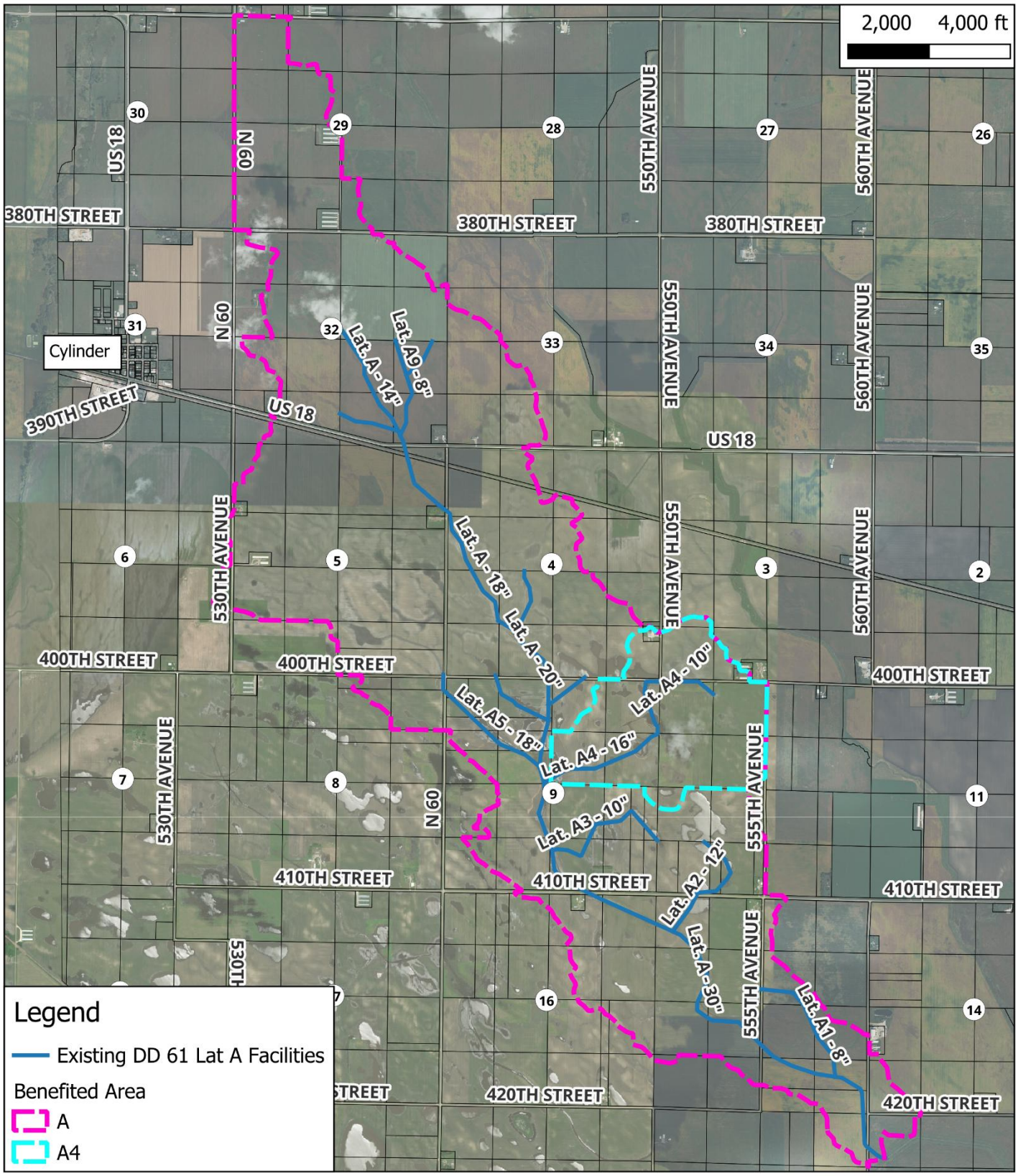
LANDOWNERS	DESCRIPTION OF LAND
[redacted] Jean Soper	Fern Valley
Soper Trust	Section 9
By: [redacted], Manager	NE4 & SE4
Sam Brownlee	
712-298-0082	

Lamy Besch
515-320-4720

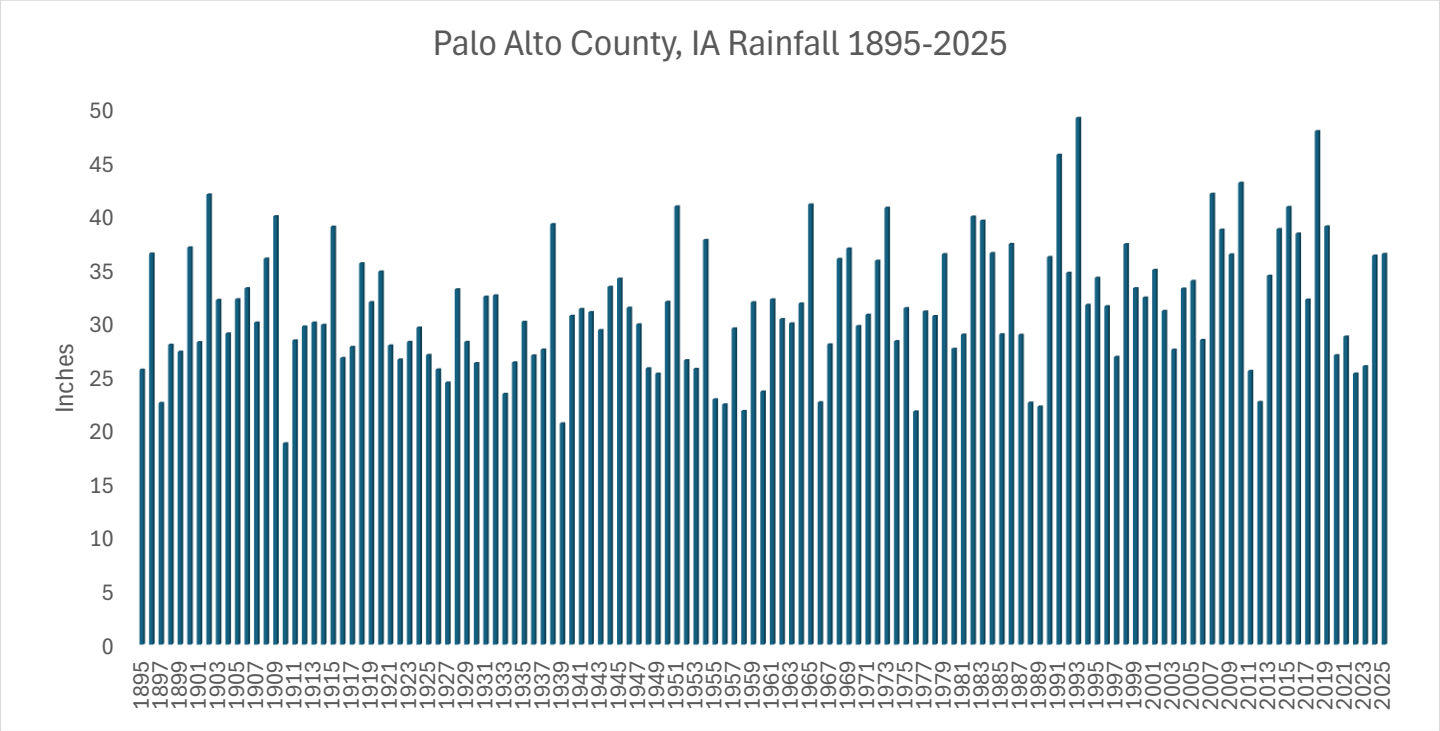
AgriVia

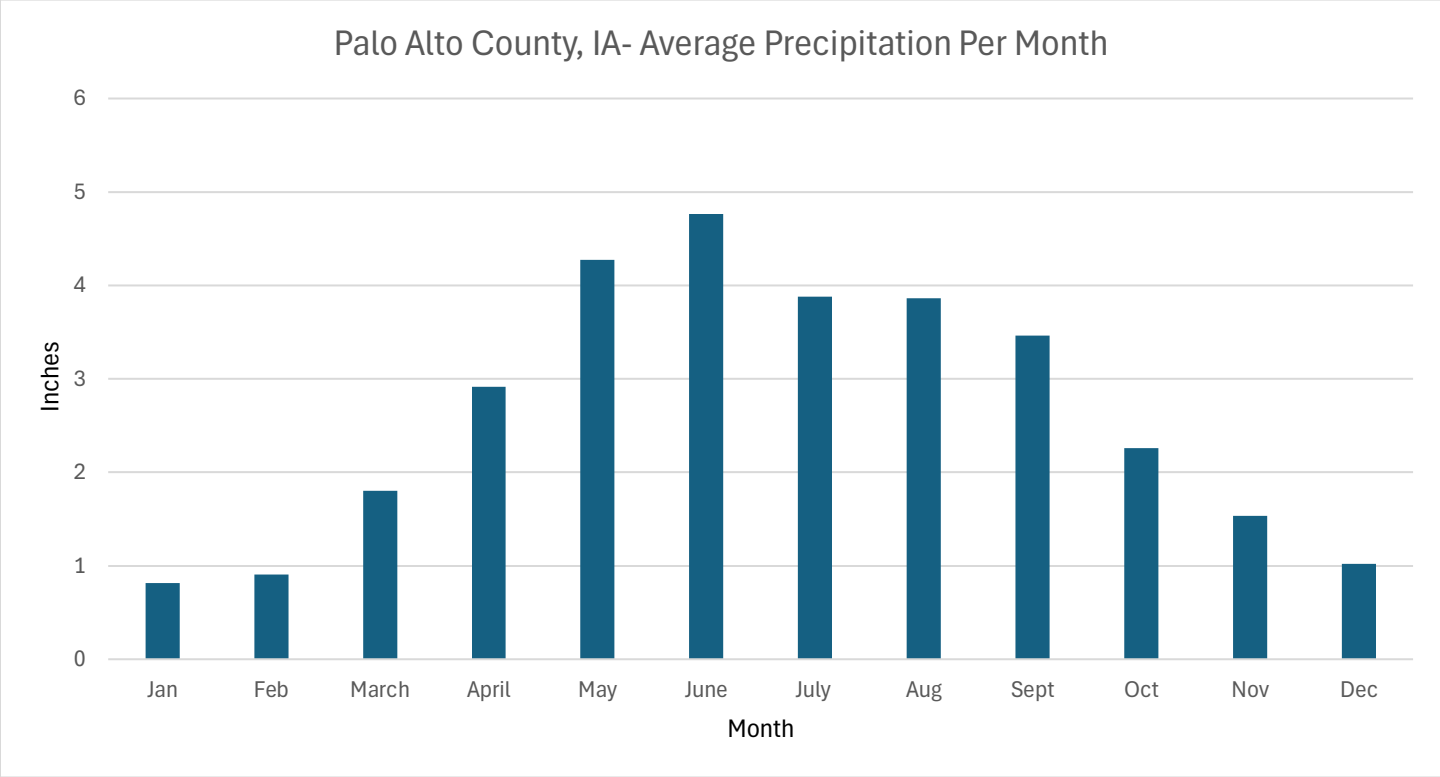
Drainage District No. 61
Lateral A
Palo Alto County, IA

Existing Facilities Map
August 2026



Appendix C – Rainfall Chart: 1895-2025





Charts created from data provided by:
NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series, published December 2025. Retrieved on December 11, 2025, from http://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series

Appendix D – Palmer Drought Severity Index: 1895-2025

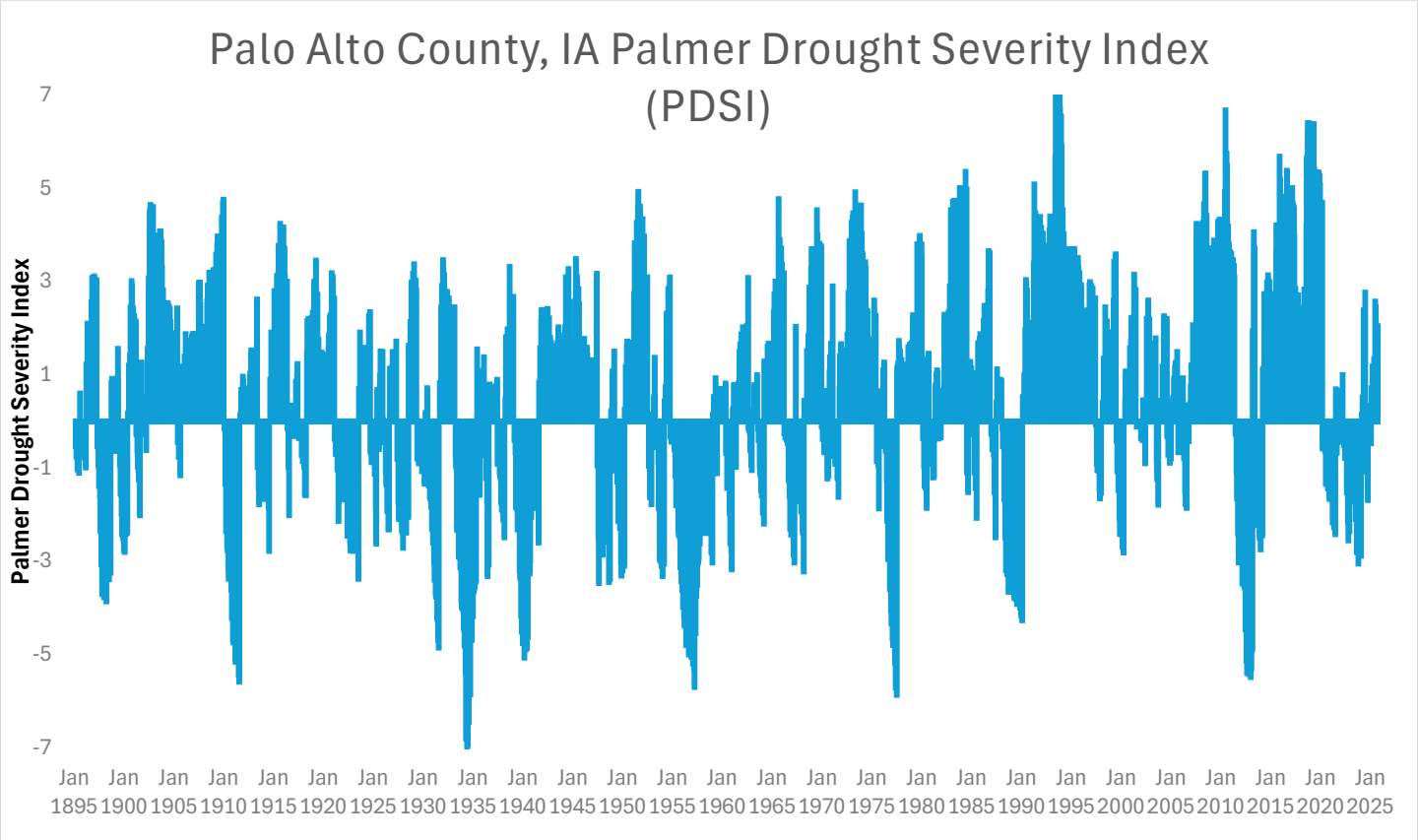
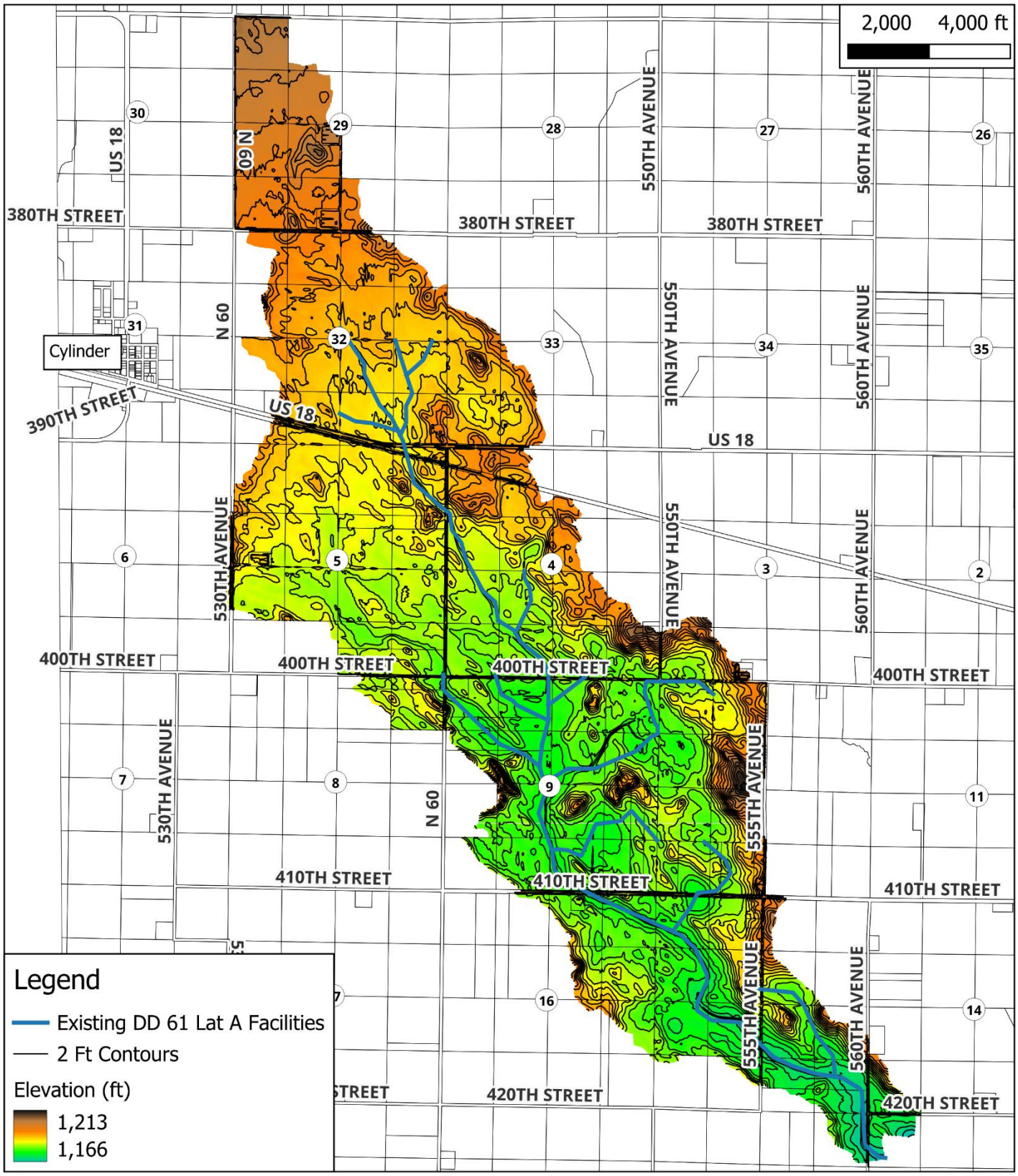


Chart created from data provided by:
NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series, published December 2025. Retrieved on December 11, 2025, from http://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series

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Drainage District No. 61
Lateral A
Palo Alto County, IA

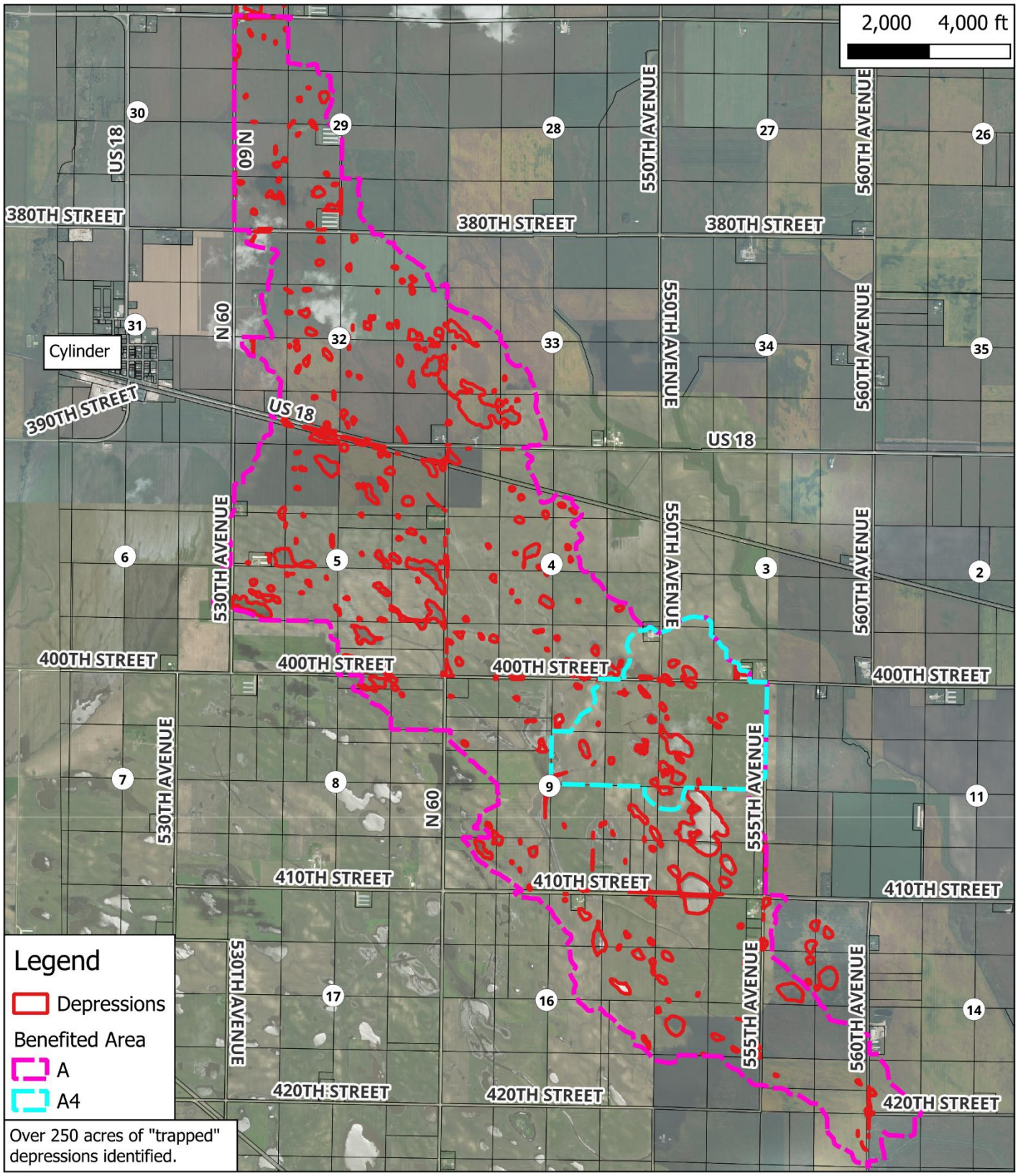
Elevation Map
August 2026



AgriVia

Drainage District No. 61
Lateral A
Palo Alto County, IA

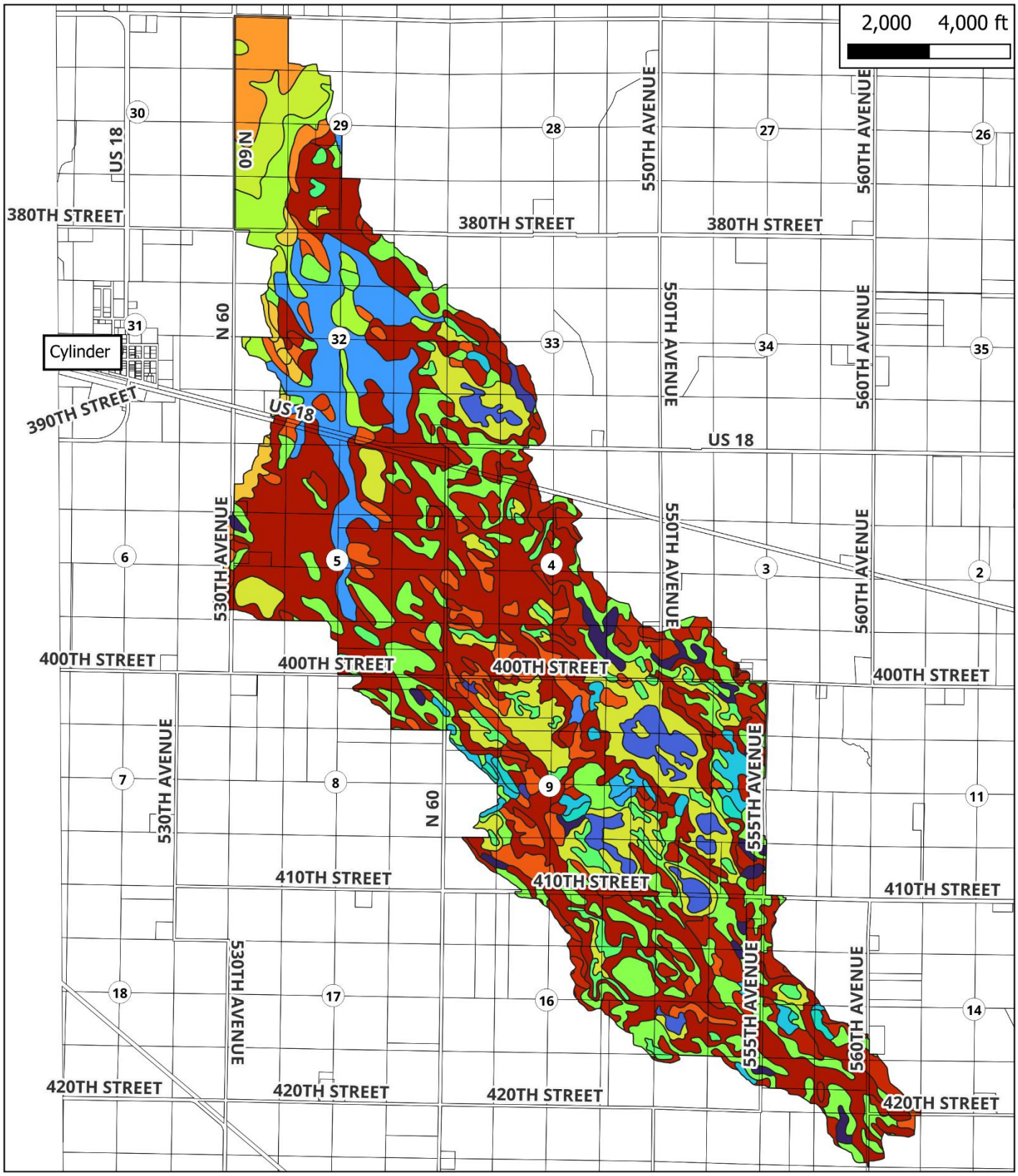
Depressions Map
August 2026

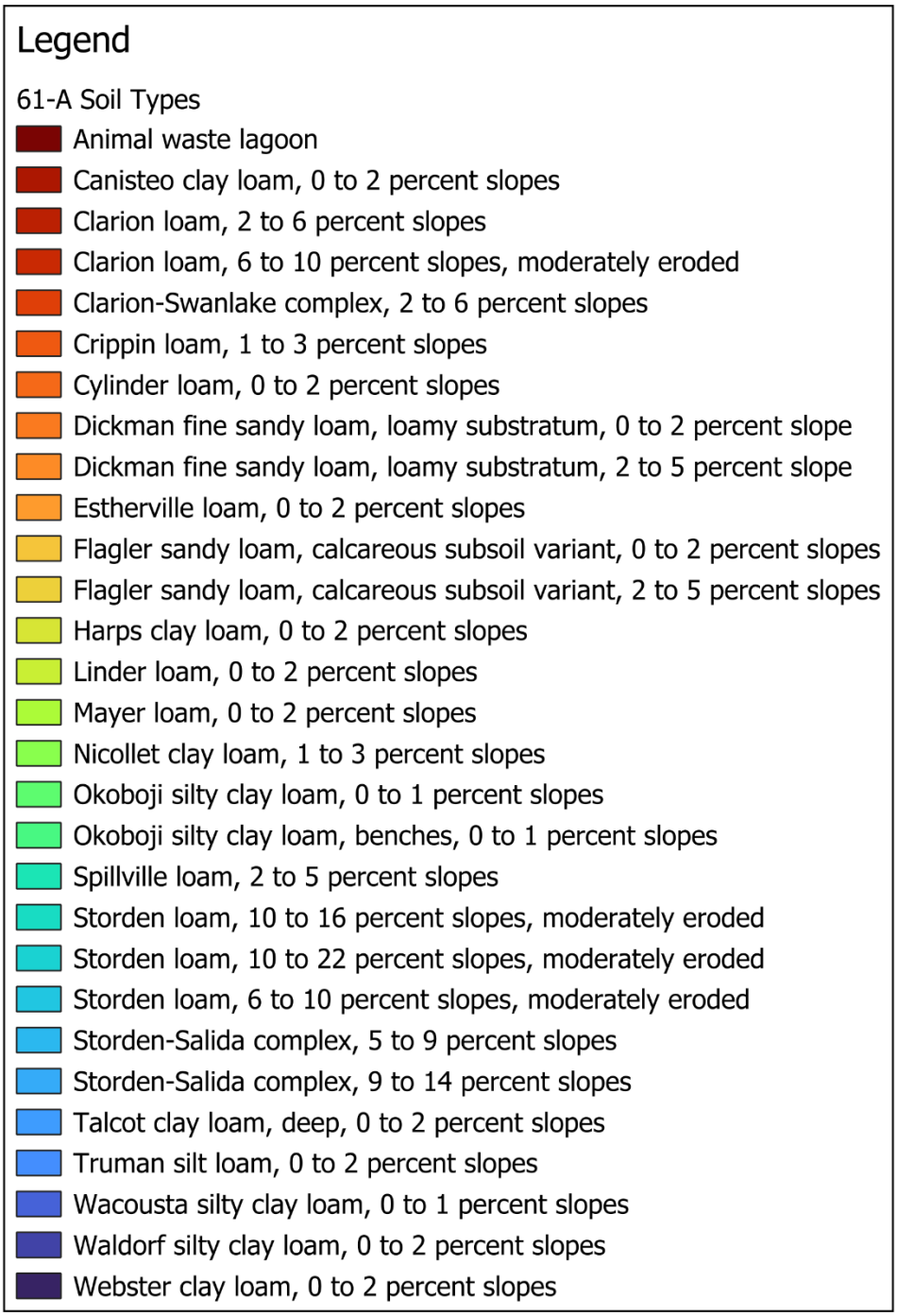


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Drainage District No. 61
Lateral A
Palo Alto County, IA

Soil Types
August 2026

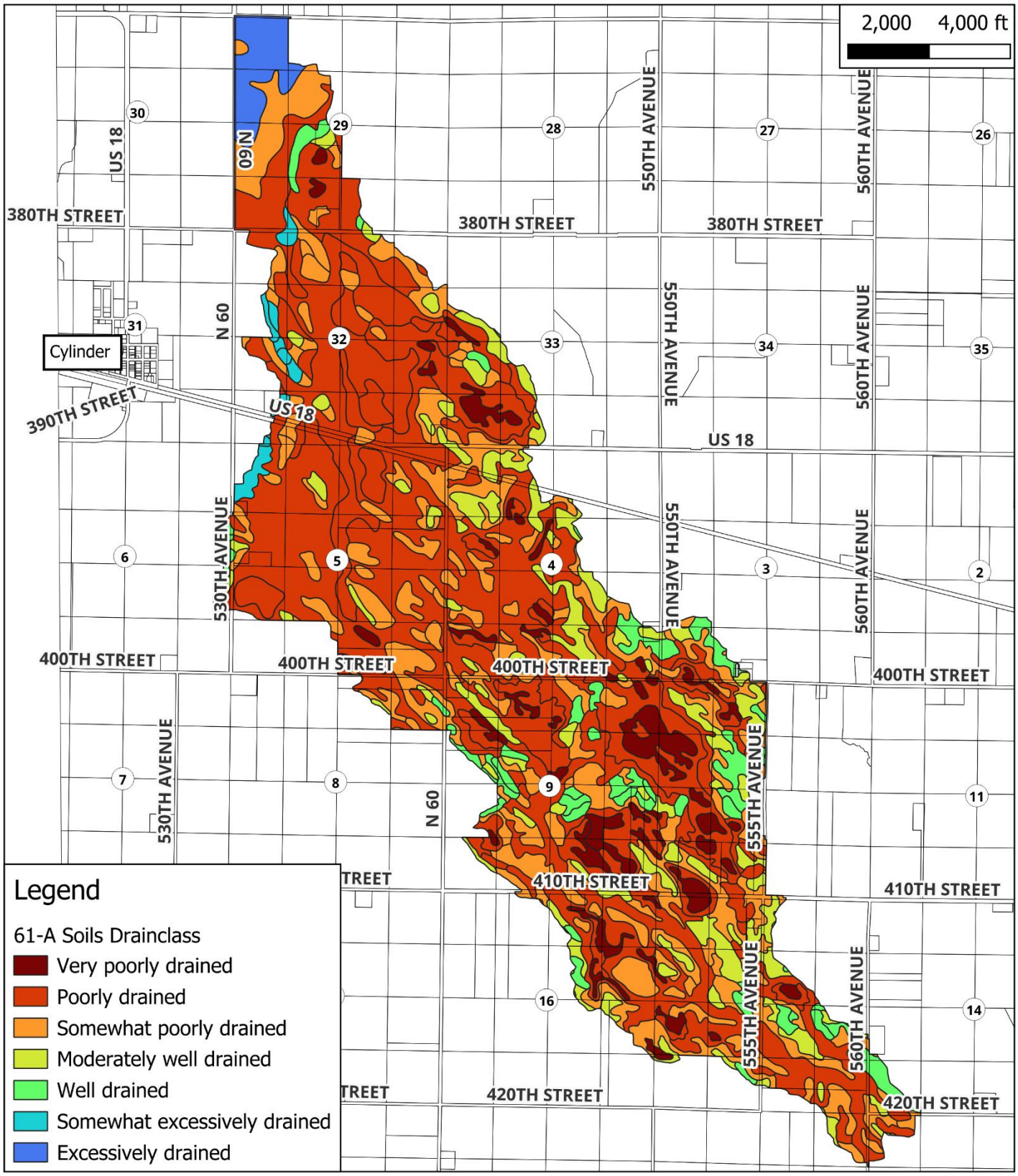



Legend
61-A Soil Types
Animal waste lagoon
Canisteo clay loam, 0 to 2 percent slopes
Clarion loam, 2 to 6 percent slopes
Clarion loam, 6 to 10 percent slopes, moderately eroded
Clarion-Swanlake complex, 2 to 6 percent slopes
Crippin loam, 1 to 3 percent slopes
Cylinder loam, 0 to 2 percent slopes
Dickman fine sandy loam, loamy substratum, 0 to 2 percent slope
Dickman fine sandy loam, loamy substratum, 2 to 5 percent slope
Estherville loam, 0 to 2 percent slopes
Flagler sandy loam, calcareous subsoil variant, 0 to 2 percent slopes
Flagler sandy loam, calcareous subsoil variant, 2 to 5 percent slopes
Harps clay loam, 0 to 2 percent slopes
Linder loam, 0 to 2 percent slopes
Mayer loam, 0 to 2 percent slopes
Nicollet clay loam, 1 to 3 percent slopes
Okoboji silty clay loam, 0 to 1 percent slopes
Okoboji silty clay loam, benches, 0 to 1 percent slopes
Spillville loam, 2 to 5 percent slopes
Storden loam, 10 to 16 percent slopes, moderately eroded
Storden loam, 10 to 22 percent slopes, moderately eroded
Storden loam, 6 to 10 percent slopes, moderately eroded
Storden-Salida complex, 5 to 9 percent slopes
Storden-Salida complex, 9 to 14 percent slopes
Talcot clay loam, deep, 0 to 2 percent slopes
Truman silt loam, 0 to 2 percent slopes
Wacousta silty clay loam, 0 to 1 percent slopes
Waldorf silty clay loam, 0 to 2 percent slopes
Webster clay loam, 0 to 2 percent slopes

AgriVia

Drainage District No. 61
Lateral A
Palo Alto County, IA

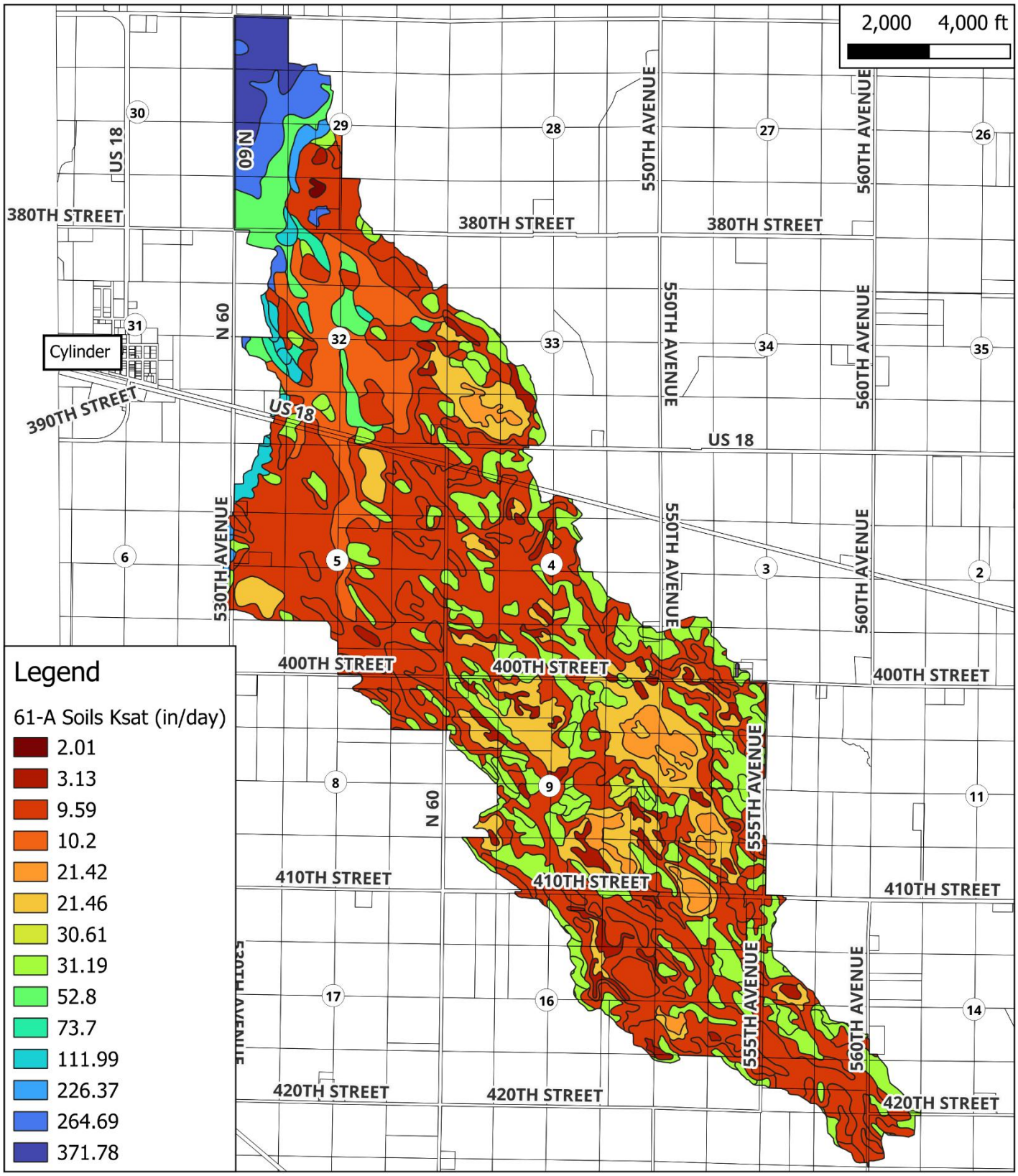
Drainclass Map
August 2026



AgriVia

Drainage District No. 61
Lateral A
Palo Alto County, IA

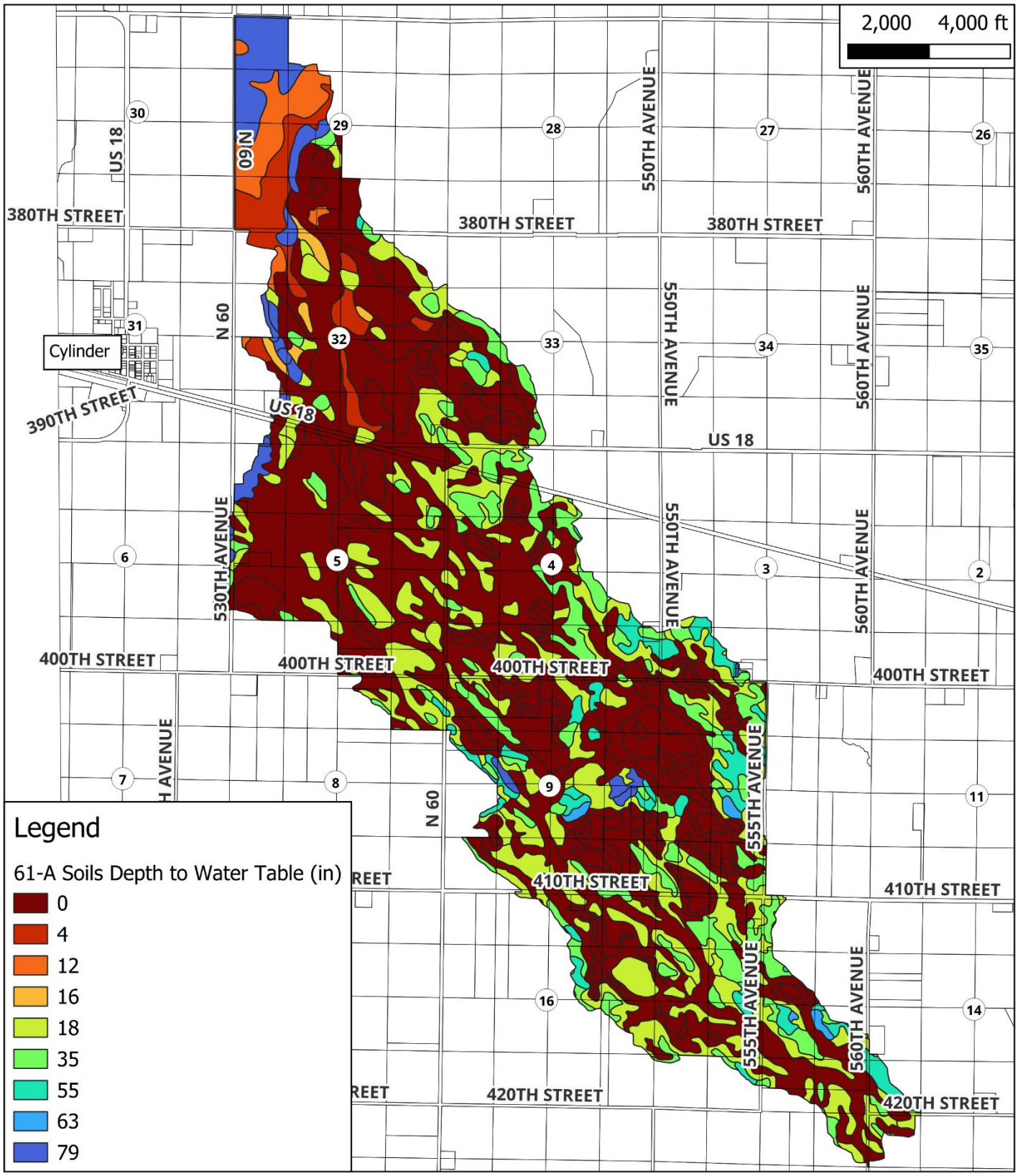
Soil Ksat
August 2026



AgriVia

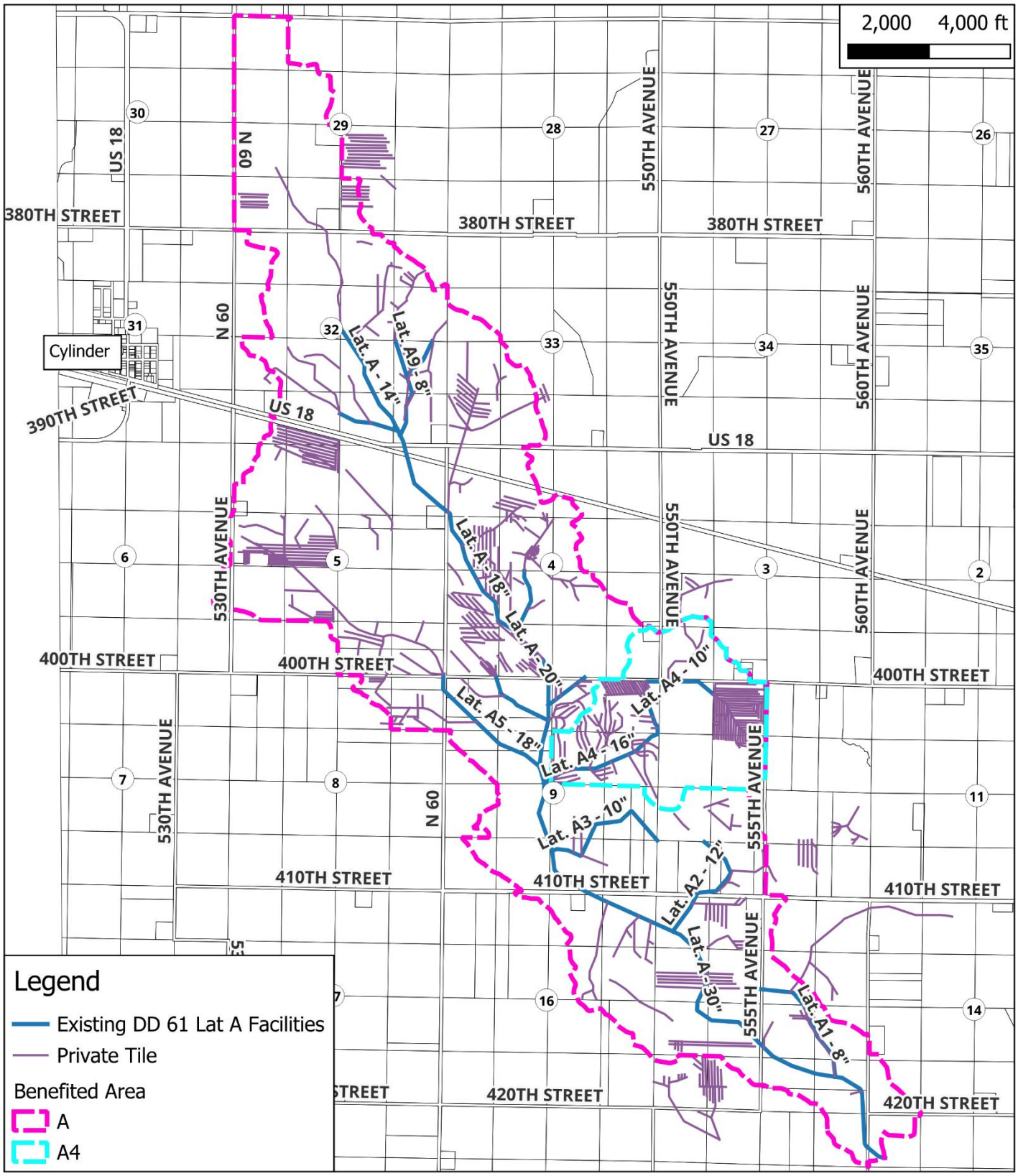
Drainage District No. 61
Lateral A
Palo Alto County, IA

Depth to Water Table
August 2026



Drainage District No. 61
Lateral A
Palo Alto County, IA

Private Tile
August 2026



Appendix L – Survey Photos



Existing Laterals A & B Outlet Bulkhead.



Culverts along the Lateral A Waterway beneath 555th Ave. Note the extensive siltation and erosive activity.



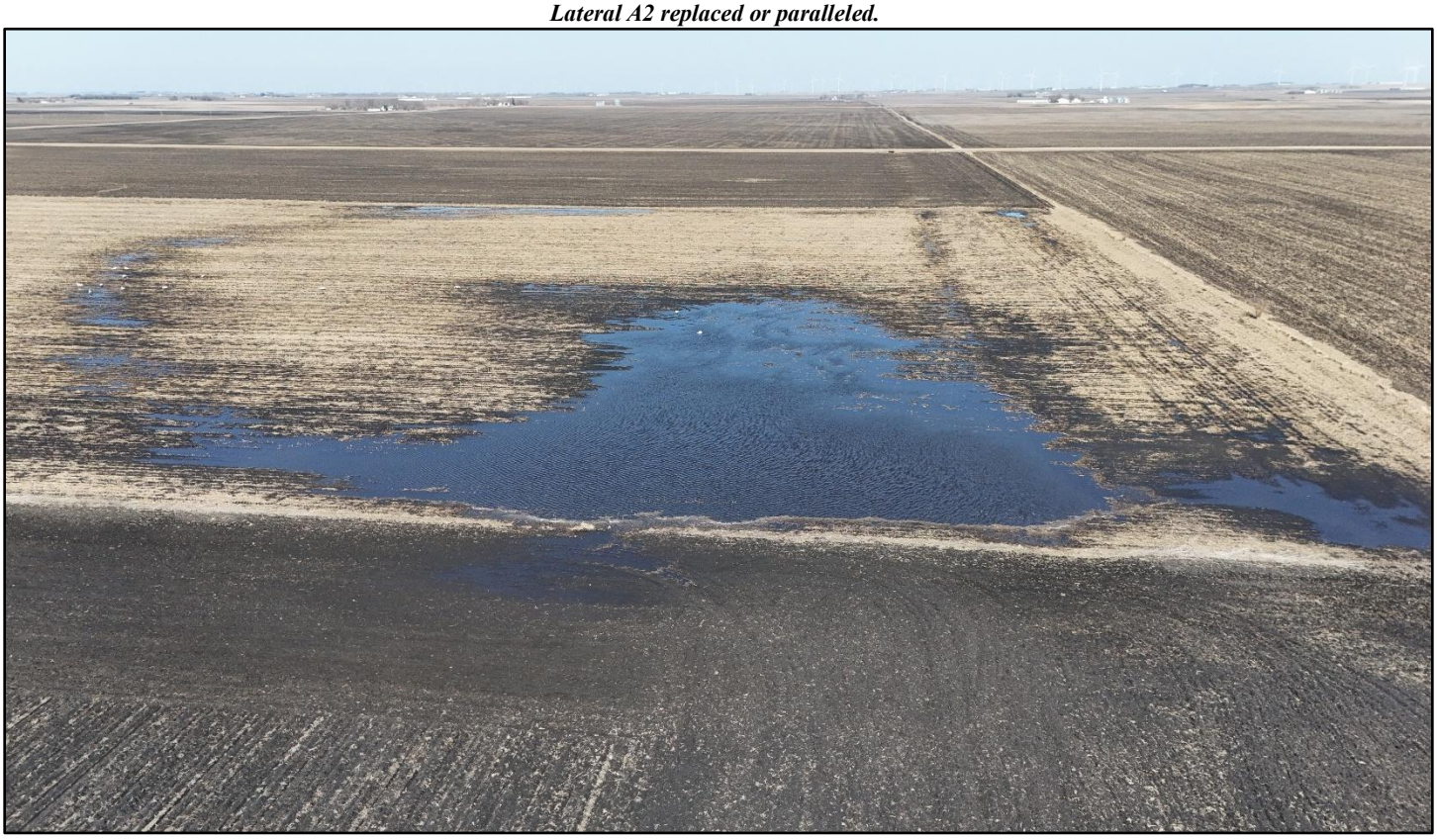
Lateral A Waterway west of 560th Ave. Note stagnant water flow.



Laterals A & B bulkhead aerial view.



Lateral A2 replaced or paralleled.



Flooded ground near Lateral A and A4 junction.



Ground served by Lateral A4 tile. Note private surface drains constructed for relief.



Lateral A Waterway looking southeast from 540th Ave. Note how slight the channel is in this area.

Appendix M – Itemized Cost Estimate

Estimated Costs - Lateral A Tile
Tile Improvements
Drainage District No. 61
Palo Alto County, IA

Division 1 - Lateral A Tile Construction Cost						
Item No.	Item Code	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
101	4020-A-1	DRAIN TILE, TRENCHED, HDPE DW, F-2 BEDDING, 60"	12840	LF	$155	$ 1,990,200
102	4020-A-1	DRAIN TILE, TRENCHED, CLASS III RCP, 60"	204	LF	$250	$ 51,000
103	4020-A-1	DRAIN TILE, TRENCHED, HDPE DW, F-2 BEDDING, 48"	1824	LF	$120	$ 218,880
104	4020-A-1	DRAIN TILE, TRENCHED, HDPE DW, F-2 BEDDING, 36"	5934	LF	$80	$ 474,720
105	4020-A-1	DRAIN TILE, TRENCHED, PP DW, F-2 BEDDING, 36"	820	LF	$110	$ 90,200
106	4020-A-1	DRAIN TILE, TRENCHED, HDPE DW, F-2 BEDDING, 30"	1051	LF	$65	$ 68,315
107	4020-A-1	DRAIN TILE, TRENCHED, HDPE DW, F-2 BEDDING, 24"	2697	LF	$50	$ 134,850
108	4020-A-1	DRAIN TILE, HDPE DW, 12"	1080	LF	$30	$ 32,400
109	4020-A-1	DRAIN TILE, HDPE SINGLE WALL, 4" - 10"	350	LF	$10	$ 3,500
110	4020-CUST	ADAPTER, HDPE DW TO RCP, 60"	9	EA	$3,000	$ 27,000
111	6010-CUST	REDUCER, HDPE DW, 48" TO 36"	1	EA	$2,000	$ 2,000
112	6010-CUST	REDUCER, HDPE DW, 36" TO 30"	1	EA	$1,000	$ 1,000
113	6010-CUST	REDUCER, HDPE DW, 30" TO 24"	1	EA	$700	$ 700
114	6010-B	INTAKE, HD BAR GUARD, 15"	13	EA	$1,000	$ 13,000
115	6010-CUST	TILE CONNECTIONS, 10" AND SMALLER	65	EA	$500	$ 32,500
116	6010-CUST	TILE CONNECTIONS, 12" AND LARGER	26	EA	$1,000	$ 26,000
117	6010-CUST	TILE CONNECTIONS, 24"	3	EA	$5,000	$ 15,000
118	2010-CUST	EXCAVATION, EXPLORATORY	24	HR	$270	$ 6,480
119	2010-CUST	TILE BERM	325	CY	$5	$ 1,625
120	9040-J	EROSION STONE	10	TN	$50	$ 500
121	3010-C	CLASS I BEDDING STONE	500	TN	$35	$ 17,500
122	9040-J	RIPRAP, CLASS E	50	TN	$70	$ 3,500
123	9040-CUST	EROSION CONTROL PLAN	1	LS	$2,000	$ 2,000
124	9010-A	CONVENTIONAL SEEDING, COVER CROP	64	AC	$100	$ 6,400
125	9040-CUST	DRIVEWAY RESTORATION, STONE	144	TN	$30	$ 4,320
126	9040-CUST	TEMPORARY CONSTRUCTION ENTRANCE	2	EA	$2,000	$ 4,000
127	11,020-A	MOBILIZATION	1	LS	$161,000	$ 161,000
					5% Construction Contingency	$ 169,000
					Subtotal Construction Cost	**$ 3,558,000**

Division 2 - Palo Alto County Secondary Roads Construction Cost						
Item No.	Item Code	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
201	4020-A-2	TRENCHLESS, STEEL CASING, 38" DIA., 0.344" MIN. THICKNESS	64	LF	$1,800	$ 115,200
202	4020-A-1	DRAIN TILE, TRENCHED, CLASS III RCP, R-2 BEDDING, 60"	232	LF	$250	$ 58,000
203	4020-A-1	DRAIN TILE, TRENCHED, CLASS III RCP, R-2 BEDDING, 36"	82	LF	$110	$ 9,020
204	4020-CUST	ADAPTER, HDPE DW TO RCP, 60"	6	EA	$3,000	$ 18,000
205	4020-CUST	ADAPTER, HDPE DW TO RCP, 36"	2	EA	$1,000	$ 2,000
206	4020-CUST	ADAPTER, PP DW TO RCP, 36"	2	EA	$1,000	$ 2,000
207	7030-H-3	CLASS A ROADSTONE	64	TN	$38	$ 2,432
208	6010-B	INTAKE, HD BAR GUARD, 15"	10	EA	$500	$ 5,000
209	9010-A	CONVENTIONAL SEEDING, TYPE 2 SEED MIXTURE	1	AC	$1,000	$ 1,000
210	2010-CUST	EXCAVATION, EXPLORATORY	10	HR	$270	$ 2,700
211	8030-A	TRAFFIC CONTROL	5	EA	$400	$ 2,000
212	11,020-A	MOBILIZATION	1	LS	$11,000	$ 11,000
					5% Construction Contingency	$ 11,000
					Subtotal Construction Cost	**$ 239,000**

Estimated Costs - Lateral A Tile
Tile Improvements
Drainage District No. 61
Palo Alto County, IA

Division 3 - Iowa Department of Transportation Construction Cost						
Item No.	Item Code	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
301	4020-A-2	TRENCHLESS, STEEL CASING, 32" DIA., 0.344" MIN. THICKNESS	97	LF	$1,500	$ 145,500
302	6010-B	INTAKE, HD BAR GUARD, 15"	2	EA	$500	$ 1,000
303	2010-CUST	EXCAVATION, EXPLORATORY	2	HR	$270	$ 540
304	9010-CUST	CONVENTIONAL SEEDING, TYPE 2 SEED MIXTURE	0.2	AC	$1,000	$ 200
305	8030-A	TRAFFIC CONTROL	1	LS	$1,000	$ 1,000
306	11,020-A	MOBILIZATION	1	LS	$8,000	$ 8,000
					5% Construction Contingency	$ 8,000
					Subtotal Construction Cost	**$ 164,000**

Division 4 - Canadian Pacific Railroad Construction Cost						
Item No.	Item Code	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
401	4020-A-2	TRENCHLESS, STEEL CASING, 32" DIA., 0.531" MIN. THICKNESS	102	LF	$1,600	$ 163,200
402	6010-B	INTAKE, HD BAR GUARD, 15"	2	EA	$500	$ 1,000
403	2010-CUST	EXCAVATION, EXPLORATORY	2	HR	$270	$ 540
404	9010-CUST	CONVENTIONAL SEEDING, TYPE 2 SEED MIXTURE	0.2	AC	$1,000	$ 200
405	1070-3	RAILROAD INSURANCE AND PERMITTING	1	EA	$25,000	$ 25,000
406	11,020-A	MOBILIZATION	1	LS	$10,000	$ 10,000
					5% Construction Contingency	$ 10,000
					Subtotal Construction Cost	**$ 210,000**

Additional Non-Construction Project Costs	
Expense	Est. Amount
Survey, Permitting, Engineer's Report, and Preliminary Plans	$ 45,000
Specifications and Construction Engineering	$ 150,000
Reclassification and Annexation	$ 15,000
Legal and Administrative	$ 5,000
Construction Damages	$ 134,000
Interest	$ 362,000
Subtotal Non-Construction Cost	**$ 711,000**

Total Project Costs	
Expense	Est. Amount
Lateral A Tile Improvement	$ 3,558,000
Palo Alto County Secondary Roads	$ 239,000
Iowa DOT	$ 164,000
Canadian Pacific Railroad	$ 210,000
Additional Non-Construction Project Costs	$ 711,000
Total Tile Improvement Cost	**$ 4,882,000**
Total Improvement Cost to Drainage District No. 61 Lateral A	**$ 4,269,000**
Average Cost per Acre Benefitted (3,648 Acres)	**$ 1,170**

Average Cost per Acre per Year (20 years at 8% interest)	**$ 107**

Estimated Costs - Lateral A4 Tile
Tile Improvements
Drainage District No. 61
Palo Alto County, IA

Lateral A4 Tile Construction Cost						
Item No.	Item Code	Bid Item	Est. Units	Unit	Est. Unit Price	Est. Amount
501	4020-A-1	DRAIN TILE, 24" HDPE DW, F-2 BEDDING	2000	LF	$50	$ 100,000
502	4020-A-1	DRAIN TILE, 18" HDPE DW, F-2 BEDDING	1400	LF	$45	$ 63,000
503	4020-A-1	DRAIN TILE, 15" HDPE DW	1691	LF	$30	$ 50,730
504	4020-A-1	DRAIN TILE, HDPE DW, 12"	45	LF	$30	$ 1,350
505	4020-A-1	DRAIN TILE, HDPE SINGLE WALL, 4" - 10"	50	LF	$10	$ 500
506	6010-A-1	MANHOLE CONNECTION, HDPE, 8' DIA.	1	EA	$15,000	$ 15,000
507	6010-B	INTAKE, HD BAR GUARD, 15"	4	EA	$1,000	$ 4,000
508	6010-CUST	TEE, HDPE DW, 15" ON 15"	2	EA	$400	$ 800
509	6010-CUST	TILE CONNECTIONS, 12" AND LARGER	5	EA	$1,000	$ 5,000
510	6010-CUST	TILE CONNECTIONS, 10" AND SMALLER	10	EA	$500	$ 5,000
511	3010-C	CLASS I BEDDING STONE	800	TN	$30	$ 24,000
512	2010-CUST	EXCAVATION, EXPLORATORY	4	HR	$270	$ 1,080
513	9010-A	TILE WORK AREA COVER CROP SEEDING	12	AC	$100	$ 1,200
514	9040-CUST	DRIVEWAY RESTORATION, STONE	24	TN	$30	$ 720
515	11,020-A	MOBILIZATION	1	LS	$14,000	$ 14,000
					5% Construction Contingency	$ 14,000
					Subtotal Construction Cost	**$ 300,000**

Additional Non-Construction Project Costs	
Expense	Est. Amount
Survey, Permitting, Engineer's Report, and Preliminary Plans	$ 5,000
Specifications and Construction Engineering	$ 5,000
Reclassification and Annexation	$ 2,500
Legal and Administrative	$ 2,500
Construction Damages	$ 25,000
Interest	$ 27,000
Subtotal Non-Construction Cost	**$ 67,000**

Total Project Costs	
Expense	Est. Amount
Lateral A4 Tile Improvement	$ 300,000
Additional Non-Construction Project Costs	$ 67,000
Total Tile Improvement Cost	**$ 367,000**
Total Improvement Cost to Drainage District No. 61 Lateral A4	**$ 367,000**
Average Cost per Acre Benefitted (378 Acres)	**$ 971**

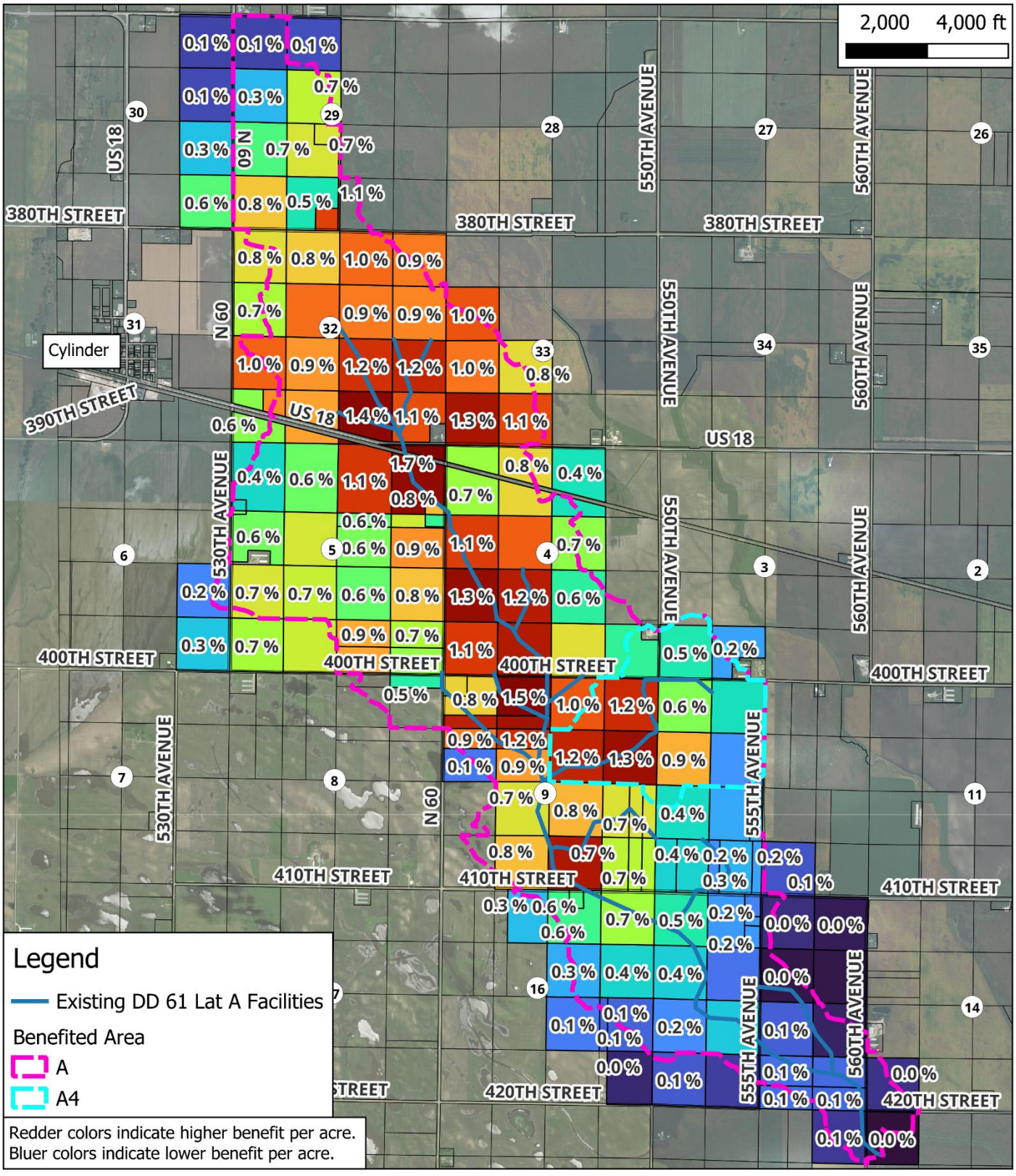
Average Cost per Acre per Year (20 years at 8% interest)	**$ 89**

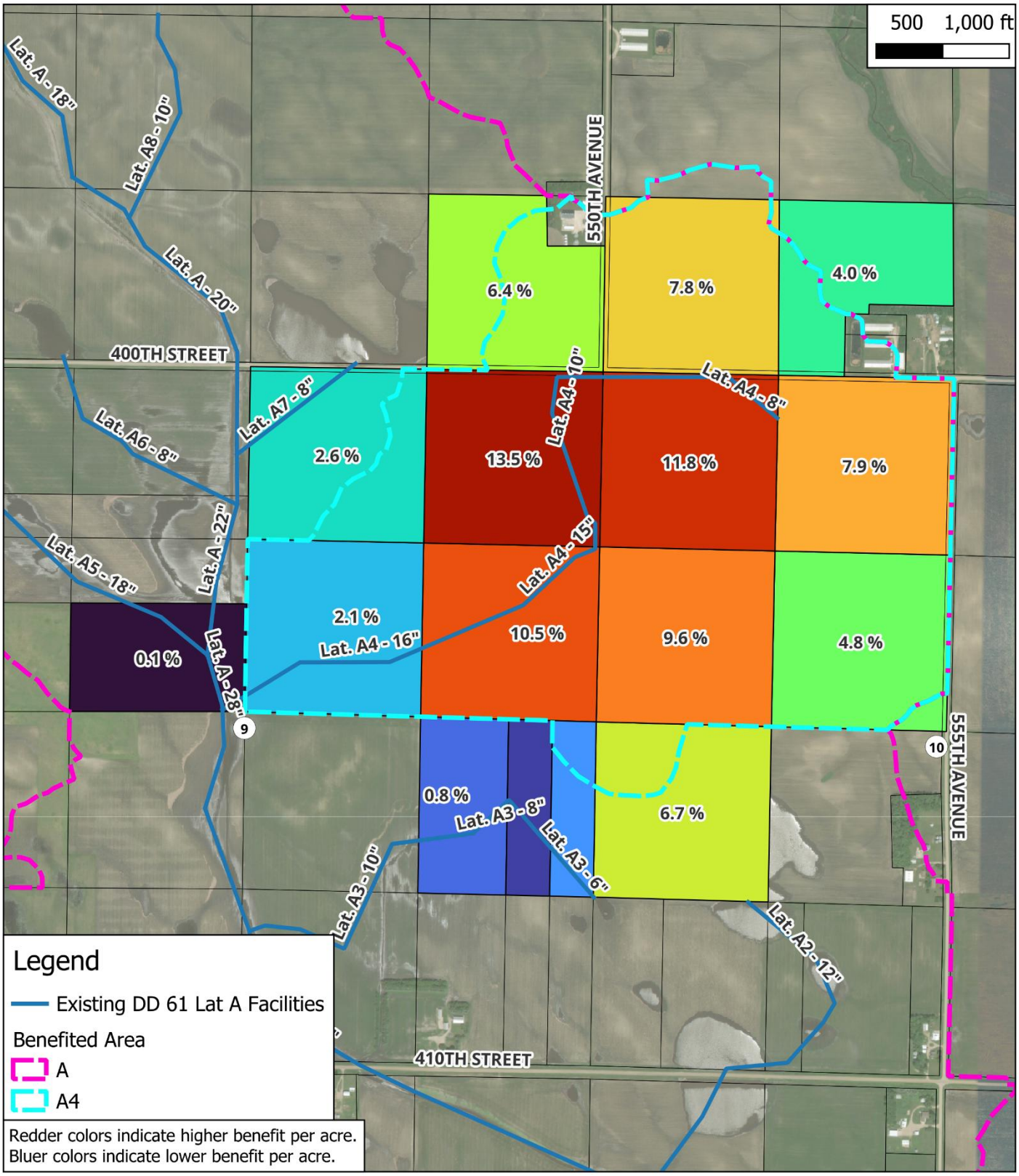
Estimated Costs- Page 1

AgriVia

Drainage District No. 61
Lateral A
Palo Alto County, IA

Lat. A Ex. Schedule
August 2026

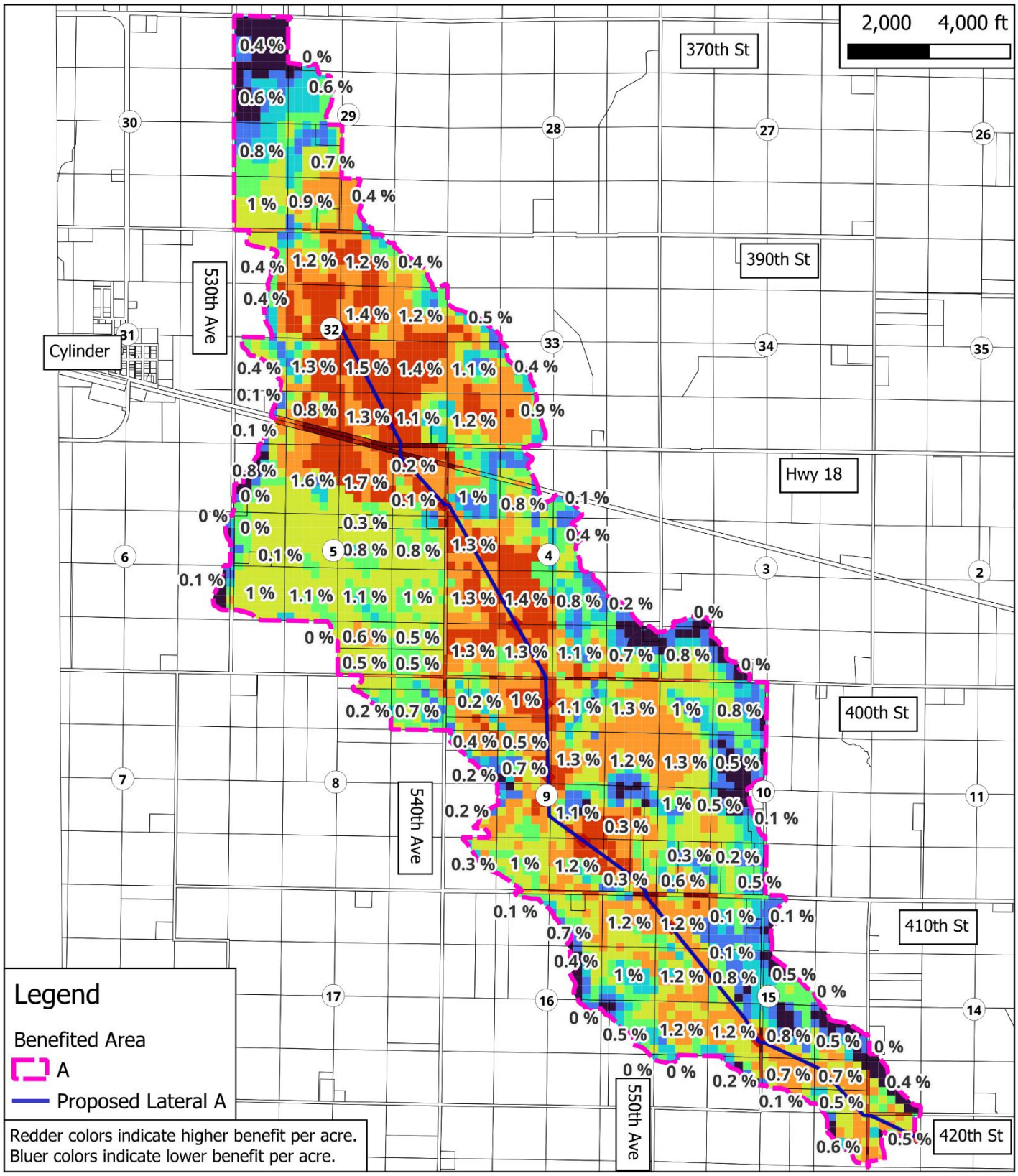


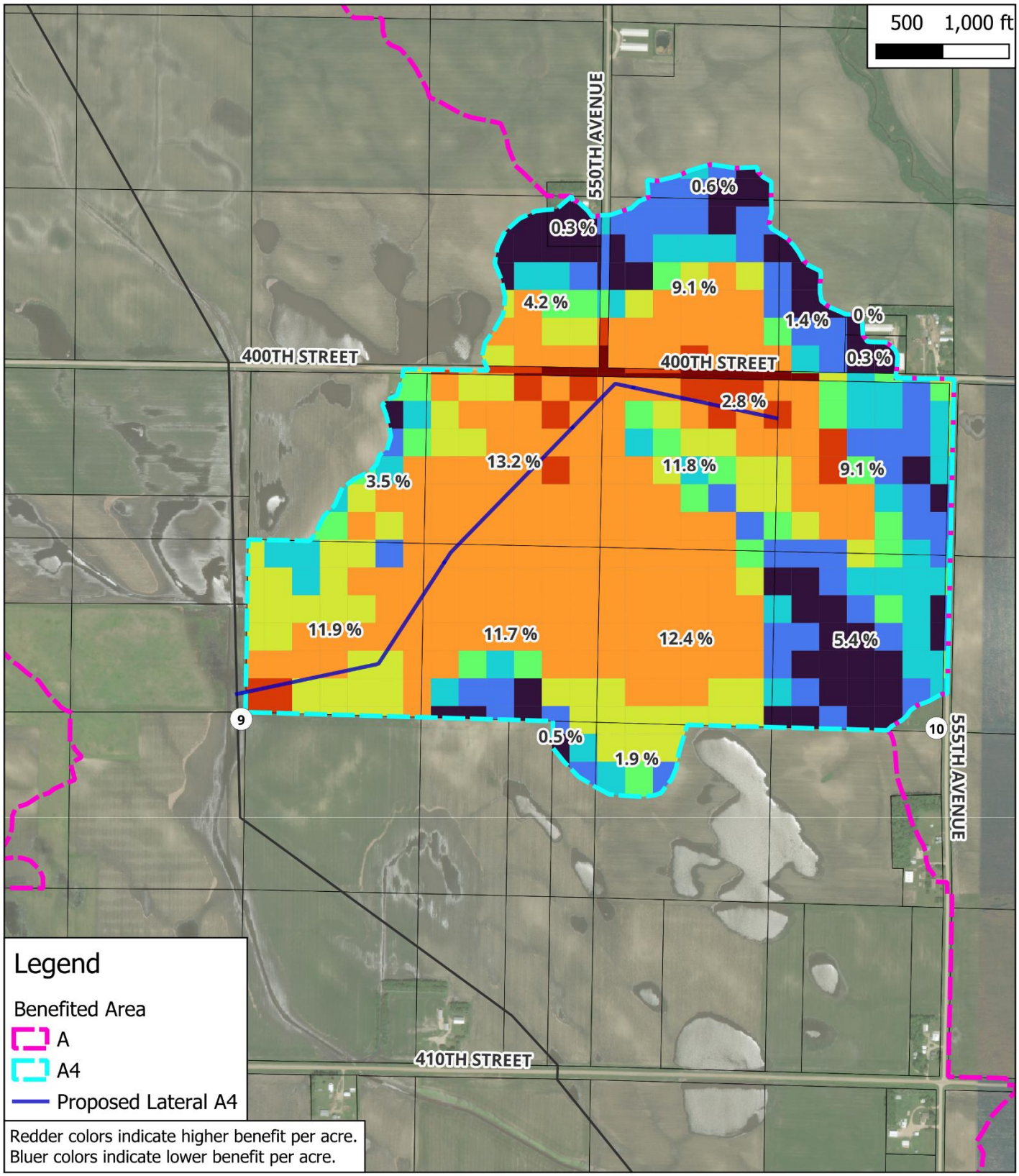

500 1,000 ft
Lat. A - 18"
Lat. A8 - 10"
Lat. A - 20"
550TH AVENUE
6.4 %
7.8 %
4.0 %
400TH STREET
Lat. A7 - 8"
Lat. A4 - 10"
Lat. A4 - 8"
Lat. A6 - 8"
2.6 %
13.5 %
11.8 %
7.9 %
Lat. A - 22"
Lat. A5 - 18"
Lat. A4 - 15"
2.1 %
Lat. A4 - 16"
10.5 %
9.6 %
4.8 %
0.1 %
Lat. A - 28"
9
10
555TH AVENUE
0.8 %
Lat. A3 - 8"
6.7 %
Lat. A3 - 6"
Lat. A3 - 10"
Lat. A2 - 12"
410TH STREET
Legend
Existing DD 61 Lat A Facilities
Benefited Area
A
A4
Redder colors indicate higher benefit per acre.
Bluer colors indicate lower benefit per acre.

AgriVia

Drainage District No. 61
Lateral A
Palo Alto County, IA

Lat. A Est. Schedule
September 2026




500 1,000 ft
550TH AVENUE
400TH STREET
400TH STREET
555TH AVENUE
410TH STREET
9
10
0.6 %
0.3 %
9.1 %
4.2 %
1.4 %
0 %
0.3 %
2.8 %
13.2 %
11.8 %
9.1 %
3.5 %
11.9 %
11.7 %
12.4 %
5.4 %
0.5 %
1.9 %
Legend
Benefited Area
A
A4
Proposed Lateral A4
Redder colors indicate higher benefit per acre.
Bluer colors indicate lower benefit per acre.

Appendix P – Iowa State Economic Returns from Tiling Spreadsheet

Iowa State University Extension and Outreach | Ag Decision Maker File C2-90

Farmland Tile Drainage Investment Analysis

Ag Decision Maker -- Iowa State University Extension and Outreach

Find out more on tiling in Information File C2-90, Understanding the Economics of Tile Drainage.

ISU Extension Spreadsheet modifed by AgriVia for Drainage District Improvements.

Drainage District Information

District name	Drainage District No. 61 Lat A
Field location (general location or legal description)	Palo Alto County, IA
District Size (acres to analyze for tile drainage)	3,648

Field Drainage Needs

Number of Acres by Drainage Needs	
Very poorly drained	204
Poorly drained	1,950
Somewhat poorly drained	842
Moderately well drained	359
Well drained and better	293
Total	3,648

Estimated Yield Response (enter impacts of tiling for both tiled and non-tiled acres)

	Very Poorly Drained	Poorly Drained	Somewhat Poorly Drained	Moderately Well Drained	Well Drained
Corn (bushels per acre)					
Pre-drainage yield (current expected yield in each category)	126.0	138.0	150.0	168.0	180.0
Post-drainage yield (expected yield after tile drainage installed)	180.0	180.0	180.0	180.0	180.0
Estimated corn yield improvement	54.0	42.0	30.0	12.0	0.0
Soybeans (bushels per acre)					
Pre-drainage yield (current expected yield in each category)	32.0	38.0	42.0	45.0	50.0
Post-drainage yield (expected yield after tile drainage installed)	50.0	50.0	50.0	50.0	50.0
Estimated soybean yield improvement	18.0	12.0	8.0	5.0	0.0

Estimated Additional Costs and Returns per Acre by Crop due to Added Tile Drainage

Enter the additional production costs expected from tiling the land and the expected value of the additional production.

	Corn (per acre)	Soybeans (per acre)	Average (per acre)	
Added Cash Income				
Expected field crop rotation on acres being analyzed	47%	47%		
Acres planted to crop based on acres being analyzed and crop rotation	1,714.6	1,714.6		
Estimated yield increase (from above section)	33.6	9.8		
Long-term expected sale price	$4.51	$10.96		10-year avg. price per ISU
Additional Cash Income due to Tile Drainage	$151.43	$106.97		
Added Cash Production Costs				
Seed	$7.00	$5.00		
Fertilizer	$15.00	$10.00		
Pesticides	$0.00	$0.00		
Hauling, drying, and handling	$10.00	$5.00		
Added Cash Costs due to Tile Drainage	$32.00	$20.00		
Net Cash Income or Loss	**$119.43**	**$86.97**	**$97.00**	

Total Cost of Tile Drainage District Investment

Total	**$ 4,269,000.00**
Per Tiled Acre (3648 acres)	**$ 1,170.00**

Return on Investment in Tile Drainage (cash return divided by investment) (before income tax)

The added net cash return divided by the investment in tile drainage. For owner-operators, the net return is the additional crop net return from tile drainage.

Annual Rate of Return on Tile Investment	Corn	Soybeans	Average
Based on Additional Crop Income	10.2%	7.4%	8.3%
Assuming Cash Financed			
No Tax Advantages Assumed			

Version 3.0_42023
Kelvin Leibold, Extension farm management specialist
Don Hofstrand, retired agricultural business specialist
Email agdm@iastate.edu for questions regarding this Decision Tool
Date Printed:
9/8/2026

IOWA STATE UNIVERSITY
Extension and Outreach

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Note: Tile drainage may result in increased land values when sold and is not factored in the results of this Decision Tool.

https://www.extension.iastate.edu/agdm/wholefarm/xls/c2-90tilinganalysis.xlsx

Appendix Q – Michigan State Drain Tool Estimated Yields

Michigan State Drain Tool Estimated Yield Increase
Tile Improvements
Drainage District No. 61 Lateral A
Palo Alto County, IA

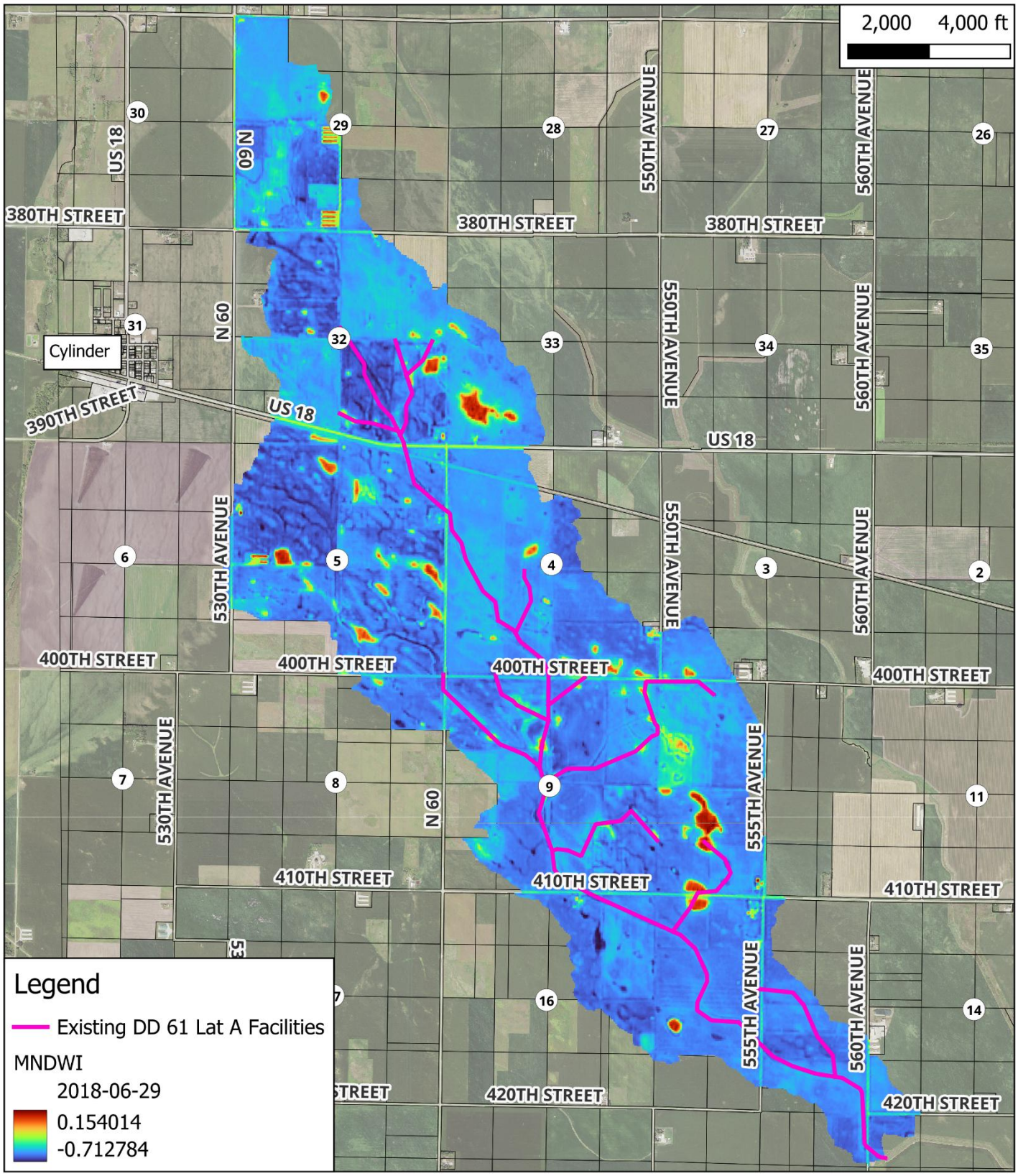
Estimated Crop Yields						
Year	Corn Yield (No Improvement	Corn Yield (Improved Drainage)	Corn Yield Increase	Soy Yield (No Improvement)	Soy Yield (Improved Drainage)	Soy Yield Increase
1995	205	205	**0**	65	70	**4**
1996	247	250	**3**	70	70	**0**
1997	250	250	**0**	68	68	**0**
1998	202	244	**42**	66	70	**3**
1999	207	250	**43**	63	68	**5**
2000	246	250	**4**	64	70	**6**
2001	173	211	**38**	55	59	**4**
2002	227	226	**0**	50	64	**15**
2003	128	237	**109**	44	65	**20**
2004	167	237	**70**	54	68	**14**
2005	161	244	**84**	67	70	**3**
2006	203	202	**-1**	64	64	**0**
2007	174	189	**15**	35	52	**17**
2008	134	231	**97**	51	65	**14**
2009	250	250	**0**	69	69	**0**
2010	93	213	**120**	40	66	**26**
2011	32	238	**207**	39	68	**29**
2012	199	205	**5**	57	57	**0**
2013	7	204	**197**	26	58	**32**
2014	0	225	**225**	38	68	**30**
2015	217	250	**33**	41	69	**28**
2016	185	250	**65**	70	70	**0**
2017	201	190	**-11**	56	61	**5**
2018	100	232	**133**	46	69	**23**
2019	111	250	**139**	43	70	**27**
2020	250	250	**0**	65	65	**0**
2021	244	244	**0**	68	68	**0**
2022	197	196	**-1**	63	63	**0**
2023	196	223	**27**	67	67	**0**
2024	0	182	**182**	25	67	**43**
2025	111	246	**135**	8	68	**61**
AVG	**164**	**229**	**+63**	**52**	**66**	**+13**

Chart and Graph created from output data from Michigan State Drain Tool
Yield Increases are estimates only based on Drain Tool.

AgriVia

Drainage District No. 61
Lateral A
Palo Alto County, IA

MNDWI Map
September 2026



AGRICULTURAL ENGINEERING
Serves Ohio
Cooperative Extension Service
The Ohio State University
Agricultural Engineering
2073 Neil Avenue
Columbus, Ohio 43210

SOIL AND WATER NO. 31

JULY 1982

TWENTY BENEFITS OF DRAINAGE

Many of the best soils in the United States and throughout the world have drainage problems that need to be solved before efficient agricultural production can be achieved. This discussion of drainage benefits is based on an earlier paper by the author entitled "Ten Benefits of Drainage" and several reports from other agricultural engineers in the United States, Canada, and England. Some of these drainage benefits are difficult to measure precisely, and many are interrelated, but their combined effect has been observed in numerous drainage studies.

1. Better soil aeration results from good drainage (surface water and free water in the root zone removed within 24 hours after heavy rainfall). This permits more extensive root development and a more favorable environment for beneficial soil microorganisms and earthworms. When soil aeration is reduced, the severity of soil-borne root diseases is increased.

2. Better soil moisture conditions with good drainage permit more efficient operation of tillage, planting, and harvesting equipment.

3. Better soil structure can be developed and maintained with good drainage, since there is less chance of destroying soil tilth due to compaction when working soil that is too wet.

4. Soils warm up more quickly in the spring when free water is removed by a drainage system. This results in better seed germination and an increased rate of plant growth.

5. An increased supply of nitrogen can be obtained from the soil when drainage lowers the water table in the root zone. Denitrification often occurs in soils with poor drainage.

6. Longer growing seasons can be achieved with good drainage due to earlier possible planting dates. This also permits the use of higher-yielding crop varities or extended grazing periods for livestock.

7. Certain toxic substances and disease organisms are removed from the soil due to better drainage and soil aeration. In wet soil, roots can be injured by toxic substances produced in the reduction of iron and manganese salts and the reduction of nitrates to nitrites.

8. Winds are less liable to uproot plants growing in soils that have been properly drained, since root systems are deeper.

9. Soil erosion and sediment loss can be reduced by subsurface drainage, since drained soils have a greater capacity to absorb rainfall and the soil filters out suspended sediment.

10. Good drainage saves fuel that would be used in working around wet areas in fields

(over)

College of Agriculture and Home Economics of The Ohio State University and The United States Department of Agriculture Cooperating

that are not properly drained. Also, since drained land is easier to work, there is less need for dual wheels or four-wheel drive tractors.

11. Good drainage reduces winter crop damage such as frost heaving of alfalfa and smothering of wheat under patches of ice.

12. Good drainage promotes earlier crop maturity and earlier fall harvests when climatic conditions are better for natural drying of grain in the field, thereby saving artificial drying costs.

13. A greater variety of crops can be grown on a farm that has good drainage. Alfalfa and sweet corn are examples of those that a farmer may choose.

14. Weed control is easier with good drainage since shallow-rooted weeds and undesirable grasses often thrive in wet soil, crowding out the planted crop.

15. Well-drained grazing land supports more livestock, with less compaction damage to vegetation and soil from animal traffic.

16. Good drainage reduces diseases that thrive on wet land. These include foot rot and liver fluke that infect livestock, and diseases carried by mosquitoes to both livestock and people.

17. Valuable livestock water supplies can be obtained by draining hillside seeps and piping the water to stock water tanks.

18. Plants are better able to withstand summer droughts with good drainage, since lower water tables in the spring permit deeper root development for extraction of soil moisture and nutrients.

19. Drainage is essential for salinity control in drier regions where irrigation is needed for permanent agricultural production.

20. Overall, good drainage results in higher crop yields, improved crop quality, and reduced risk of crop loss due to waterlogged soil. Also, fewer acres are required to produce our needed food supplies.

Several years of drainage research in Ohio has compared corn and soybean yields from undrained, surface drained only, tile drained only, and combined tile plus surface drained plots. Annual benefit/cost ratios were also calculated for these alternative drainage systems. It was shown that the average annual return per $100 invested in drainage ranged from $120 to $210 for soybeans, and from $170 to $220 for corn. Further details on this research are reported in Soil and Water No. 23 (DRAINAGE--What is it Worth on CORN Land?" and Soil and Water No. 24 (DRAINAGE--What is it Worth for SOYBEAN Land?"). These leaflets are available from Extension Agricultural Engineers, 2073 Neil Avenue, Columbus, OH 43210.

Actual returns on a drainage investment for a particular farm will vary with factors such as soil type, weather conditions, cost of the drainage system, crops grown, and management. Drainage improvements may involve surface drainage, subsurface drainage, outlet ditches, or a combination of practices. Changes in soil and crop management techniques may also be desirable to improve soil structure and water movement in the soil. Almost 60 percent of Ohio's cropland and 25 percent of all U. S. cropland is in need of drainage.

Melville L. Palmer

Melville L. Palmer
Extension Agricultural Engineer

All educational programs and activities conducted by the Ohio Cooperative Extension Service are available to all potential clientele on a non-discriminatory basis without regard to race, color, national origin, sex, handicap or religious affiliation.

Appendix T – Nutrient Reduction Strategy Example

Nutrient Reduction Calculator

Practice	Nitrogen Reduction	Phosphorus Reduction	Acres	Avg. Annual Cost ($/Acre)	Total Annual Cost ($)	Practice Type	Notes
Wetlands	52%	0%	996	$15.00	$ 14,940.00	Edge-of-Field	Highly effective for nitrate removal from tile drainage. P reduction varies.
Bioreactors	43%	0%	1459	$10.00	$ 14,590.00	Edge-of-Field	Trenches with woodchips that treat tile drainage water.
Saturated Buffers	91%	58%		$231.00	$ -	Edge-of-Field	This high N reduction only applies to water that interacts with the buffer's active root zone.
Drainage Water Mgt.	33%	0%	3	$10.00	$ 30.00	Edge-of-Field	Load reduction achieved by reducing flow volume, not concentration.
Terraces	0	77%			$ -	Edge-of-Field	An erosion control practice highly effective at reducing sediment and P loss.
Sediment Control	0	85%			$ -	Edge-of-Field	Includes practices like sedimentation basins or ponds.
Reduce N Rate to MRTN	10%	0%	1459	-$2.00	$ (2,918.00)	In-Field	MRTN is the Maximum Return to Nitrogen rate, an economically optimal amount.
Nitrification Inhibitor	9%	0%	729	-$3.00	$ (2,187.00)	In-Field	Used with fall-applied anhydrous ammonia.
Move Fall N to Spring	6%	0%	1459	-$20.00	$ (29,180.00)	In-Field	Moves fall fertilizer application to pre-plant in the spring.
Sidedress N Application	7%	0%	1459	$0.00	$ -	In-Field	Compares sidedress application to a single pre-plant application.
Cover Crops	31%	29%	304	$49.00	$ 14,896.00	In-Field	One of the most effective in-field practices for reducing both N and P.
No-Till	0%	90%	1459	$12.00	$ 17,508.00	In-Field	Compares no-till to a chisel plow system. Very effective for P reduction.
Conservation Tillage	0%	33%	729	-$1.00	$ (729.00)	In-Field	Compares chisel plowing to more intensive moldboard plowing.
Extended Rotations	42%	0%		$30.00	$ -	Land Use	Involves a 4- or 5-year rotation with at least two years of alfalfa.
Land Retirement (CRP)	85%	75%		$192.00	$ -	Land Use	Converts cropland to perennial vegetation.
					$ 26,950.00		

This Example Reduction	
Nitrogen Reduction	**45%**
Phosphorus Reduction	**45%**

Spreadsheet Created by: AgriVia

"This spreadsheet is for illustrative purposes only. All acreage figures are examples and not intended to reflect actual values."

Appendix U – Landowner Engagement Letter

AgriVia

PO Box 44
1124 Willis Ave
Perry, IA 50220

February 18, 2026

Subject: Informational Meeting

Dear Landowners and Trustees of Drainage District No. 61 Lateral A,

You are invited to attend an informational meeting regarding the ongoing improvement study for Drainage District No. 61 Lateral A. The meeting will be held in the Election Center at 1302 1/2 Broadway St, Emmetsburg, IA on Tuesday, March 24th, 2026, at 9:00 AM.

The purpose of this meeting is to update landowners on the status of the engineer's study and to gather any pertinent information or input that you may have. No formal decisions will be made at this meeting. This is strictly an informational meeting to help guide the direction of the proposed improvements based on landowner feedback.

We encourage landowners to bring any relevant information they may have about their property, particularly private tile maps and wetland determinations. Wetland determinations can be obtained from your local NRCS office.

Much of the initial study has been completed, and we will be bringing materials and findings gathered to date to share with you.

Attendance is not required, but your participation is appreciated, especially if you have input, concerns, or historical knowledge that may be helpful in the planning process. Following the meeting, we will finalize the engineer's report and begin preparing proposed plans for the district based on the feedback received. Thank you for your time and your assistance in this shared effort.

Sincerely,

Jacob Hagan, P.E.
jacob.agrivia@gmail.com
712-250-4318
AgriVia PLLC

Tyler Buman
tyler.agrivia@gmail.com
712-579-5296

cc: Jordan Morey, Palo Alto Co. Drainage Clerk
Palo Alto County Board of Supervisors

Appendix V – Proposed Work Limits

Proposed Work Limits
Tile Improvements
Drainage District No. 61-A
Palo Alto County, IA

Lateral A Tile Approximate Work Limits				
Deedholder	**S-T-R**	**Legal**	**Width (ft)**	**Acres**
Amen Farms, LLC	9-95-31	NW SE	100 (50 each side)	2.2
Amen Farms, LLC	9-95-31	SW SE	100 (50 each side)	1.6
Bargman, Melva M, Rev Trust	23-95-31	NW NW	100 (50 each side)	3.4
Cinbur Properties, LLC	4-95-31	NW NW	100 (50 each side)	0.8
Cinbur Properties, LLC	4-95-31	SW NW	100 (50 each side)	3.9
Cinbur Properties, LLC	4-95-31	NE SW	100 (50 each side)	2
Cinbur Properties, LLC	4-95-31	NW SW	100 (50 each side)	1.9
Cinbur Properties, LLC	4-95-31	SE SW	100 (50 each side)	3.8
Crippen Corner Farms, LP	15-95-31	PT. NW NW	100 (50 each side)	2.9
Fehr, James A & Sharon A, Trust	9-95-31	PT. SE NW	100 (50 each side)	2.3
Firkins, Terry Lynn	9-95-31	PT. NE NW	100 (50 each side)	2.4
FKF Farms, LLC	32-96-31	SW SE	100 (50 each side)	2.3
FKF Farms, LLC	32-96-31	NW SE	100 (50 each side)	3.4
Fogarty, Lawrence & Karen, Jt Ten	15-95-31	SE SE EXC N 744'	100 (50 each side)	1.9
Funk Family Farm Trust	32-96-31	PT. SE SE	100 (50 each side)	1.5
Geelan, John W & C Virginia	15-95-31	SW NW	100 (50 each side)	1.8
Geelan, John W & C Virginia	15-95-31	SE NW	100 (50 each side)	2.2
Geelan, John W & C Virginia	15-95-31	NE SW	100 (50 each side)	2.7
Grimm, Colman Wayne	9-95-31	W1/2 E1/2 SE SE	100 (50 each side)	1.5
Grimm, Jordon W	9-95-31	W1/2 SE SE	100 (50 each side)	2.1
Grimm, Nathan Jordon & Sierra Rose, Jt	9-95-31	E1/2 E1/2 SE SE	100 (50 each side)	0.3
Gunderson, Dean	32-96-31	SE NW	100 (50 each side)	0.1
Jackson, Viola Ann Trust, Trustee	9-95-31	PT. SE NW	100 (50 each side)	1.1
Jackson, Viola Ann Trust, Trustee	9-95-31	PT. NE NW	100 (50 each side)	0.7
Johnson, Gary L, Rev Tr	16-95-31	NE NE	100 (50 each side)	1.4
Kellenberger, Robin, Kent, Kristi, Amber & Ryen	5-95-31	4.83 TRIANGULAR TRACT IN NE CORNER BETWEEN ROAD & R.R. AND BILLBOARD	100 (50 each side)	0.6
Kuecker, Thomas James	22-95-31	NE NE	100 (50 each side)	0.3
Mason, Henry & Sharon, Jt Ten	5-95-31	TRACT IN NE NE	100 (50 each side)	0.1
Metzger, David J & Carolyn N, Jt Ten	32-96-31	SW NE	100 (50 each side)	0.8
Meyer, Debra S, Trustee, Rev Trust	9-95-31	NE SW	100 (50 each side)	2.3
Salz, James P, LE	15-95-31	NW SE	100 (50 each side)	2.2
Soper, Jean Soper, Trustee of Rev Trust 1/2	9-95-31	NW NE	100 (50 each side)	0.1
Wardell, Susan S, Living Tr	5-95-31	PT. NE NE	100 (50 each side)	4.7
Wilt-Cable, Elizabeth A, Revocable Trust, 1/2int	15-95-31	N 744' SW SE	100 (50 each side)	1
Wilt-Cable, Elizabeth A, Revocable Trust, 1/2int	15-95-31	N 744' SE SE	100 (50 each side)	2
			Total Acres	**64.3**

Proposed Work Limits
Tile Improvements
Drainage District No. 61-A
Palo Alto County, IA

Lateral A4 Tile Approximate Work Limits				
Deedholder	**S-T-R**	**Legal**	**Width (ft)**	**Acres**
Fehr, James A & Sharon A, Trust	9-95-31	PT. SE NW	100 (50 each side)	0.1
Fish, Clayton H & Catherine Fish Hayes, LE, Rem	10-95-31	NW NW	100 (50 each side)	3.5
Fuerstenau, Wayne	10-95-31	NE NW	100 (50 each side)	0.1
Soper, Jean Soper, Trustee of Rev Trust 1/2	9-95-31	NE NE	100 (50 each side)	3.6
Soper, Jean Soper, Trustee of Rev Trust 1/2	9-95-31	SW NE	100 (50 each side)	3.8
Soper, Jean Soper, Trustee of Rev Trust 1/2	9-95-31	SE NE	100 (50 each side)	1.1
			Total Acres	**12.2**

PROPOSED PLANS FOR
DRAINAGE DISTRICT NO. 61
LATERALS A & A4 TILE IMPROVEMENTS
PALO ALTO COUNTY, IA
2026

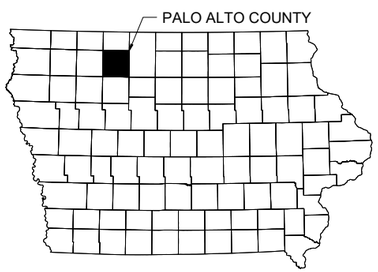
IOWA ONE CALL SM
1-800-292-8989 811
www.iowaonecall.com
Know what's below. Call before you dig.

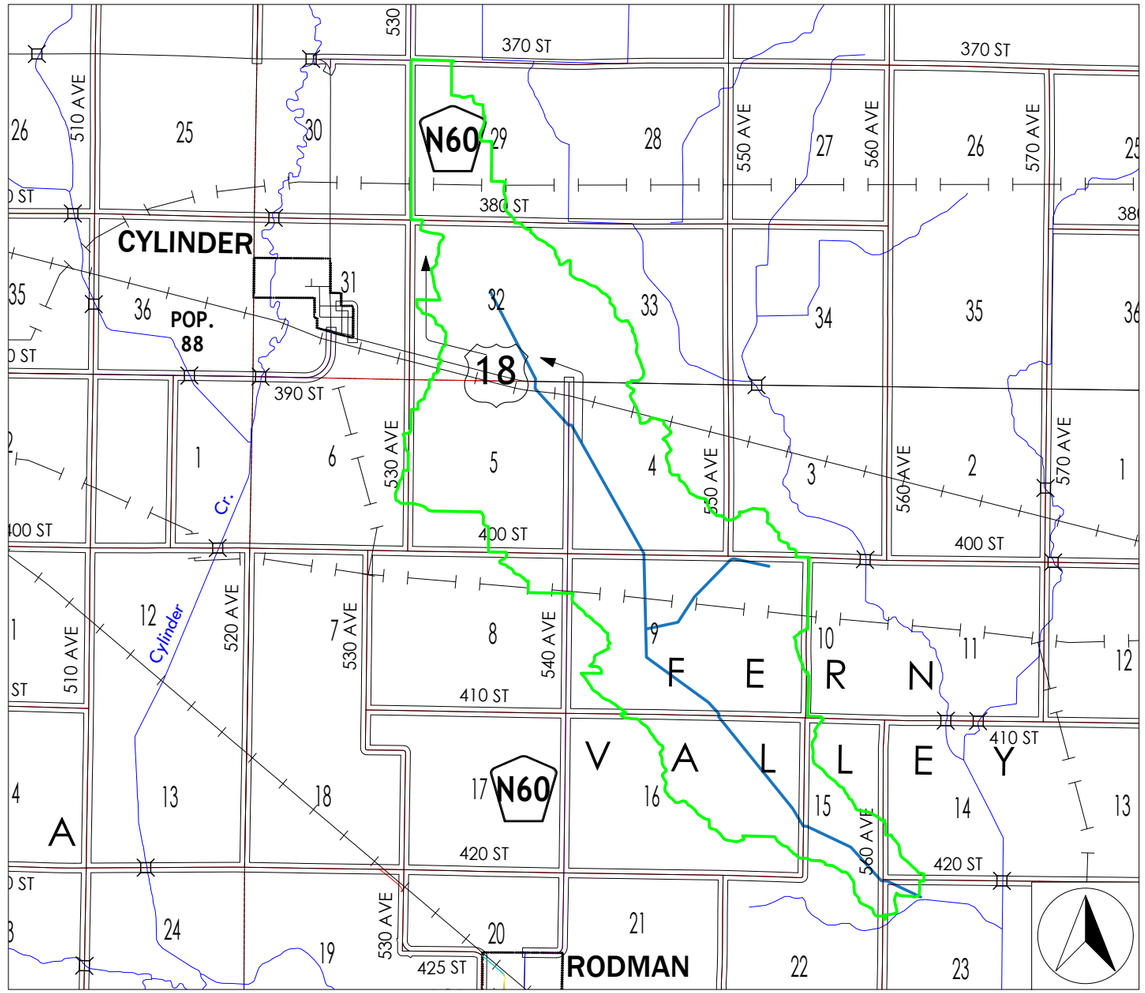
Utilities shown are estimates only. The Engineer makes no guarantee of the location or existence of those shown or not shown on the plans. The Contractor shall field verify exact locations prior to commencing construction as required by state law. Notify Iowa One Call, 811 or 1-800-292-8989.

Specifications

Unless otherwise noted, the governing standards for this project shall be the 2026 edition of the Iowa Statewide Urban Design and Specifications (SUDAS) for Public Improvements, supplemented where referenced by the Iowa Department of Transportation's Standard Specifications for Highway and Bridge Construction, Series 2023, along with all active general supplemental specifications, materials, instructional memoranda, and relevant special provisions.

Where conflicts arise, the stricter requirement shall take precedence. Complete compliance with all applicable federal, state, and local laws, ordinances, and regulations is mandatory throughout the project's execution.





Horizontal Datum: NAD83, Iowa State Plane Coordinate System, North Zone, U.S. Survey Feet | Vertical Datum: NAVD88 | Geoid Model: GEOID18

Sheet List	
Number	Title
A.01	Title Sheet
A.02	District Plat
C.01	General Notes
C.02	Pipe Construction Notes
C.03	Pipe Structure Notes
M.01	Plan & Profile - Lat. A Sta 0+00 → 30+00
M.02	Plan & Profile - Lat. A Sta 30+00 → 60+00
M.03	Plan & Profile - Lat. A Sta 60+00 → 90+00
M.04	Plan & Profile - Lat. A Sta 90+00 → 120+00
M.05	Plan & Profile - Lat. A Sta 120+00 → 150+00
M.06	Plan & Profile - Lat. A Sta 150+00 → 180+00
M.07	Plan & Profile - Lat. A Sta 180+00 → 210+00
M.08	Plan & Profile - Lat. A Sta 210+00 → 240+00
M.09	Plan & Profile - Lat. A Sta 240+00 → 270+00
M.10	Plan & Profile - Lat. A4 Sta 0+00 → 30+00
M.11	Plan & Profile - Lat. A4 Sta 30+00 → 60+00
V.01	540th Ave Boring
V.02	Railroad Boring
V.03	US Hwy 18 Boring

PROFESSIONAL ENGINEER
JACOB L. HAGAN
25738
IOWA

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

Jacob L. Hagan, P.E. (date)
License No. 25738
My license renewal date is December 31, 2026.
Pages or sheets covered by this seal:
All

PROFESSIONAL ENGINEER
TYLER J. BUMAN
30759
IOWA

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

Tyler J. Buman, P.E. (date)
License No. 30759
My license renewal date is December 31, 2027.
Pages or sheets covered by this seal:
All

AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

PLAN LEGEND
Proposed District Facilities
Benefited Area

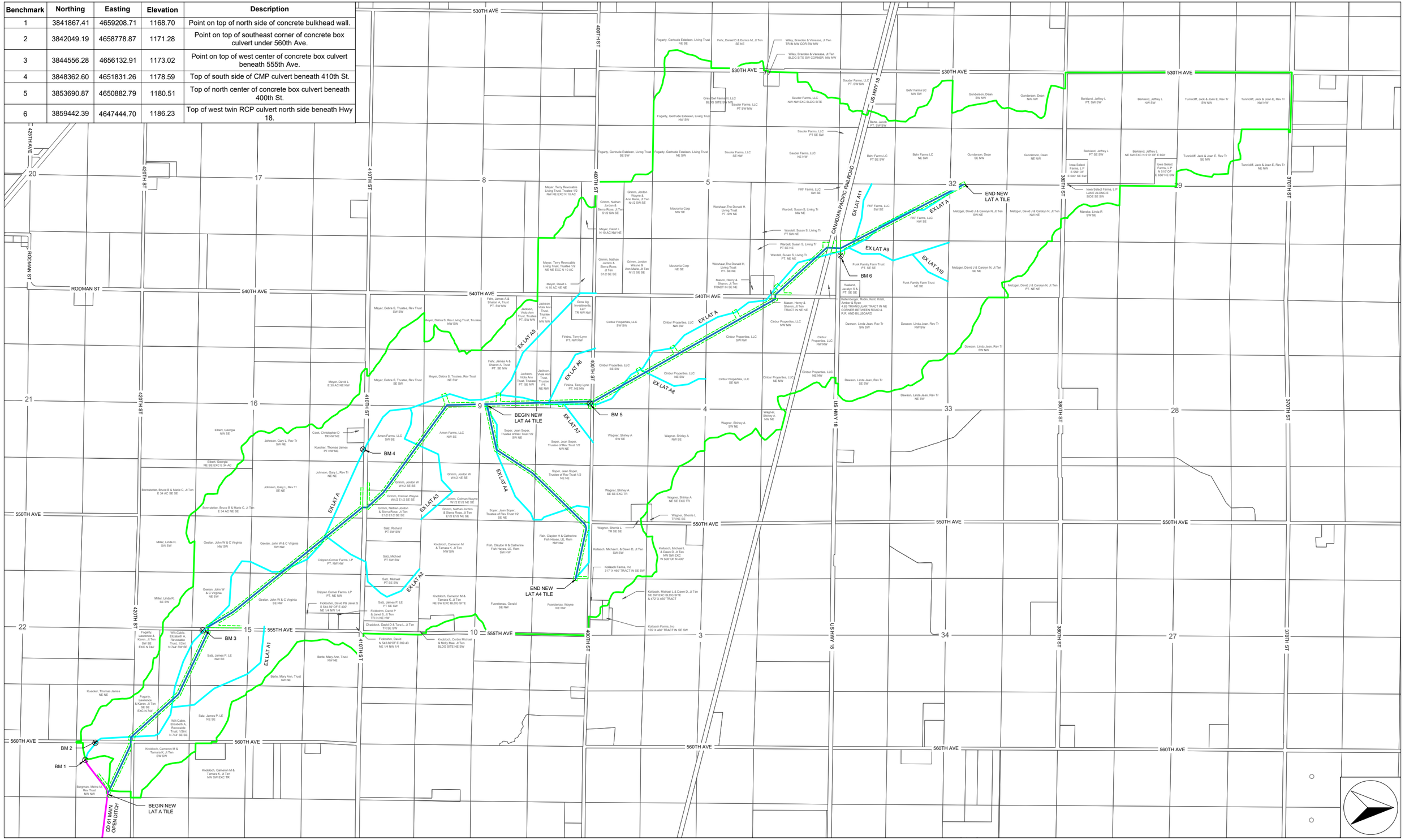
No.	Revision/Issue	Date

Sheet Name: Title Sheet

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project: 2601-74
Date: 2026-09-01
Plan Scale: 1" = 5,000'
Sheet: A.01

Benchmark	Northing	Easting	Elevation	Description
1	3841867.41	4659208.71	1168.70	Point on top of north side of concrete bulkhead wall.
2	3842049.19	4658778.87	1171.28	Point on top of southeast corner of concrete box culvert under 560th Ave.
3	3844556.28	4656132.91	1173.02	Point on top of west center of concrete box culvert beneath 555th Ave.
4	3848362.60	4651831.26	1178.59	Top of south side of CMP culvert beneath 410th St.
5	3853690.87	4650882.79	1180.51	Top of north center of concrete box culvert beneath 400th St.
6	3859442.39	4647444.70	1186.23	Top of west twin RCP culvert north side beneath Hwy 18.



AgriVia

Company Information
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PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

PLAN LEGEND
- Proposed District Facilities
- Existing DD 61 Facilities
- Approximate Benefited Area
- Parcel Lines
- Work Area

No.	Revision/Issue	Date

Sheet Name
District Plat

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 2,000'
Sheet A.02

GENERAL PROVISIONS & PRE-CONSTRUCTION

1. **WORK AREA:** THE PLANS SHOW THE WORK AREA. STANDARD WORK AREA IS 50 FEET EACH SIDE FROM THE CENTERLINE OF THE TILE UNLESS OTHERWISE NOTED. THE CONTRACTOR MUST STAY WITHIN THIS AREA. ANY DAMAGE OUTSIDE THE WORK AREA WILL BE DEDUCTED FROM FINAL PAYMENT. ALL STAGING AND STORAGE SHALL BE WITHIN THE WORK AREA. NO STORAGE OR STAGING SHALL TAKE PLACE ON ROADWAYS.

2. **ACCESS:** ACCESS TO THE WORK AREA IS LIMITED TO PUBLIC ROAD INTERSECTIONS AND DRIVEWAYS CALLED OUT ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR SECURING ANY ADDITIONAL TEMPORARY ACCESS AGREEMENTS WITH LANDOWNERS OR THE COUNTY ENGINEER FOR ROAD ROW ENTRY.

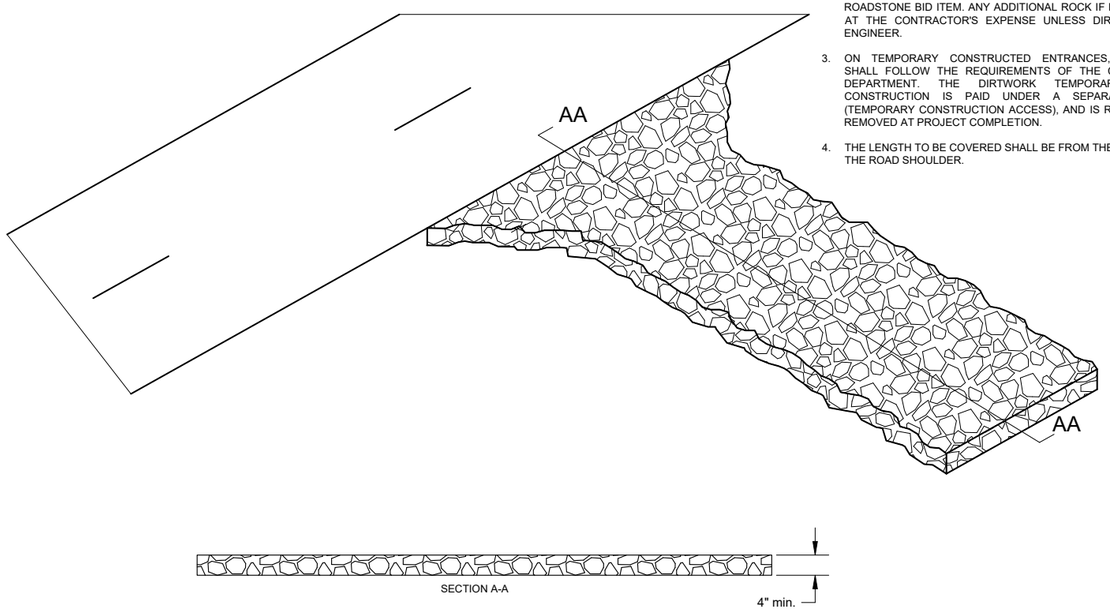
3. **UTILITIES & LOCATES:** THE CONTRACTOR SHALL NOTIFY IOWA ONE CALL (811) PRIOR TO EXCAVATION. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR PROTECTING ALL MARKED AND UNMARKED UTILITIES.

4. **TILE EXPLORATION:** EXISTING TILE IS APPROXIMATELY LOCATED ON THE PLANS. ENGINEER MAY DIRECT CONTRACTOR TO LOCATE TILE BEFORE STARTING AND ADVANCING WORK TO DETERMINE EXISTING TILE LOCATION AND DEPTH TO AVOID POTENTIAL CONFLICTS. CONTRACTOR SHALL BE COMPENSATED ON AN HOURLY BASIS PER EXCAVATION, EXPLORATORY BID ITEM.

5. **AS-BUILT DOCUMENTATION:** THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A COMPLETE SET OF DRAWINGS SUITABLY MARKED TO SHOW ANY DEVIATIONS FROM THE ORIGINAL PLANS, INCLUDING BUT NOT LIMITED TO ACTUAL PIPE ALIGNMENTS, DEPTHS, CONNECTION LOCATIONS, AND ANY FIELD MODIFICATIONS. THIS DOCUMENTATION SHALL BE PROVIDED PRIOR TO FINAL ACCEPTANCE.

6. **THE LANDOWNERS** WHERE THE TILE IS BEING INSTALLED ARE PAYING FOR THIS PROJECT. AT COMPLETION OF THE PROJECT, THOSE LANDOWNERS ARE INVITED TO A PUBLIC HEARING AND CAN FILE CLAIMS FOR DAMAGES. THESE SPECIFICATIONS AND PLANS EXIST AS MUCH TO GUIDE AND PROTECT THE CONTRACTOR AS TO PROTECT THE LANDOWNERS. REGULAR DOCUMENTATION ALONG WITH OPEN COMMUNICATION WITH THE ENGINEER IS ESSENTIAL TO A SMOOTH PROJECT FOR ALL PARTIES.

CONSTRUCTION ACCESS



GENERAL NOTES:

1. LOCATIONS OF CONSTRUCTION ENTRANCES ARE MARKED ON THE PLANS. CONTRACTOR SHALL OBTAIN APPROVAL FROM THE ENGINEER PRIOR TO USING ANY OTHER ENTRANCES.
2. PLACING 12 TONS OF CLASS A ROADSTONE ON EACH EXISTING AND TEMPORARY ENTRANCE WILL BE PAID UNDER THE CLASS A ROADSTONE BID ITEM. ANY ADDITIONAL ROCK IF PLACED WILL BE AT THE CONTRACTOR'S EXPENSE UNLESS DIRECTED BY THE ENGINEER.
3. ON TEMPORARY CONSTRUCTED ENTRANCES, CONTRACTOR SHALL FOLLOW THE REQUIREMENTS OF THE COUNTY ROADS DEPARTMENT. THE DIRTWORK TEMPORARY DRIVEWAY CONSTRUCTION IS PAID UNDER A SEPARATE BID ITEM (TEMPORARY CONSTRUCTION ACCESS), AND IS REQUIRED TO BE REMOVED AT PROJECT COMPLETION.
4. THE LENGTH TO BE COVERED SHALL BE FROM THE FIELD EDGE TO THE ROAD SHOULDER.

ROADWAY CROSSINGS

1. **PERMITS & NOTIFICATIONS:** THE CONTRACTOR SHALL OBTAIN ALL NECESSARY OCCUPANCY PERMITS FROM THE COUNTY ENGINEER OR IOWA DOT. NOTIFY THE RESPECTIVE AGENCY AND THE PROJECT ENGINEER AT LEAST 48 HOURS PRIOR TO COMMENCING ANY WORK WITHIN THE ROW.

2. **TRAFFIC CONTROL:** THE CONTRACTOR IS RESPONSIBLE FOR ALL TRAFFIC CONTROL, INCLUDING SIGNAGE, BARRICADES, AND FLAGGERS. ALL SETUPS MUST STRICTLY ADHERE TO THE LATEST MUTCD (MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES) STANDARDS AND ANY SPECIFIC REQUIREMENTS SET BY THE COUNTY OR DOT PERMIT.

3. **UTILITY VERIFICATION:** ALL UTILITIES WITHIN THE ROW (FIBER OPTIC, GAS, WATER, ETC.) MUST BE DAYLIGHTED VIA POTHOLING PRIOR TO THE ARRIVAL OF THE BORING OR TRENCHING EQUIPMENT.

4. **SEEDING:** DISTURBED ROAD DITCHES SHALL BE SEEDED FOLLOWING SUDAS TYPE 2 (PERMANENT COOL SEASON MIXTURE FOR SLOPES AND DITCHES) SEED MIXTURE.

5. **STORAGE AND PARKING:** NO STORAGE OR PARKING OF EQUIPMENT IN PUBLIC RIGHT-OF-WAY. NO CROSSING PAVED ROADS WITH TRACKED EQUIPMENT.

6. **OPEN CUT: COUNTY GRAVEL ROAD**

   a. PIPE SUPPORT: ALL PIPE UNDER THE ROADWAY MUST BE INSTALLED USING MODIFIED TYPE 4 TRENCHING.

   b. MATERIALS: WITHIN THE ROAD PRISM, NATIVE SOIL SHALL NOT BE USED FOR HAUNCHING. USE 1-INCH CLEAN CRUSHED STONE OR SUDAS CLASS I CRUSHED STONE TO THE SPRINGLINE OF THE PIPE. FROM THE TOP OF THE PIPE TO WITHIN 12 INCHES OF THE ROAD SURFACE, THE TRENCH MAY BE FILLED WITH NATIVE SUBSOIL MATERIAL PER THE ENGINEER'S APPROVAL. THE ENGINEER MAY REQUIRE THE BACKFILL TO BE CLASS I STONE PER THEIR DIRECTION.

   c. COMPACTION LIFTS: BACKFILL SHALL BE PLACED IN MAXIMUM 8-INCH LOOSE LIFTS. EACH LIFT MUST BE MECHANICALLY COMPACTED TO 95% STANDARD PROCTOR DENSITY.

   d. SURFACE MATERIAL: THE TOP 12 INCHES OF THE TRENCH SHALL BE FILLED WITH CLASS A ROAD STONE (OR THE SPECIFIC GRAVEL GRADE USED BY THE COUNTY) AND COMPACTED THOROUGHLY.

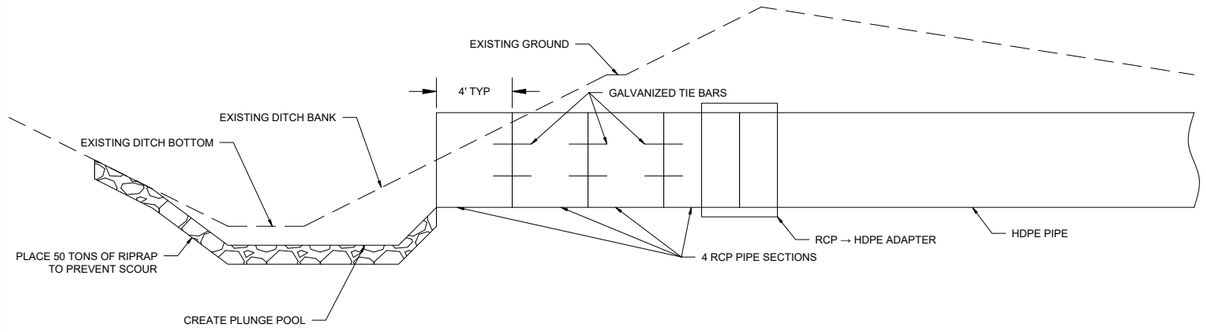
   e. CROWNING: THE FINISHED SURFACE OF THE TRENCH SHOULD BE "CROWNED" APPROXIMATELY 1 TO 2 INCHES HIGHER THAN THE ADJACENT ROAD GRADE TO ALLOW FOR INITIAL TRAFFIC-DRIVEN COMPACTION WITHOUT CREATING A DEPRESSION.

   f. SHOULDER REPAIR: ANY DAMAGE TO THE ROAD SHOULDERS OR SIDE SLOPES SHALL BE RESHAPED TO MATCH THE ORIGINAL PROFILE AND IMMEDIATELY SEEDED/MULCHED.

   g. ROAD CLOSURE: THE CROSSING NEEDS TO BE COMPLETED IN ONE DAY. THE ROAD SHALL ONLY BE CLOSED FROM SUNRISE TO SUNSET. BY SUNSET THE ROAD SHALL BE OPEN TO TRAFFIC.

7. **TRENCHLESS / BORED METHOD:** SHALL FOLLOW SUDAS 3020 AND IOWA DOT PERMIT REQUIREMENTS.

OUTLET DETAIL



AgriVia

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Checker TJB

No.	Revision/Issue	Date

Sheet Name: General Notes

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project: 2601-74
Date: 2026-09-01
Plan Scale:
Sheet: C.01

PIPE EXCAVATION, TRENCHING & BEDDING NOTES

1. **RIGID PIPE (RCP):** STANDARD SPOON TRENCH METHOD. THE TRENCH BASE MUST BE EXCAVATED WITH A SHAPED BOTTOM GROOVE CONFORMING TO AT LEAST 1/6 OF THE PIPE OUTSIDE CIRCUMFERENCE TO PROVIDE UNIFORM SUPPORT. IF A FIRM TRENCH BOTTOM IS NOT FOUND, THE CONTRACTOR SHALL OVER-EXCAVATE AND PLACE 1"–3" CLEAN CRUSHED STONE BEDDING (SUDAS CLASS 1) TO STABILIZE THE BASE PER ENGINEER'S DIRECTION. GPS LOCATED AND TIME STAMPED PHOTOS SHALL BE TAKEN EVERY 100 FEET OR ANY TIME ROCK BEDDING IS USED AND ROCK TICKETS SHALL BE SUBMITTED.

2. **FLEXIBLE PIPE (CPDT):** SUDAS SW-103 F-2 BEDDING REQUIREMENTS. TRENCH WIDTH SHALL BE THE OUTSIDE DIAMETER PLUS 12 INCHES. GPS LOCATED AND TIME STAMPED PHOTOS SHALL BE TAKEN EVERY 100 FEET SHOWING THE ROCK TO THE TOP OF THE PIPE BEFORE BACKFILLING WITH DIRT. ALL ROCK TICKETS SHALL BE SUBMITTED, AND ALL ROCK USED IS INCIDENTAL TO INSTALLATION. ROCK TICKETS SHALL BE SUBMITTED WEEKLY WITH A LOG OF LENGTH OF TILE INSTALLED CORRESPONDING TO THE ROCK USED. A SPOON BOTTOM MAY BE USED FOR PIPE 15" OR SMALLER IF LAID USING A TILE PLOW OR TRENCHER WITH GRADE CONTROL. A SPOON BOTTOM (NO ROCK BEDDING) USING AN EXCAVATOR IS NOT ACCEPTABLE FOR ANY SIZE PIPE.

   TO ENSURE LONGEVITY AND MINIMIZE SETTLEMENT FOR FLEXIBLE PIPE INSTALLATION, THE CONTRACTOR MUST PARTICIPATE IN THE FOLLOWING VERIFICATION PROCESS:

   STEP 1 (DEMONSTRATION): IN THE PRESENCE OF THE ENGINEER, THE CONTRACTOR SHALL DEMONSTRATE THEIR COMPACTION METHOD ON THE FIRST SEVERAL PIPE SECTIONS. DENSITY TESTS MAY BE TAKEN TO CONFIRM THE METHOD ACHIEVES 95% STANDARD PROCTOR DENSITY.

   STEP 2 (SPOT CHECKING): ONCE A METHOD IS APPROVED, THE CONTRACTOR MAY PROCEED, BUT MAY BE RANDOMLY TESTED BY THE ENGINEER AT THE ENGINEER'S SOLE DECISION. GPS LOCATED AND TIME STAMPED PHOTOS EVERY 100 FEET SHOWING THE TILE UNBLINDED WITH THE HAUNCHES FILLED AND COMPACTED ARE REQUIRED TO BE SUBMITTED.

   STEP 3 (VIDEO AND DEFLECTION TESTING): PER SUDAS REQUIREMENTS FOR FLEXIBLE PIPE AFTER COMPLETION OF THE PROJECT.

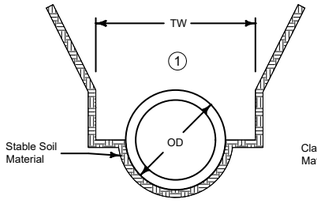
3. **BACKFILL AND TOPSOIL:** TOPSOIL (TOP 12" OR HORIZON A SOIL IF DEEPER) SHALL BE SEGREGATED DURING EXCAVATION AND PLACED ON THE OPPOSITE SIDE OF THE TRENCH AS THE SUBSOIL IS PLACED. THE SUBSOIL SHALL BE PLACED FIRST IN 6-INCH LIFTS AND THE TOPSOIL PLACED ON TOP. ROCKS SHALL BE PICKED UP AND BURIED AT LEAST 4 FEET DEEP. A SMALL MOUND IS ALLOWABLE (MAXIMUM HEIGHT OF 6 INCHES).

4. **ELBOWS AND BENDS:** THE PLANS SHOW BENDS AND ELBOWS. ADDITIONAL BENDS OR ELBOWS MAY BE REQUIRED DEPENDING ON EXISTING TILE LOCATIONS AND UNKNOWN SUBSURFACE CONDITIONS. ALL BENDS AND ELBOWS ARE INCIDENTAL UNLESS CALLED OUT IN BID DOCUMENTS. CONTRACTOR SHALL RECEIVE NO ADDITIONAL COMPENSATION FOR ADDITIONAL RCP BENDS OR HDPE ELBOWS NEEDED DUE TO ALIGNMENT CHANGES.

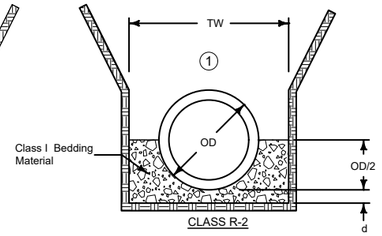
   RCP PIPE: GENTLE CURVES CAN BE ACCOMPLISHED VIA GAPPING THE PIPE. ALL RADII SHALL BE WRAPPED IN FABRIC. MAXIMUM ALLOWABLE DEGREE PER PIPE SECTION IS 2.5 DEGREES.

   HDPE PIPE: ALL CHANGES IN DIRECTIONS SHALL BE DONE USING MANUFACTURED ELBOWS. THE MAXIMUM ALLOWABLE ELBOW TO BE USED IS 30 DEGREES. TO ACHIEVE BENDS GREATER THAN 30 DEGREES, MULTIPLE ELBOWS SHALL BE USED.

RCP AND VCP CIRCULAR PIPE BEDDING



STANDARD SPOON TRENCH METHOD



CLASS R-2

① Use Standard Spoon Trench Method or R-2 unless specified otherwise.

① Place remainder of bedding and backfill materials as specified in the contract documents.

Key

OD = Outside diameter of pipe

TW = Trench width at top of pipe:
Min. = OD+18 inches
Max.= 1.25xOD+12 inches OR
54 inches (whichever is greater)

d = Depth of bedding material below pipe: OD/8 or OS/8, OR 4 inches (whichever is greater)

ALLOWABLE BURY DEPTH

CLASS III RCP

Pipe Diameter (in)	Standard "Spoon-Trench" Method	Class R-2 Bedding
12	7'	10'
15	8'	10'
18	8'	11'
21	8'	11'
24	8'	12'
27	10'	15'
30	11'	15'
33	11'	15'
36	11'	15'
42	11'	15'
48	11'	15'
54	11'	15'
60	11'	15'
66	11'	15'
72	11'	15'

CLASS IV RCP

Pipe Diameter (in)	Standard "Spoon-Trench" Method	Class R-2 Bedding
12	12'	15'
15	12'	16'
18	13'	16'
21	13'	18'
24	16'	23'
27	19'	30'
30	19'	29'
33	19'	28'
36	19'	28'
42	18'	27'
48	18'	26'
54	18'	25'
60	18'	25'
66	18'	25'
72	18'	24'

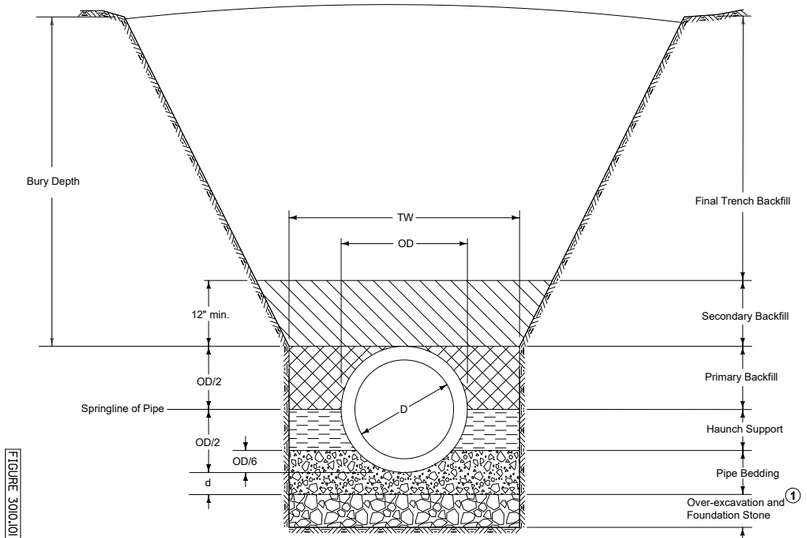
CLASS V RCP

Pipe Diameter (in)	Standard "Spoon-Trench" Method	Class R-2 Bedding
12	18'	23'
15	19'	24'
18	19'	30'
21	25'	40'
24	34'	40'
27	40'	40'
30	40'	40'
33	40'	40'
36	40'	40'
42	37'	40'
48	35'	40'
54	33'	40'
60	32'	40'
66	31'	40'
72	31'	40'

TRENCH BEDDING AND BACKFILL ZONES

Refer to the contract documents for specific material and placement requirements.

① Required only when specified in the contract documents or when directed by the Engineer.



Key

OD = Outside diameter of pipe

D = Inside diameter of pipe

TW = Trench width at top of pipe

d = Depth of bedding material below pipe

FIGURE 3010.101 SHEET 1 OF 1

SUDAS | IOWADOT | REVISION 1 04-17-18

FIGURE 3010.101 | STANDARD ROAD PLAN | SW-101 | SHEET 1 of 1

REVISIONS: Replaced Iowa DOT and SUDAS logos.

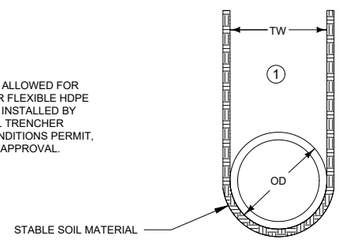
Paul D. Wiegand, SUDAS DIRECTOR — Brian Smith, DESIGN METHODS ENGINEER

TRENCH BEDDING AND BACKFILL ZONES

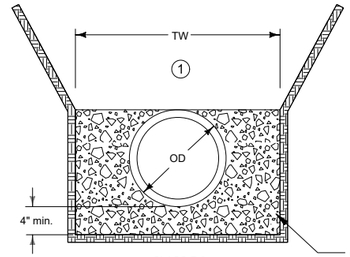
HDPE & PP PIPE INSTALLATION DETAIL

NOTE

1. SPOON METHOD ALLOWED FOR 15" AND SMALLER FLEXIBLE HDPE DUAL WALL PIPE INSTALLED BY PLOW OR WHEEL TRENCHER WHERE SOIL CONDITIONS PERMIT, WITH ENGINEER APPROVAL.



SPOON TRENCH METHOD



CLASS F-2

KEY

OD = Outside diameter of pipe

TW = Trench width at top of pipe
Min. = OD+18 inches OR 1.25xOD+12 inches
(whichever is greater)

ALLOWABLE BURY DEPTH

HDPE PIPE		POLYPROPYLENE PIPE	
Pipe Diameter (in)	AASHTO M 294	Pipe Diameter (in)	ASTM F 2764
12	8'	12	24'
15	9'	15	25'
18	9'	18	22'
24	9'	24	20'
30	9'	30	22'
36	9'	36	21'
42	8'	42	22'
48	8'	48	23'
54	8'	54	21'
60	8'	60	21'

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Sheet Name: Pipe Construction Notes

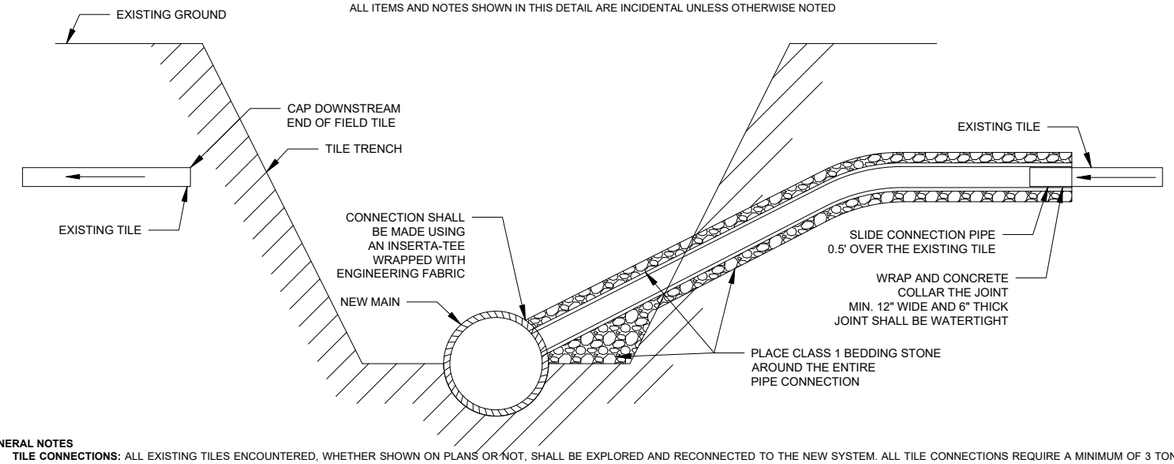
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560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale

Sheet C.02

TYPICAL TILE CONNECTION DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED

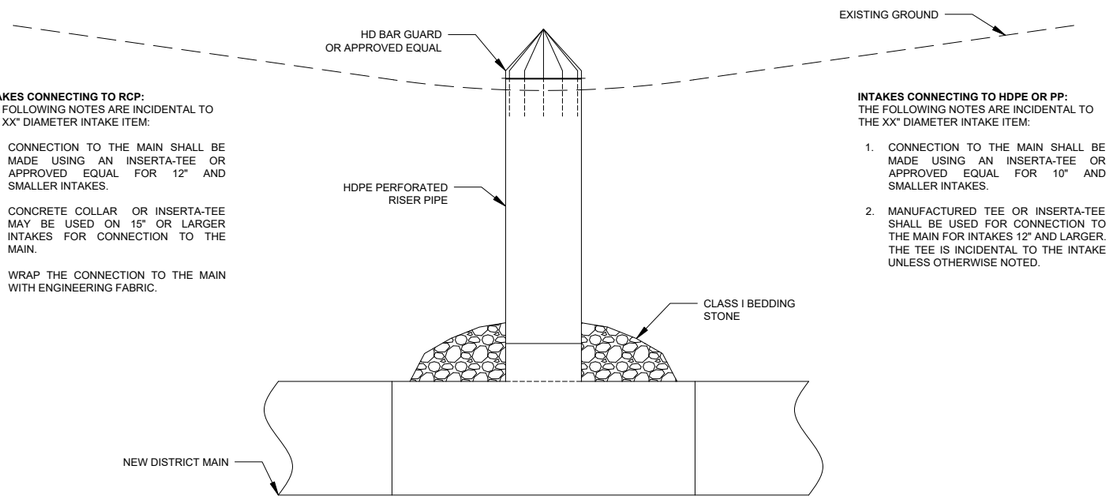


GENERAL NOTES

1. **TILE CONNECTIONS:** ALL EXISTING TILES ENCOUNTERED, WHETHER SHOWN ON PLANS OR NOT, SHALL BE EXPLORED AND RECONNECTED TO THE NEW SYSTEM. ALL TILE CONNECTIONS REQUIRE A MINIMUM OF 3 TONS OF CLASS I BEDDING STONE TO BE PLACED AROUND THE ENTIRE TILE CONNECTION. A TIME-STAMPED AND GPS-LOCATED PHOTO WILL BE REQUIRED FOR EACH CONNECTION. THE PHOTO SHALL BE TAKEN BEFORE THE ROCK HAS COMPLETELY ENCASED THE PIPE. A LOG OF ALL CONNECTIONS INCLUDING SIZE, LOCATION AND EXISTING MATERIAL SHALL BE SUBMITTED PRIOR TO PAYMENT. ROCK TICKETS MUST BE SUBMITTED. ROCK USED IS INCIDENTAL TO INSTALLATION. ANY LATERAL TILE CROSSING THE MAIN LINE TRENCH MUST BE SUPPORTED BY CRUSHED STONE BEDDING TO PREVENT SETTLEMENT AND SHEARING AT THE CONNECTION POINT.
2. TO MAKE THE CONNECTION, SINGLE WALL CORRUGATED DRAIN TILE OF THE SAME OR LARGER SIZE THAN THE EXISTING TILE MAY BE USED FOR TILES UP TO 10" IN DIAMETER. ANY TILE 12" OR LARGER WILL REQUIRE USING FLEXIBLE DUAL WALL DRAIN TILE OF THE SAME OR LARGER TILE TO MAKE THE CONNECTION. 25 LF OF DRAIN TILE IS CONSIDERED INCIDENTAL TO THE CONNECTION, IF LONGER THAN 25 FEET IS USED, IT NEEDS TO BE NOTED IN THE LOG WITH A PHOTO TO BE PAID.
3. THE UPSTREAM END CONNECTING TO THE TILE SHALL BE WRAPPED WITH FABRIC AND CONCRETE COLLARED. THE DOWNSTREAM END OF THE TILE CONNECTION SHALL BE CAPPED WITH BROKEN TILE AND CONCRETE PIECES BONDED WITH SACKRETE OR APPROVED SIMILAR AND WRAPPED WITH FABRIC OR A HDPE END CAP MAY BE USED.
4. 12" TILE INTERCONNECTIONS WITH THE EXISTING DISTRICT TILE WILL BE PAID AS LARGE TILE CONNECTIONS. TILE INTERCONNECTIONS WITH THE EXISTING FIELD TILE WILL BE PAID AS SMALL TILE CONNECTIONS.
5. **RCP DISTRICT TILE CONNECTIONS:** ALL TILE CONNECTIONS 12" OR SMALLER SHALL BE MADE WITH INSERTA-TEE OR APPROVED SIMILAR. ALL TILE CONNECTIONS 15" OR LARGER SHALL BE MADE WITH EITHER AN INSERTA-TEE OR MAY BE CONCRETE COLLARED.
6. **HDPE DISTRICT TILE CONNECTIONS:** ALL TILE CONNECTIONS 10" OR SMALLER SHALL BE MADE WITH AN INSERTA-TEE OR APPROVED SIMILAR. TILE CONNECTIONS ONTO 42" PIPE MAY USE UP TO A 15" INSERTA-TEE. TILE CONNECTIONS ONTO 48" MAY USE UP TO AN 18" INSERTA-TEE. TILE CONNECTIONS ONTO 60" PIPE MAY USE UP TO A 24" INSERTA-TEE. ALL OTHER TILE CONNECTIONS 12" OR LARGER SHALL USE A MANUFACTURED TEE CONNECTED VIA A CONCRETE COLLAR OR INTERLOCKED.

HD XX" BAR GUARD INTAKE DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED



INTAKES CONNECTING TO RCP:
THE FOLLOWING NOTES ARE INCIDENTAL TO THE XX" DIAMETER INTAKE ITEM:

1. CONNECTION TO THE MAIN SHALL BE MADE USING AN INSERTA-TEE OR APPROVED EQUAL FOR 12" AND SMALLER INTAKES.
2. CONCRETE COLLAR OR INSERTA-TEE MAY BE USED ON 15" OR LARGER INTAKES FOR CONNECTION TO THE MAIN.
3. WRAP THE CONNECTION TO THE MAIN WITH ENGINEERING FABRIC.

INTAKES CONNECTING TO HDPE OR PP:
THE FOLLOWING NOTES ARE INCIDENTAL TO THE XX" DIAMETER INTAKE ITEM:

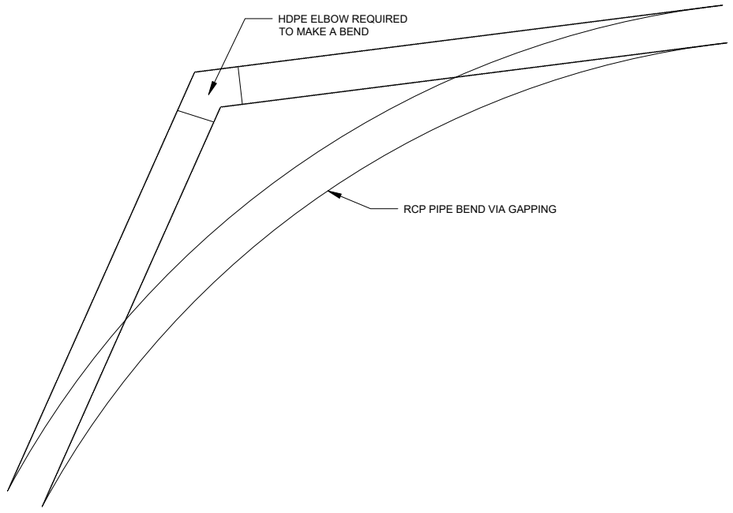
1. CONNECTION TO THE MAIN SHALL BE MADE USING AN INSERTA-TEE OR APPROVED EQUAL FOR 10" AND SMALLER INTAKES.
2. MANUFACTURED TEE OR INSERTA-TEE SHALL BE USED FOR CONNECTION TO THE MAIN FOR INTAKES 12" AND LARGER. THE TEE IS INCIDENTAL TO THE INTAKE UNLESS OTHERWISE NOTED.

GENERAL NOTES

1. **INTAKES (HICKENBOTTOM/BAR GUARD):** ALL INTAKES ARE CALLED OUT ON THE PLANS. ALL INTAKES REQUIRE A MINIMUM OF 3 TONS OF CLASS I BEDDING STONE TO BE PLACED AROUND THE ENTIRE CONNECTION. A TIME-STAMPED AND GPS-LOCATED PHOTO WILL BE REQUIRED FOR EACH CONNECTION. THE PHOTO SHALL BE TAKEN BEFORE THE ROCK HAS COMPLETELY ENCASED THE PIPE. A LOG OF ALL CONNECTIONS INCLUDING SIZE, LOCATION AND MATERIAL SHALL BE SUBMITTED PRIOR TO PAYMENT. ROCK TICKETS MUST BE SUBMITTED. ROCK USED IS INCIDENTAL TO INSTALLATION. THE GROUND AROUND THE INTAKE SHALL BE RESHAPED TO DRAIN TO THE INTAKE.
2. **BAR GUARD INTAKES:** ALL BAR GUARD INTAKES SHALL BE CONSIDERED HEAVY DUTY CONSTRUCTED OF ½" STEEL ROD WITH A YELLOW POWDER COAT FINISH. AGRI-DRAIN HD YELLOW BAR GUARD OR APPROVED EQUAL.
3. **INTAKE MARKER:** ALL INTAKES PLACED IN ROAD DITCHES SHALL INCLUDE AN INLET TILE MARKER SIGN, SUCH AS PROVIDED AT AGRI-DRAIN OR APPROVED EQUAL. THE SIGN SHALL BE FIXED TO A STEEL OR WOODEN POST AT MINIMUM 6' LONG.
4. **RISER:** PERFORATED HDPE DUAL WALL PIPE SHALL BE USED AS THE RISER, THE APPROXIMATE LENGTH REQUIRED IS SHOWN ON THE PLANS. THE PIPE USED AS A RISER IS CONSIDERED INCIDENTAL TO THE INTAKE INSTALLATION. NO MEASUREMENT WILL BE MADE OF THE LENGTH NEEDED. RISER MUST BE CUT FLUSH TO GROUND LEVEL.

HDPE ELBOW DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED



GENERAL NOTES

1. MAXIMUM DEGREE OF BEND PER HDPE ELBOW SHALL BE 30 DEGREES. IF THE DEGREE OF BEND EXCEEDS 30 DEGREES, MULTIPLE ELBOWS SHALL BE USED.
2. INSTALL AT ALL BEND LOCATIONS SHOWN ON PLANS.
3. HDPE ELBOWS ARE INCIDENTAL TO THE INSTALLATION OF HDPE TILE INSTALLATION. QUANTITY SHOWN ON PLANS IS ESTIMATED TO BE THE MINIMUM REQUIRED TO COMPLETE THE REQUIRED BENDS. IF MORE ELBOWS ARE NEEDED THAN SHOWN ON THE PLANS TO PROPERLY ALIGN THE PIPE, ANY ADDITIONAL COST FOR INSTALLATION IS THE RESPONSIBILITY OF THE CONTRACTOR FOR SUCH ACCOMMODATIONS. ALL ITEMS SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED.
4. CONTRACTOR SHALL PROVIDE TIMESTAMPED AND GPS LOCATED PHOTOS OF EACH ELBOW PRIOR TO BACKFILLING. ROCK TICKETS FOR EACH ELBOW MUST BE SUBMITTED. ROCK USED FOR EACH ELBOW IS INCIDENTAL.

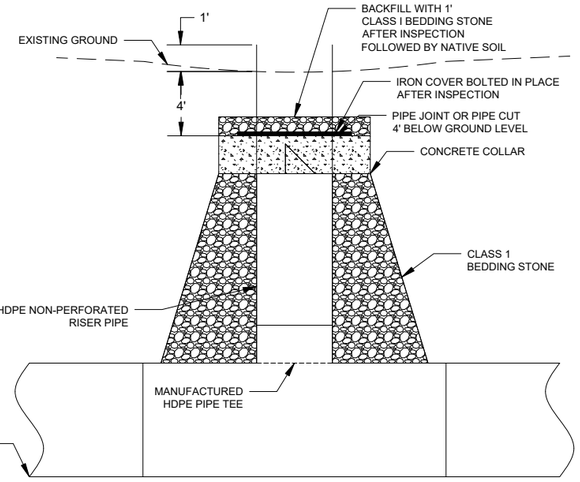
HDPE & PP INSPECTION PORT DETAIL

ALL ITEMS AND NOTES SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED

MATERIALS

1. **TEE BASE:** XX" ON "MAIN TILE SIZE" FABRICATED HDPE TEE (WATERTIGHT/SOIL-TIGHT).
2. **RISER PIPE:** DUAL-WALL HDPE (NON-PERFORATED) (AASHTO M294 TYPE S).
3. **COVER ASSEMBLY:** NYLOPLAST XX" DUCTILE IRON SOLID COVER (ADS PART #1801DI OR SIMILAR).

   NOTE: THE COVER MUST BE H-20 LOAD RATED (CAPABLE OF SUPPORTING 32,000 LBS PER AXLE). DO NOT USE PLASTIC SEPTIC LIDS OR FLAT END CAPS.
4. **SUPPORT STRUCTURE:** 4,000 PSI STRUCTURAL CONCRETE (FOR THE COLLAR).
5. **BEDDING/BACKFILL:** CLEAN, CRUSHED ANGULAR STONE (SUDAS CLASS I OR "1-INCH CLEAN") FOR THE BEDDING AND THE FIRST 2 FEET OF RISER BACKFILL.



INSTALLATION

1. **PHASE I: MAIN LINE CONSTRUCTION**

   INSTALL THE XX" ON MAIN TILE SIZE TEE ON A STABLE FOUNDATION OF F-2 BEDDING (PER USER SPEC).

   INSTALL THE XX" RISER PIPE VERTICALLY. FOR THE 30-DAY INSPECTION PERIOD, LEAVE THE PIPE EXTENDING 1 FOOT ABOVE THE SURFACE.
2. **PHASE II: 30-DAY INSPECTION**

   THIRTY (30) DAYS POST-CONSTRUCTION, PERFORM THE REQUIRED CAMERA INSPECTION AND MANDREL PULL THROUGH THE MAIN VIA THE XX" PORT.

   UPON APPROVAL OF THE INSPECTION, PROCEED TO FINAL BURIAL.
3. **PHASE III: FINAL BURIAL & LOAD SUPPORT**

   CUTTING: EXCAVATE AROUND THE RISER AND CUT THE HDPE PIPE TO A DEPTH OF 4 FEET BELOW FINAL GRADE.

   CONCRETE COLLAR (CRUCIAL): EXCAVATE A SHELF IN THE NATIVE SOIL AROUND THE TOP OF THE XX" PIPE. POUR AN 8-INCH-THICK CONCRETE COLLAR (SUDAS CLASS C) (APPROX. 36" IN DIAMETER) AROUND THE PIPE.

   LID PLACEMENT: SET THE NYLOPLAST DUCTILE IRON FRAME AND SOLID COVER INTO THE CONCRETE COLLAR / RISER. ENSURE THE FRAME IS LEVEL AND SUPPORTED BY THE CONCRETE, NOT JUST RESTING ON THE PLASTIC PIPE.

   BEDDING: PLACE 12 INCHES OF CRUSHED ROCK OVER THE LID TO PROVIDE A DRAINAGE/STABILITY LAYER.

   FINAL BACKFILL: BACKFILL THE REMAINING 3 FEET WITH NATIVE SOIL IN 6-INCH LIFTS, COMPACTING WITH BUCKET, LEAVE MOUND NOT TO EXCEED 6 INCHES.

GENERAL NOTES

1. ALL MATERIALS AND INSTALLATION SHALL COMPLY WITH IOWA SUDAS SECTION 4020/4040 AND MANUFACTURER SPECIFICATIONS FOR H-20 TRAFFIC LOADING.
2. INSTALL AT INTERVALS AS REQUIRED BY YOUR TESTING EQUIPMENT.
3. INSPECTION PORTS ARE INCIDENTAL TO THE INSTALLATION OF HDPE AND PP DRAINAGE MAIN TILE. QUANTITY SHOWN ON PLANS IS ESTIMATED TO BE THE MINIMUM REQUIRED TO COMPLETE THE REQUIRED TESTING. IF MORE INSPECTION PORTS ARE NEEDED THAN SHOWN ON THE PLANS TO PROPERLY INSPECT THE PIPE OR IF LARGER INSPECTION PORTS ARE NEEDED FOR THE TOOLS REQUIRED, ANY ADDITIONAL COST FOR INSTALLATION IS THE RESPONSIBILITY OF THE CONTRACTOR FOR SUCH ACCOMMODATIONS. ALL ITEMS SHOWN IN THIS DETAIL ARE INCIDENTAL UNLESS OTHERWISE NOTED.
4. CONTRACTOR SHALL PROVIDE TIMESTAMPED AND GPS LOCATED PHOTOS OF EACH PORT PRIOR TO BACKFILLING. ROCK TICKETS FOR EACH PORT MUST BE SUBMITTED. ROCK USED FOR EACH PORT IS INCIDENTAL.

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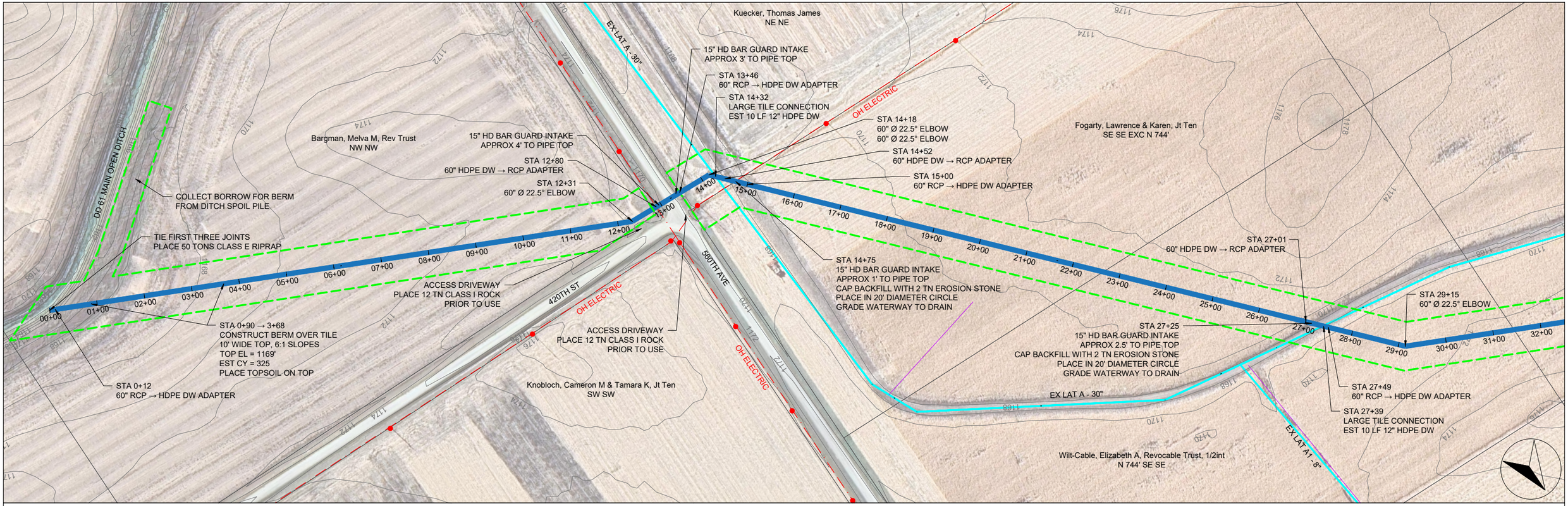
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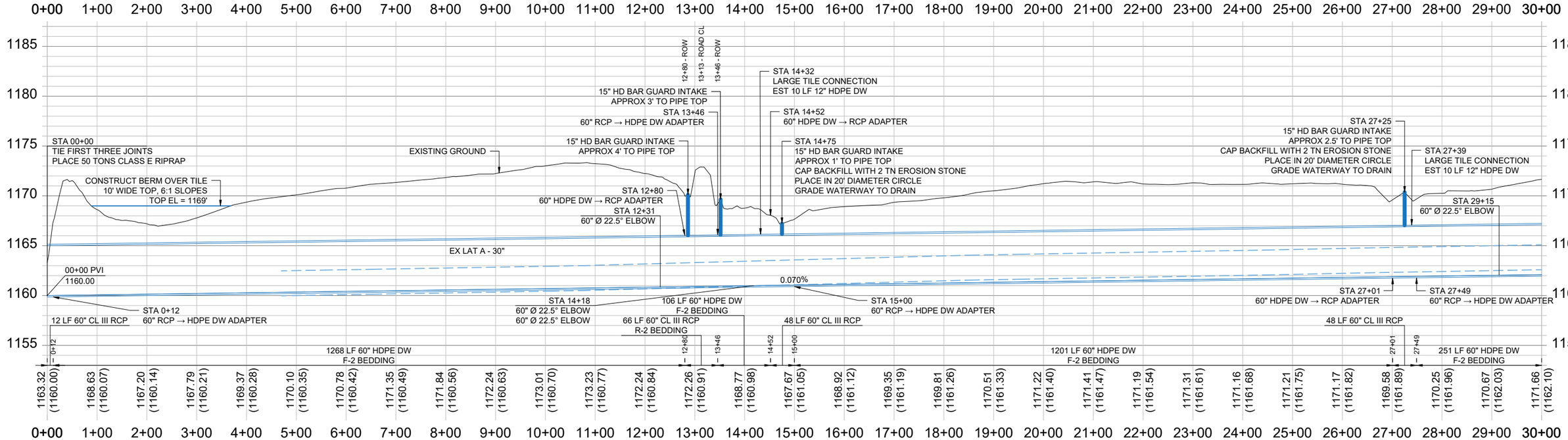
No.	Revision/Issue	Date

Sheet Name: Pipe Structure Notes

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project: 2601-74
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Plan Legend

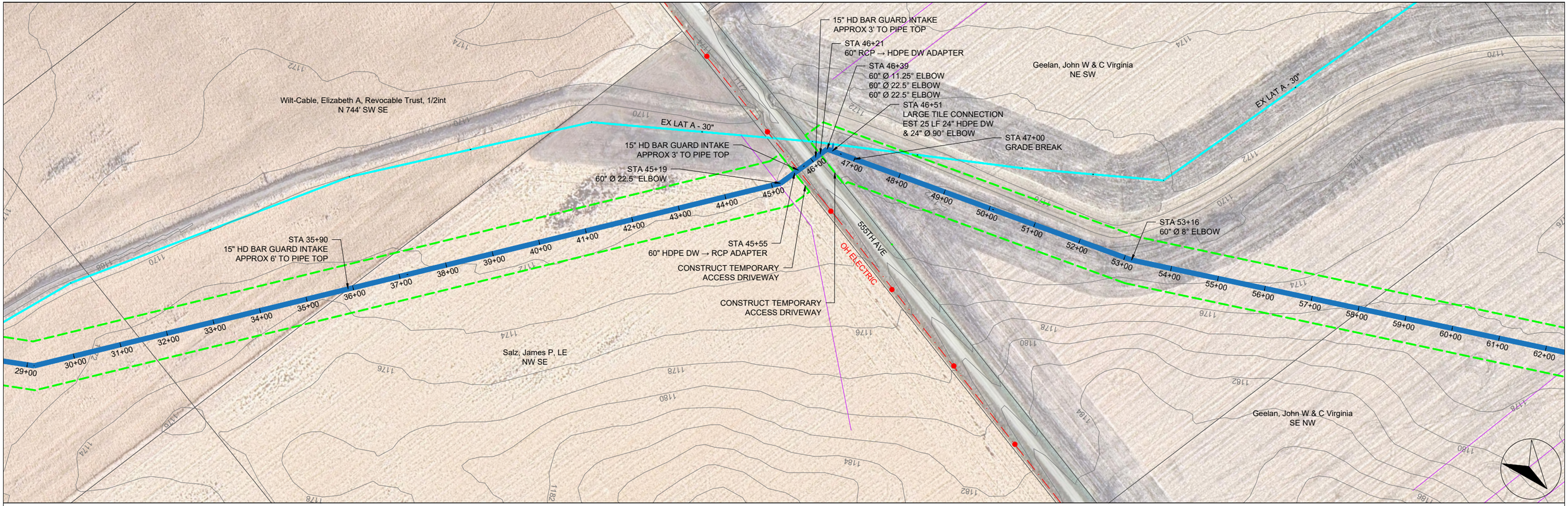
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- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

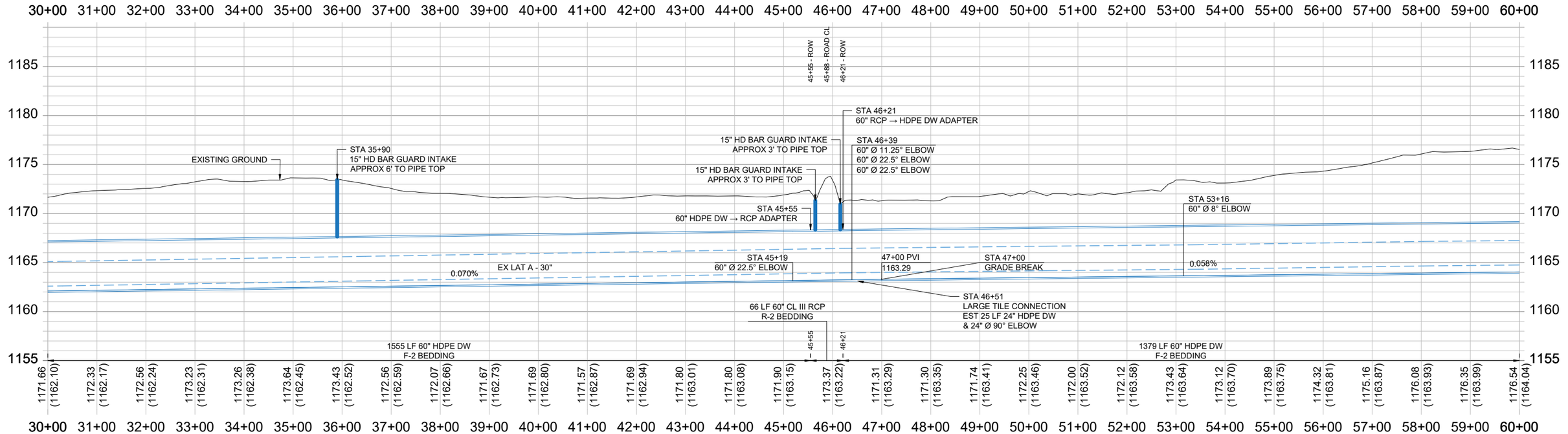
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 0+00 → 30+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.01





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

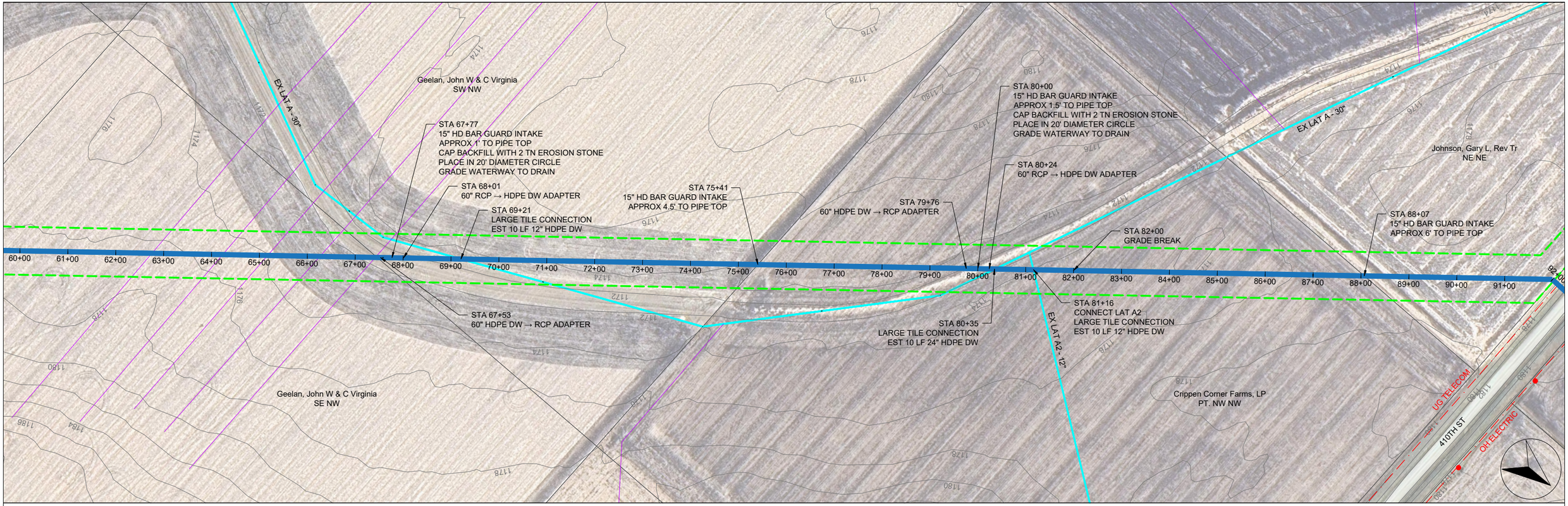
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

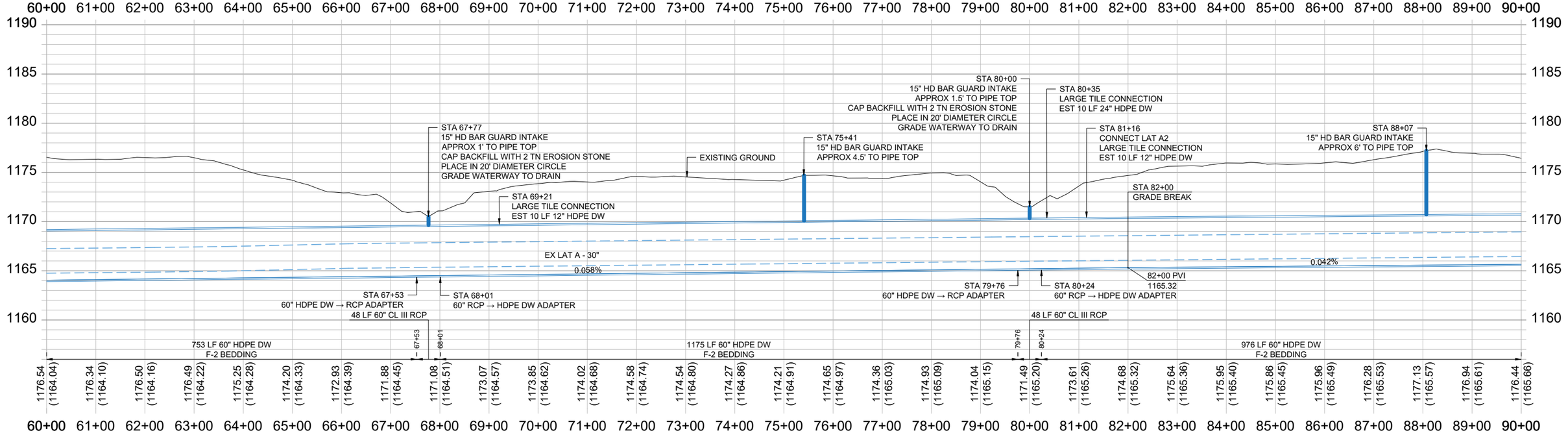
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 30+00 → 60+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.02





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

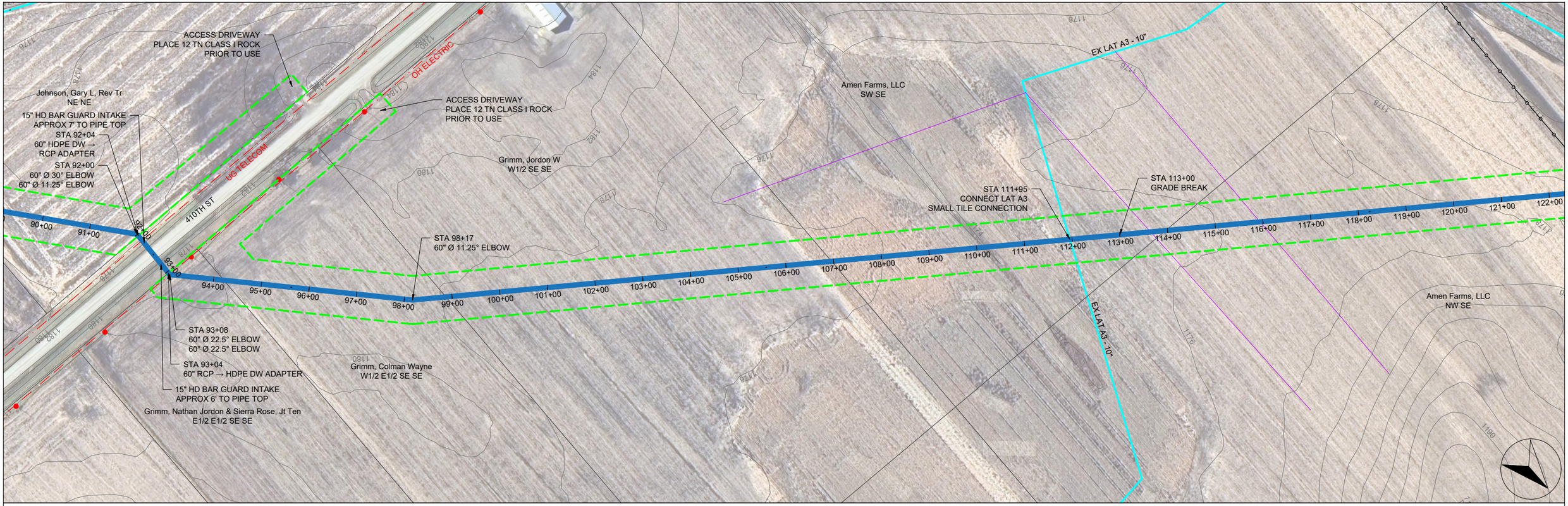
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

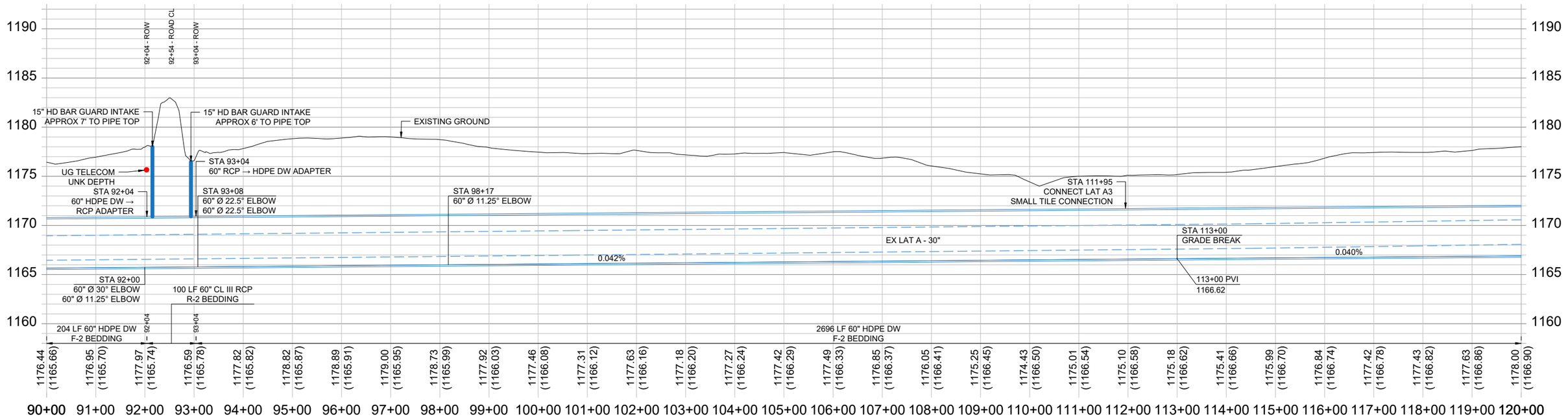
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 60+00 → 90+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.03





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

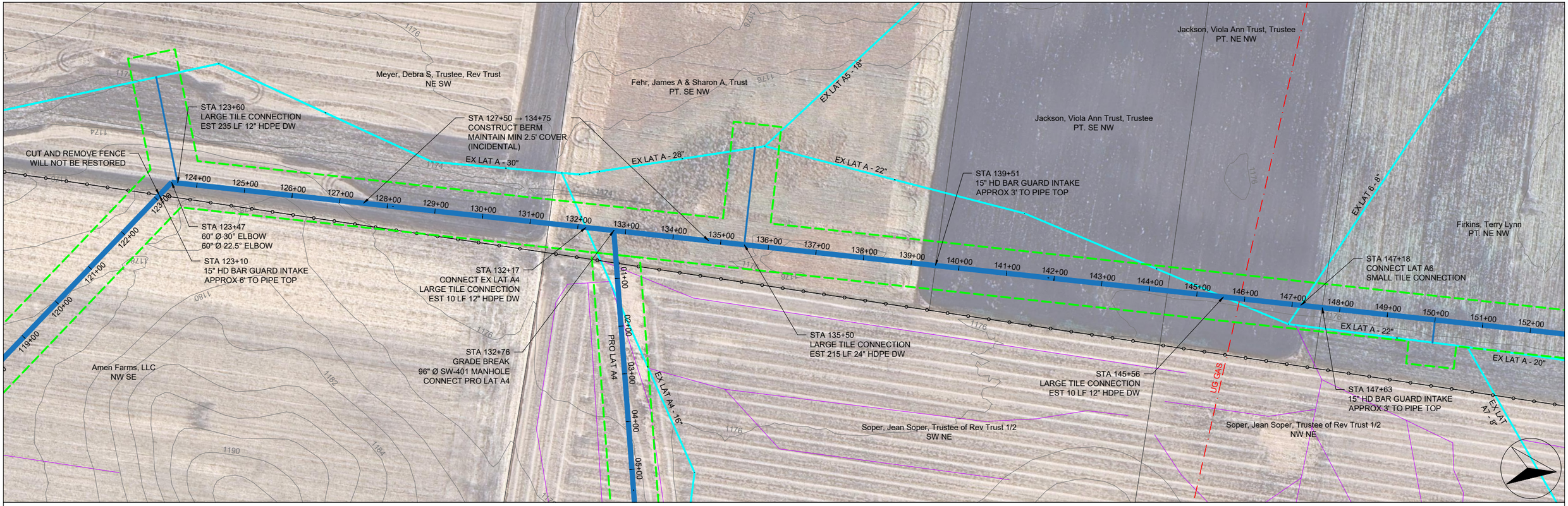
Plan Legend
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

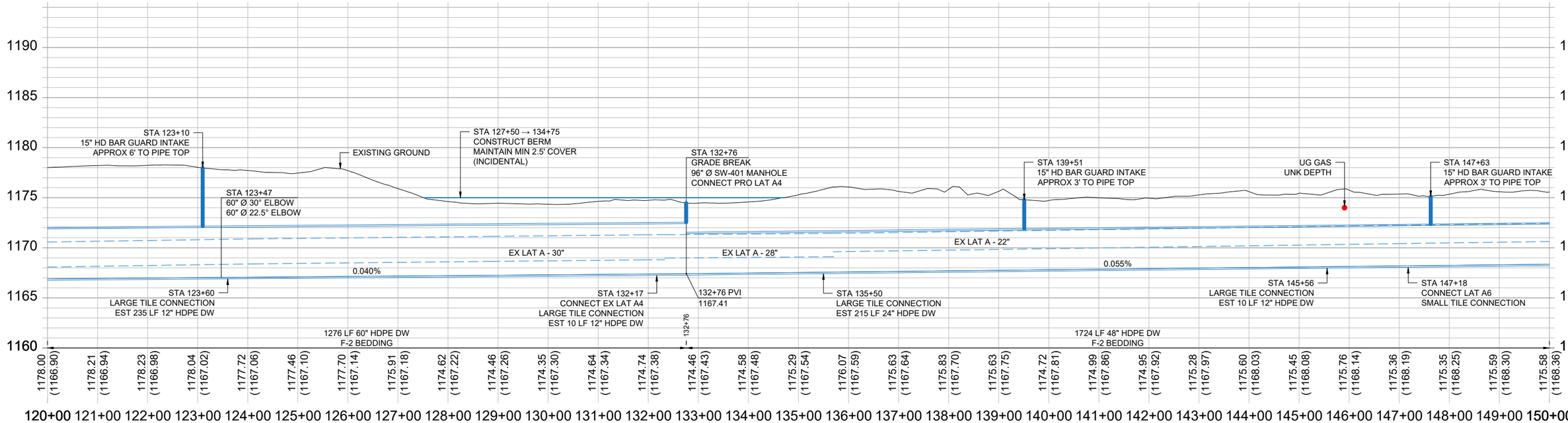
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 90+00 → 120+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.04





AgriVia

Company Information
AgriVia PLLC
PO Box 44
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Designer JLH
Drafter TJB
Checker TJB

Plan Legend

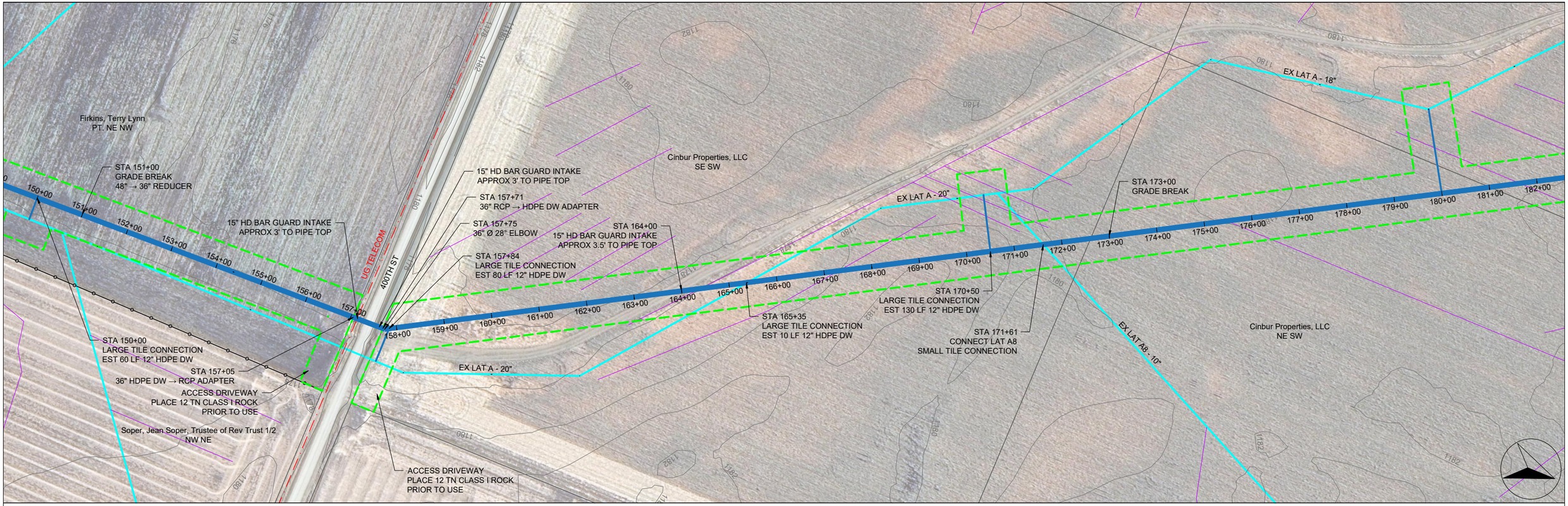
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 120+00 →
150+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.05



AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
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Designer JLH
Drafter TJB
Checker TJB

Plan Legend

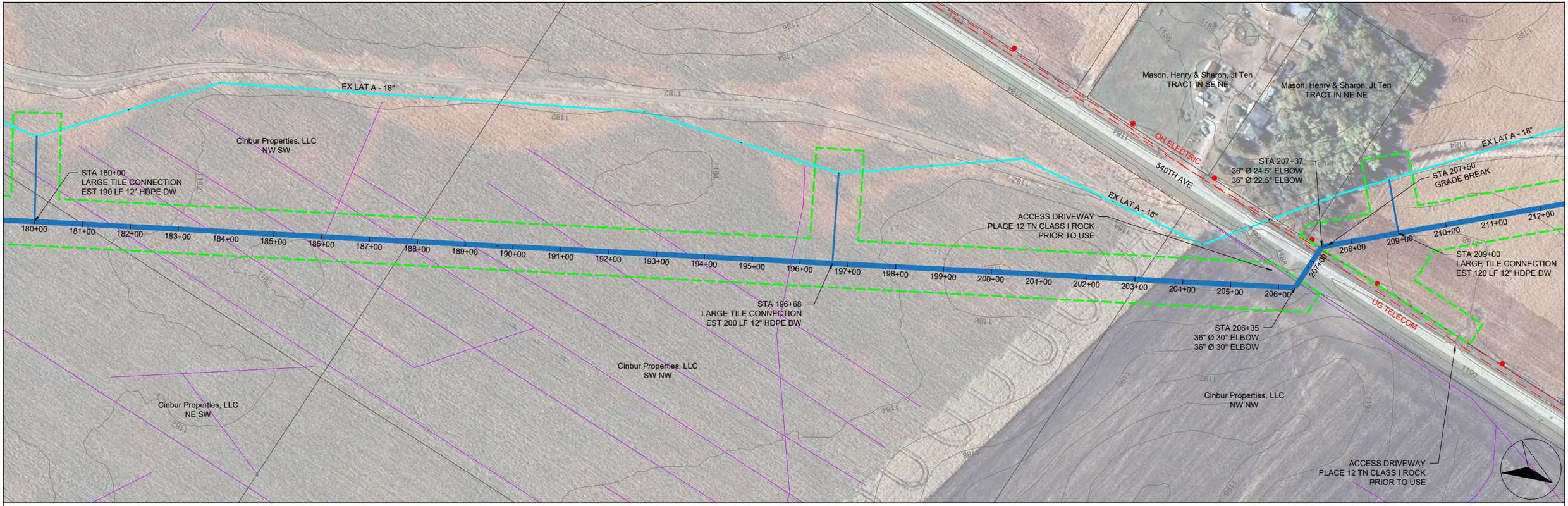
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

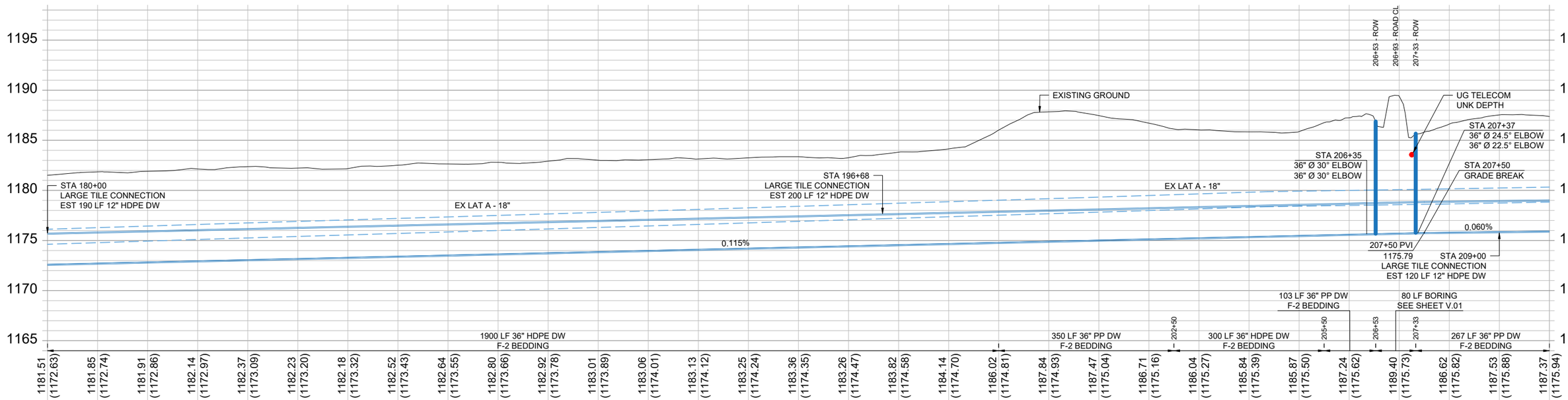
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 150+00 →
180+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.06





AgriVia

Company Information
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PO Box 44
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Designer JLH
Drafter TJB
Checker TJB

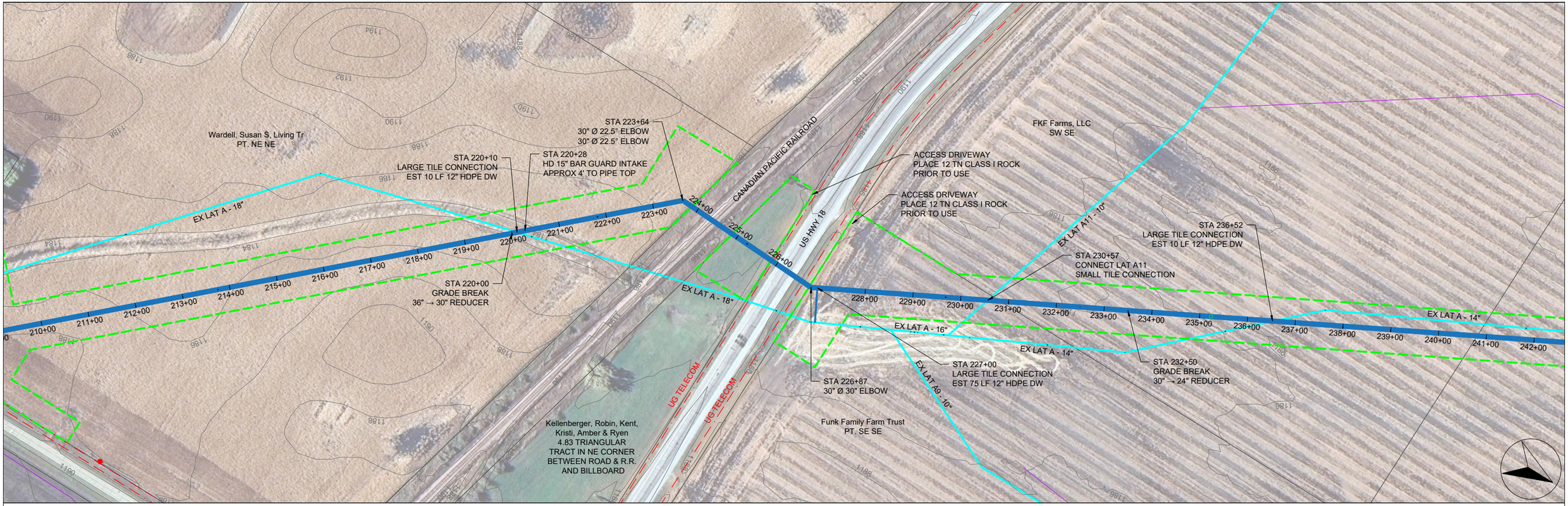
Plan Legend
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 180+00 →
210+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.07



AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

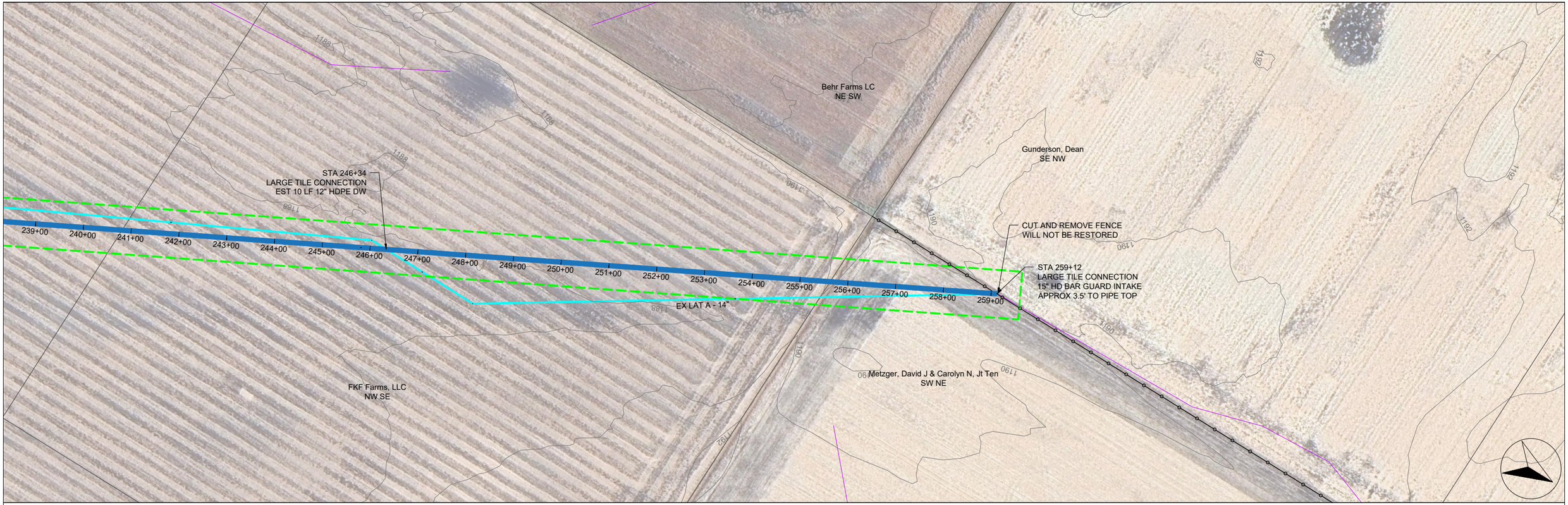
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

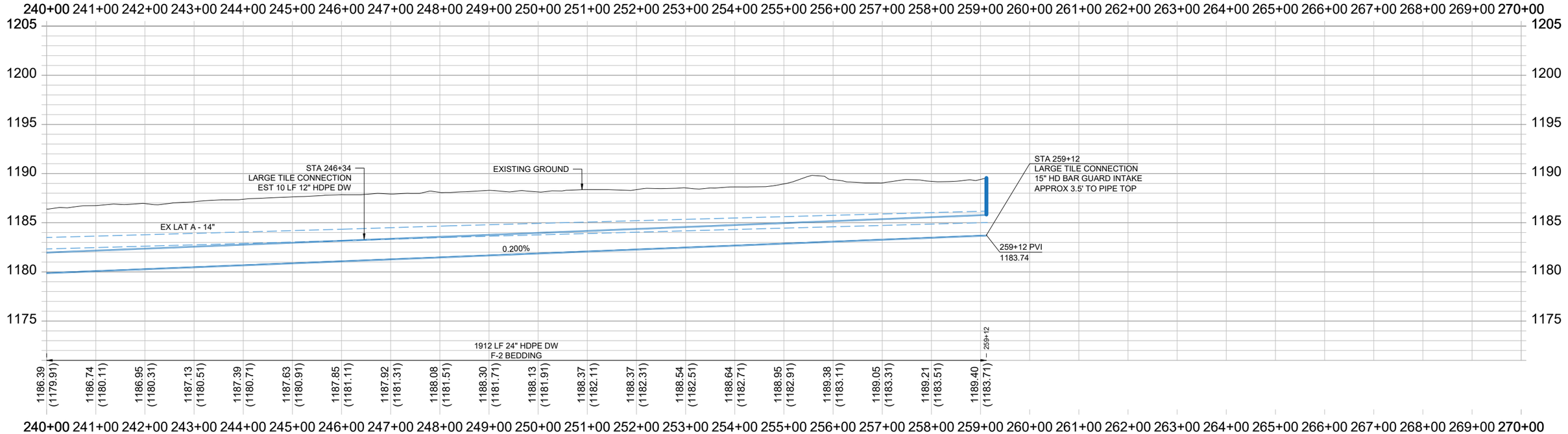
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 210+00 →
240+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.08





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

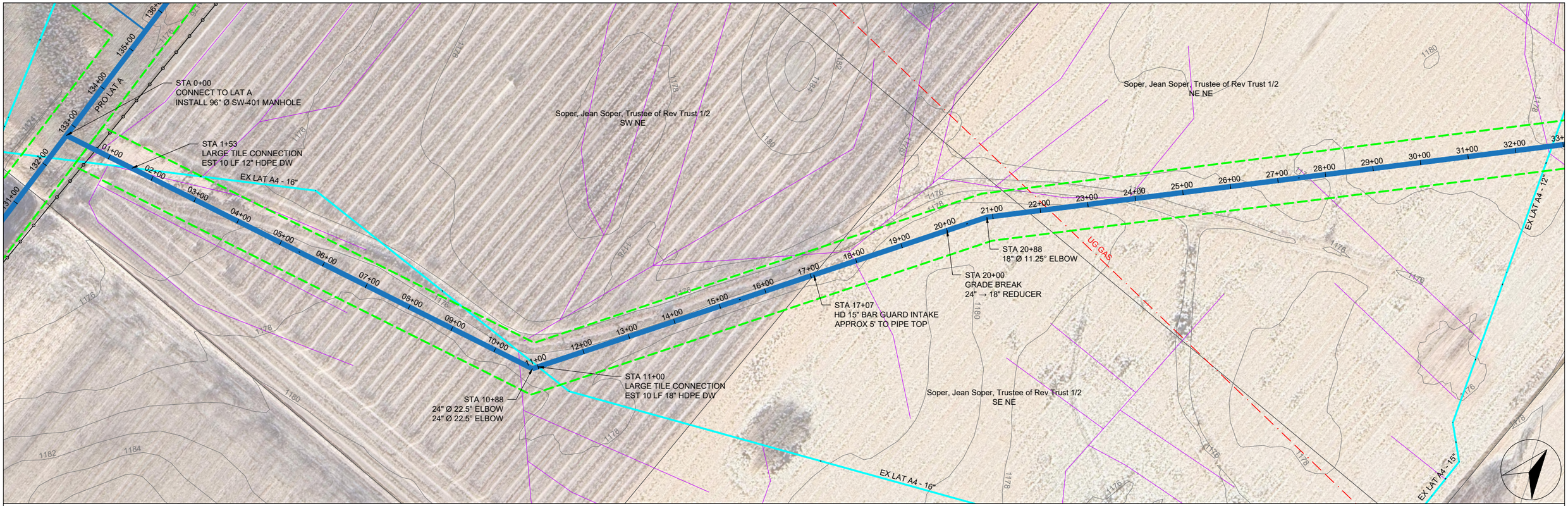
Plan Legend
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

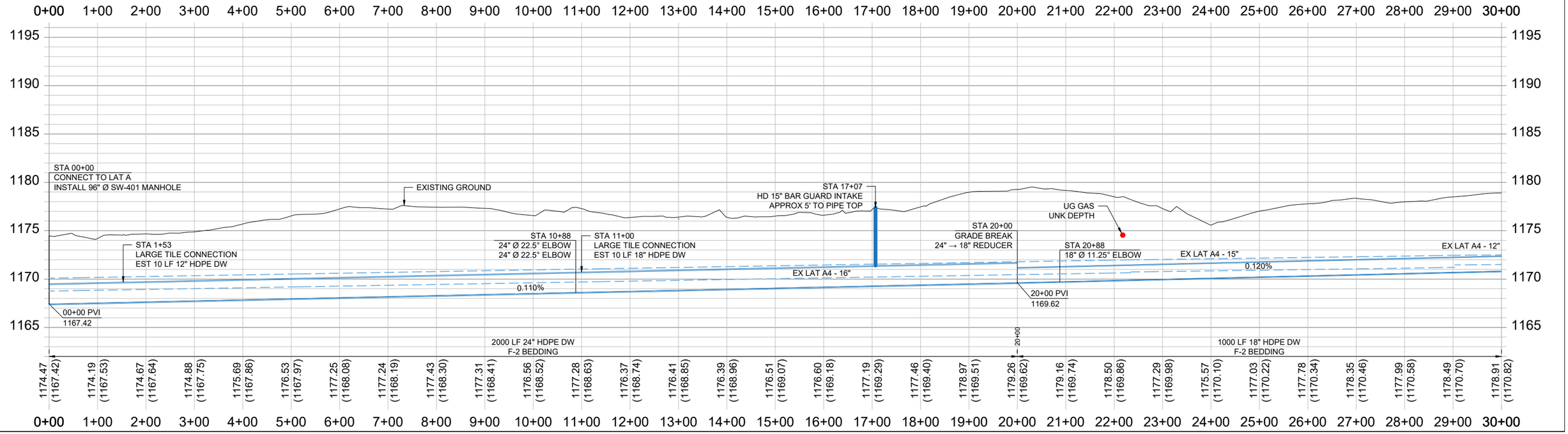
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A
Sta 240+00 →
270+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2601-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.09





1174.47 (1167.42)	1174.19 (1167.53)	1174.67 (1167.64)	1174.88 (1167.75)	1175.69 (1167.86)	1176.53 (1167.97)	1177.25 (1168.08)	1177.24 (1168.19)	1177.43 (1168.30)	1177.31 (1168.41)	1176.56 (1168.52)	1177.28 (1168.63)	1176.37 (1168.74)	1176.41 (1168.85)	1176.39 (1168.96)	1176.51 (1169.07)	1176.60 (1169.18)	1177.19 (1169.29)	1177.46 (1169.40)	1178.97 (1169.51)	1179.26 (1169.62)	1179.16 (1169.74)	1178.50 (1169.86)	1177.29 (1169.98)	1175.57 (1170.10)	1177.03 (1170.22)	1177.78 (1170.34)	1178.35 (1170.46)	1177.99 (1170.58)	1178.49 (1170.70)	1178.91 (1170.82)

0+00	1+00	2+00	3+00	4+00	5+00	6+00	7+00	8+00	9+00	10+00	11+00	12+00	13+00	14+00	15+00	16+00	17+00	18+00	19+00	20+00	21+00	22+00	23+00	24+00	25+00	26+00	27+00	28+00	29+00	30+00

AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

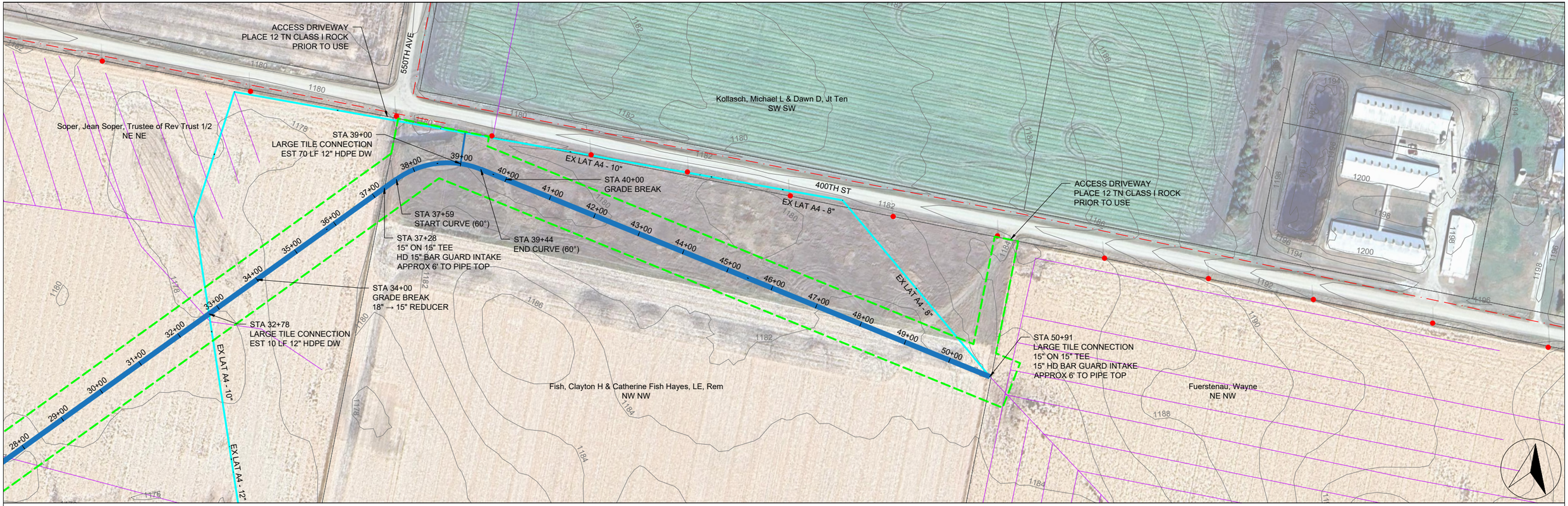
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

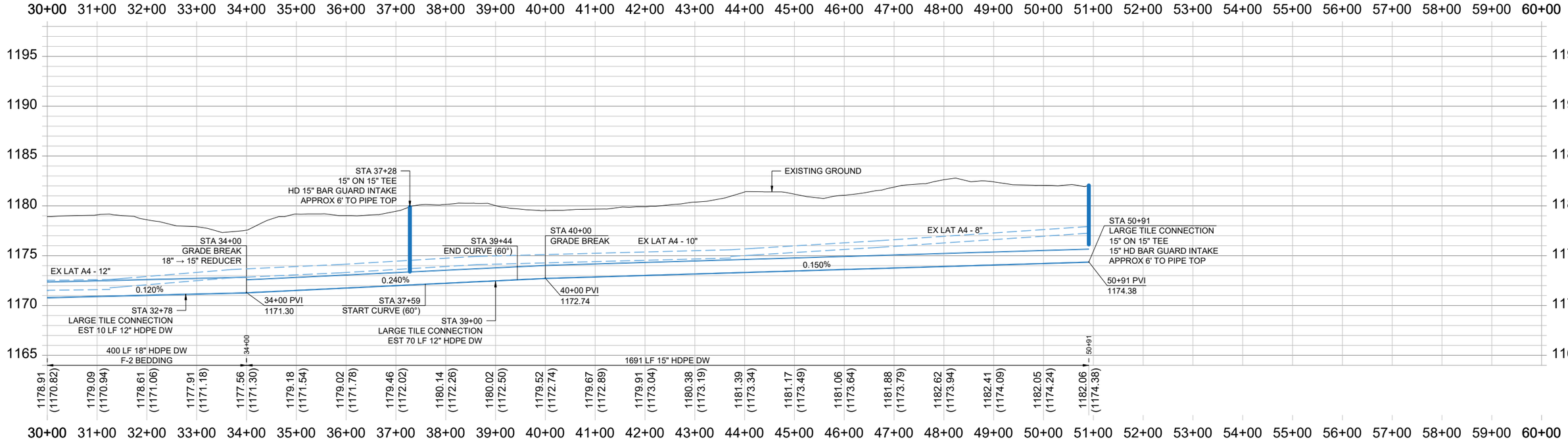
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A4 Sta 0+00 → 30+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2618-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.10





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

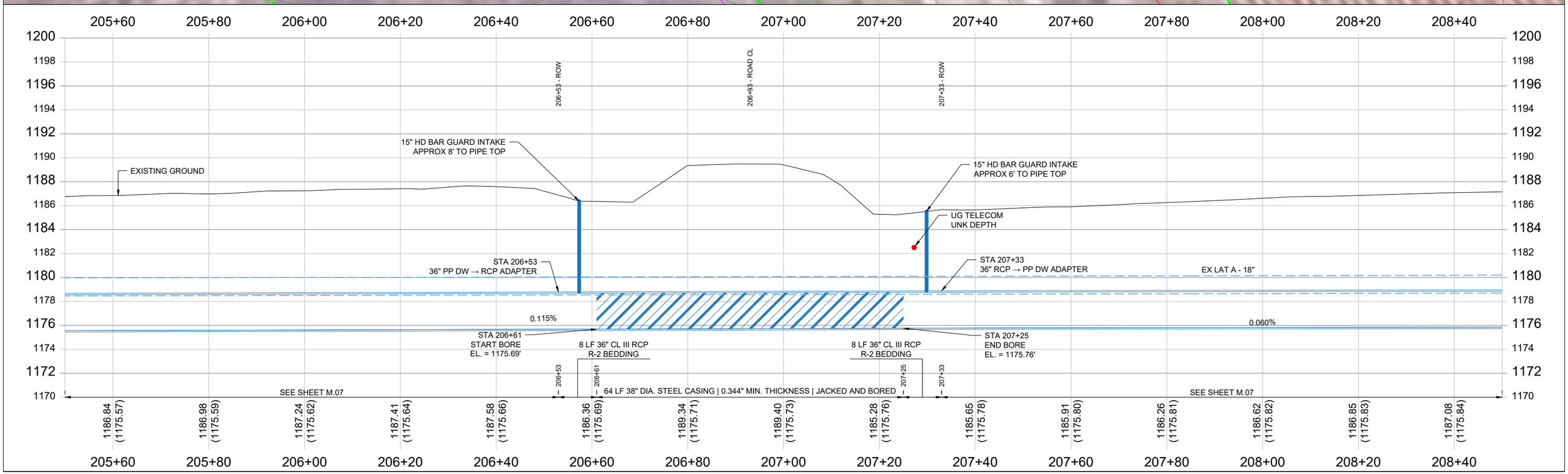
No.	Revision/Issue	Date

Sheet Name
Plan & Profile - Lat. A4 Sta 30+00 → 60+00

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project 2618-74
Date 2026-09-01
Plan Scale 1" = 200'
Sheet M.11





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

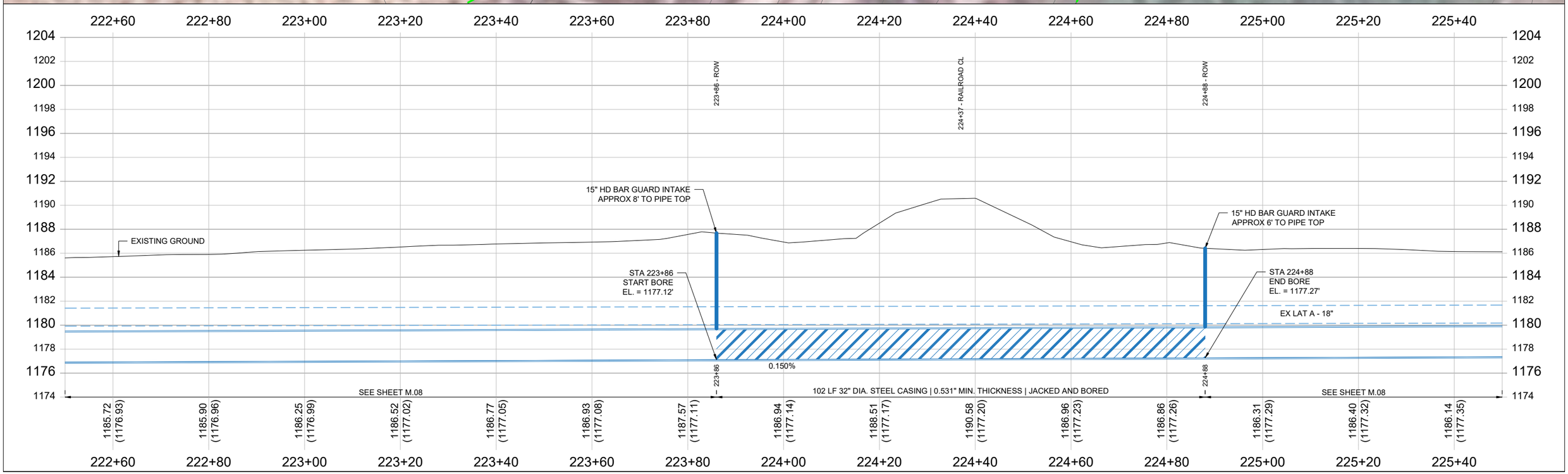
No.	Revision/Issue	Date

Sheet Name: 540th Ave Boring

Project Name, Client, and Address:
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project: 2601-74
Date: 2026-09-01
Plan Scale: 1" = 20'
Sheet: V.01





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer: JLH
Drafter: TJB
Checker: TJB

Plan Legend
- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

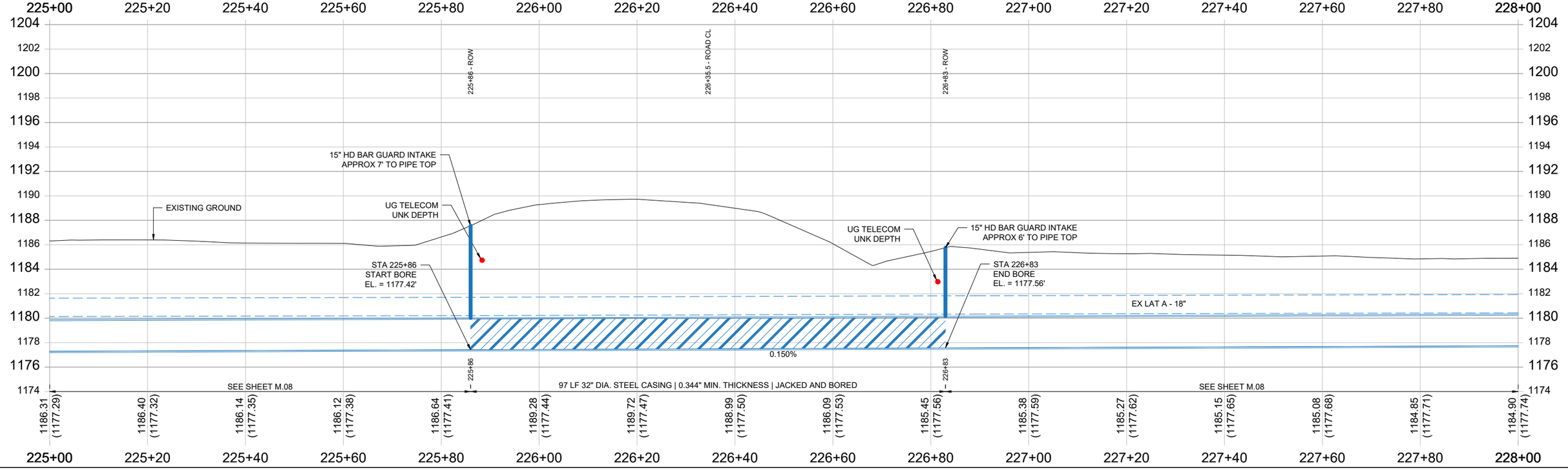
No.	Revision/Issue	Date

Sheet Name: Railroad Boring

Project Name, Client, and Address
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project: 2601-74
Date: 2026-09-01
Plan Scale: 1" = 20'
Sheet: V.02





AgriVia

Company Information
AgriVia PLLC
PO Box 44
1124 Willis Ave
Perry, IA 50220

Designer JLH
Drafter TJB
Checker TJB

Plan Legend

- Proposed District Tile
- Old District Tile
- Private Tile
- Work Area (ROW)
- Fenceline
- 2' Contours
- Utilities (in red)

No.	Revision/Issue	Date

Sheet Name: US Hwy 18 Boring

Project Name, Client, and Address:
Laterals A & A4 Tile Improvements
Drainage District No. 61
Palo Alto County, IA
560th Ave & 420th St, Cylinder, IA 50528

Project: 2601-74
Date: 2026-09-01
Plan Scale: 1" = 20'
Sheet: V.03